Academic Program - UG

Syllabus 2026-27

III & IV Semester B.E.

Computer Science and Engineering

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 Computer Science and Engineering is recommended by Board of Studies of Computer Science and Engineering 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 2026-27 till further revision.

Principal Chairman BoS & HoD

Department of Computer Science and Engineering

College Vision and Mission

Vision

To develop competent professions 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

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

VISION

To develop competent professionals in the field of Computer Science and Engineering with human values.

MISSION

1. To have contextually relevant curricula in line with industry trends and body of knowledge stated by IEEE/ACM.
2. To promote OBE based effective Teaching Learning Practices supported by modern educational tools and techniques.
3. To enhance research.
4. To involve the industrial expertise for connecting classroom contents to real-life situations.
5. To inculcate ethics and soft-skills leading to overall personality development.

Program educational Objectives (PEO)

I. To prepare students for successful careers in Industry, Research and Institutions of higher learning

II. To encourage students to work in teams to address industrial and socially relevant problems / projects.

III. To provide students with a sound mathematical, scientific and engineering fundamentals necessary to formulate, analyse and solve engineering problems.

IV. To promote student awareness and commitment to lifelong learning and professional ethics during the course of professional practice.

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. **System Inception and Elaboration to Build Smart Space:** Conceptualize the smart real time system with appropriate software and/or hardware systems, system components and process/procedures through requirement analysis, modeling /design of the system using various architectural / design patterns, standard notations, procedures and algorithms.
14. **System Construction:** Implement the systems, procedures and processes using the state-of-the-art technologies, standards, tools and programming paradigms.
15. **System Testing and Deployment:** Verify and validate the systems, procedures and processes using various testing and verification techniques and tools.

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Computer Science and Engineering
III Semester
Scheme of Teaching and Examinations 2026 – 27

Sl No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture L	Tutorial T	Practical P	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
1	ASC	22UMAC300	Engineering Mathematics – III	BS	2	2	0	3	50	100	100	3
2	PCC	22UCSC300	Data Structures and Applications	CSE	4	0	0	3	50	100	100	4
3	PCC	22UCSC301	Digital Systems and Computer Architecture	CSE	3	0	0	3	50	100	100	3
4	PCC	22UCSC302	Operating Systems	CSE	3	0	0	3	50	100	100	3
5	PCCL	22UCSL303	Data Structures and Applications Laboratory	CSE	0	0	2	3	50	50	100	1
6	PCCL	22UCSL304	Digital Systems Laboratory	CSE	0	0	2	3	50	50	100	1
7	ESC	22USCSC305	Discrete Structures in Computer Science	CSE	3	0	0	3	50	100	100	3
8	UHV	22UHVK306	Universal Human Values–I	CSE	1	0	0	1	50	50	100	1
9	AEC	22UCSE321	Unix Shell Programming	CSE	0	0	2	3	50	50	100	1
10	ASC	22UMBA301	Mathematics	BS	3	0	0	3	50	-	50	Audit
11	MC	22UNSK307	National Service Scheme	CSE	0	0	2	-	50	-	50	Audit
										Total	**1000**	**20**

ASC: Applied science course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **UHV:** Universal Human Value Course, **AEC:** Ability Enhancement Course, **SEC:** Skill Enhancement Course, **MC:** Mandatory Course, **L**: Lecture, **T**: Tutorial, **P**: Practical, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **MC:** Mandatory Course. This letter in the course code indicates common to all the stream of engineering. **TD**: Teaching department, **PSB**: Paper Setting Board.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical

Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is 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 NSS, PE, and Yoga activities. These 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 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 students 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 Computer Science and Engineering
IV Semester
Scheme of Teaching and Examinations 2026 – 27

Sl No	Course Type	Course Code	Course Title	Teaching Department	Teaching Hrs/Week			Examination				Credits
					Lecture L	Tutorial T	Practical P	Duration in Hrs	CIE Marks	SEE Marks	Total Marks	
1	ASC	22UMAC400	Engineering Mathematics – IV	BS	2	2	0	3	50	100	100	3
2	PCC	22UCSC400	Analysis and Design of Algorithms	CSE	3	0	0	3	50	100	100	3
3	PCC	22UCSC401	Object Oriented Programming	CSE	3	0	0	3	50	100	100	3
4	PCC	22UCSC402	Programming Computer Peripherals and Interfacing	CSE	3	0	0	3	50	100	100	3
5	PCCL	22UCSL403	Object Oriented Programming Laboratory	CSE	0	0	2	3	50	50	100	1
6	PCCL	22UCSL404	Programming Computer Peripherals and Interfacing Laboratory	CSE	0	0	2	3	50	50	100	1
7	PLC	22UPCSC405	Web Technology	CSE	3	0	0	3	50	100	100	3
8	UHV	22UHVK406	Universal Human Values–II	HU	1	0	0	1	50	50	100	1
9	AEC	22UCSE421	Project Management Tools	CSE	0	0	2	3	50	50	100	1
10	MC	22UBEK407	Biology for Engineers	CSE	1	0	0	1	50	50	100	1
11	ASC	22UMBA401	Mathematics	BS	3	0	0	3	50	-	50	Audit
12	MC	22UNSK408	National Service Scheme	CSE	0	0	2	-	50	-	50	Audit
								Total			**1100**	**20**

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III Semester

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

Contact Hours:39 CIE:50 Marks SEE: 50 Marks Exam Duration:3 Hrs.

Course Learning Objectives (CLOs):

To have an insight into Fourier series, Fourier transforms, Z-transforms. To solve linear and Non-linear programming problems and use statistical tools to problems 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	

POs	1	2	3	4	5	6	7	8	9	10	11	12
Mapping Level	1.4	1.4										2

Pre-requisites: Knowledge of fundamentals of calculus, 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).

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 $J_n(x)$- 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 $= \boldsymbol{ax + b}; \boldsymbol{y = ax^2 + bx + c}; \boldsymbol{y = ax^b}$..

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, Khanna Publishers, 44th Ed., 2017.
2) E.Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint).2016.

3) Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd Edition, 2016.
4) B. V. Ramana, "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5) 5.Er.Prem Kumar Gupta, Dr.D.S.Hira**,** Operation Research S.Chand & Company Pvt .Ltd. 7th edition, 2014.

22UCSC300	Data Structures and Applications	(4-0-0) 4

Contact Hours: 52

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

- Working of various basic data structures and their implementation.
- Implementation issues of data structure in programming language.
- Selection of the appropriate data structure for solving 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(1-12) / PSOs(13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Write** programs to solve simple problems using stack and **explain** its working principles.	-	14	1,3,15
CO-2	**Write** programs to solve problems using queue and **explain** its working principles.	-	14	1,3,15
CO-3	**Write** programs to solve problems using Linked Lists and **explain** its working principles.	-	14	1,3,15
CO-4	**Write** programs to solve problems using trees and **explain** its working principles.	-	14	1,3,15
CO-5	**Write** programs to solve problems using advanced concepts of trees.	-	14	1,3,15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	2.0	1.0

Pre-requisites: Problem Solving skills and knowledge of Programming in C language.

Contents:

Unit-I

Revision of Functions, Structures, Unions and Pointers
Stack: Realization of stack and its operations using static implementation. Applications of stacks – Polish Notation, Evaluation of Postfix Expression, Infix to Postfix Expression, Recursion – Factorial, GCD, Fibonacci Sequence, Towers of Hanoi. **12 Hrs**

Unit-II

Queues: Definition, Array representation, Basic operations, Types of Queues – Circular Queue, Dequeue, Priority Queue, Multiple Queues. Applications. **10 Hrs**

Unit-III

Linked Lists: Definition, Representation of linked list in memory, Memory allocation and deallocation, Operations – Traversing, Searching, Insertion, and Deletion. Types – Doubly Linked List, Circular Linked List, Linked List with header nodes. Stack and Queue implementation using list, Applications – Polynomial evaluation, Sparse Matrix representation. **10 Hrs**

Unit-IV

Trees - 1: Definition, Binary Trees and Binary Search Trees – Definitions, Representations, Insertion, Traversals. Application – Expression tree **10 Hrs**

Unit-V

Trees - 2: AVL tree, 2-3 tree, 2-3-4 tree, B-tree. **10 Hrs**

Reference Books:

1) Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, "Data Structures using C and C++", Pearson Education, 2006
2) Thomas H.Cormen, Charles E.Leiserson & Ronald L. Rivest, "Introduction to Algorithms", 2/E, Prentice Hall of India, 2003.
3) E. Balagurusamy, "Programming in ANSI C", 7/E, Tata McGraw-Hill, 2016
4) Behrouz A. Forouzan & Richard F. Gilberg, "Computer Science: A Structured Programming Approach Using C", 2/E, Cengage Learning, 2003.

22UCSC301 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 (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Conceptualize** and **solve** the given real time application by employing suitable combinational circuit.	2	4	-
CO-2	**Conceptualize** and **solve** the given real time application by employing suitable Sequential circuit.	2, 13	3	15
CO-3	**Design** the required memory bank using basic memory units.	-	2,3	5
CO-4	**Explain** the working principles of different sub systems, 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/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	-	3.0	2.5	2.0	1.0	-	-	-	-	-	-	-	2.3	1.0	1.3

Pre-requisites: 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-McClusky 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 & SafwatZaky, “Computer Organization”, 5/E, Tata Mc Graw Hill, 2011.
4) William Stallings, “Computer Organization & Architecture”, 9/E, Prentice Hall of India, 2012.

22UCSC302	Operating Systems	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): The contents of this course deal with the structure and working principles of generic operating systems at introductory level, focusing on process management, memory management, file system and device management. It also focuses on architecture and programming aspects of Linux based OS at fundamental level.

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	**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	1,15
CO-2	**Compare** different scheduling algorithms.	-	2	3,13
CO-3	**Compare** and contrast various memory allocation strategies.	-	2	3,13
CO-4	**Explain** the structure and working principles of a file organization and **Write** programs to demonstrate the various file operations using system calls.	-	13,14	1,15
CO-5	**Explain** the structure and working principles of secondary storage and issues related to protection/access strategies.	-	13	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**	**15**
Mapping Level	1.0	2.0	1.0	-	-	-	-	-	-	-	-	-	1.7	2.0	1.0

Pre-requisites: Knowledge of Computer Organization, Digital Electronics and Computer Programming at introductory level.

Contents:

Unit-I

Introduction to Operating Systems: 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, Distributed system, Special-purpose systems, Computing environments.

Process Management: Process concept, Process scheduling, Operations on processes, Multithreading models, Thread Libraries, Threading issues. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling, Thread scheduling. **8 Hrs**

Unit-II

Process Synchronization: Synchronization, The Critical section problem, Peterson's solution; Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors. **8 Hrs**

Unit-III

Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock. **8 Hrs**

Unit-IV

Memory Management: Strategies: Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation. Virtual Memory Management: Background, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing. **8 Hrs**

Unit-V

File System, Implementation of File System: File System: File concept, Access methods, Directory structure, File system mounting, File sharing, Protection. Implementing File System: File system structure, File system implementation, Directory implementation, Allocation methods, Free space management

Secondary Storage Structures & Protection: Mass storage structures, Disk structure, Disk attachment, Disk scheduling, Disk management, Swap space management. Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights, Capability-Based systems **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.

22UCSL303 Data Structures and Applications Laboratory (0-0-2) 1

Contact Hours: 26

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

- Realization of fundamental data structures like stacks, queues, linked lists and trees.
- Compare and contrast the benefits of dynamic and static data structure implementations.
- Selection of the appropriate data structure for solving 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(1-12) / PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Write** programs to solve problems using stack.	-	14	1,3, 15
CO-2	**Write** programs to solve problems using queue.	-	14	1,3, 15
CO-3	**Write** programs to solve problems using Linked Lists.	-	14	1,3, 15
CO-4	**Write** programs to solve problems using binary search trees.	-	14	1,3, 15
CO-5	**Write** programs to solve problems using 2-3 trees and 2-3-4 trees.	-	14	1,3, 15

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	1.0	-	1.0	-	-	-	-	-	-	-	-	-	-	2.0	1.0

Suggested list of term works:

The list of experiments is based on the following concepts:

1. Stack
2. Queue
3. Linked Lists
4. Trees (Binary Search Trees, 2-3 Trees, 2-3-4 Trees).

Reference Books:

1) Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, “Data Structures using C and C++”, Pearson Education, 2006
2) Thomas H.Cormen, Charles E.Leiserson & Ronald L. Rivest, “Introduction to Algorithms”, 2/E, Prentice Hall of India, 2003.
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4) Behrouz A. Forouzan & Richard F. Gilberg, “Computer Science: A Structured Programming Approach Using C”, 2/E, Cengage Learning, 2003.

22UCSL304	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 (13-15)**		
		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	15	-
CO-4	**Implement** n-bit arithmetic circuits using digital simulators.	1,2	15	-

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	3.0	2.5	2.0	-	-	-	-	-	-	-	-	1.0	3.0	-	2.0

Pre-requisites: 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.

3	Flip-Flops (Sequential Circuits): i) To realize flip-flop conversions. ii) Applications Flip-Flops: a) To design and implement mod-n synchronous counter. b) Design and implement a mod-n asynchronous counter. c) To realize and study Shift Registers / Ring counter and Johnson counter.
4	Design and Implement a 4-bit (8-bit) ALU using DigiSim / Proteas / Verilog simulator.

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) Donald P Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", 7/E, Tata McGraw Hill, 2010.
4) Charles H. Roth, "Fundamentals of Logic Design", 5/E, Cengage Learning, 2004.

22USCSC305 Discrete Structures in Computer Science (3-0-0) 3

Contact Hours: 39

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

- The basic terminologies of mathematical and logical reasoning, functions, and relations associated with its properties and corresponding practical examples.
- Various counting principle methods to solve complex problems in combinatorics.
- Demonstration with examples, the basic terminologies of graphs and its types.
- Identify the applications of mathematical structures in other fields of computer science such as data structures and algorithms, databases, networks, operating systems etc.

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	**Verify** the correctness of an argument using various techniques and strategies.	1	2	4,15

CO-2	**Solve** problems using counting techniques and combinatorics.	1	2	4,15
CO-3	**Solve** the problems on different types of functions, relations, and Generating functions.	1	2	4,13
CO-4	**Solve** the problems pertaining to graphs and related discrete structures.	1	2	4,13
CO-5	**Explain** the concepts and properties of algebraic structures such as groups and coding theory.	1	2	4,15

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	3.0	2.0	-	1.0	-	-	-	-	-	-	-	-	1.0	-	1.0

Pre-requisites: None

Contents:

Unit-I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence – The Laws of Logic, Logical Implication – Rules of Inference, The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems **9 Hrs**

Unit-II

Fundamental Counting: The Rules of Sum and Product, Permutations and Combinations, The Binomial coefficients, The Pigeonhole Principle.
Relations: Cartesian Products and Relations, Properties of Relations, Equivalence Relations and Partitions **9 Hrs**

Unit-III

Functions: Definition, Plain and One-to-One, Onto Functions, Function Composition, Inverse Functions, Directed Graphs, Hasse Diagrams. **7 Hrs**

Unit-IV

Generating Functions: Definitions and examples, Exponential Generating Functions.
Recurrence Relations: Recursive definitions. First Order Linear Recurrence Relations, Second order linear homogeneous recurrence relation with constant coefficients. **7 Hrs**

Unit-V

Graphs: Elements of graph theory, Graphs and its properties, Directed graphs, Sub-graph, Complements, Planar graphs, Euler Graph, Hamiltonian Graphs, Graph Colouring, Representation of graphs, Trees. Application to engineering. **7 Hrs**

Reference Books:

1) Ralph P Grimaldi & B.V.Ramana "Discrete and Combinatorial Mathematics", 5/E, Pearson Education, 2006.
2) Kenneth H Rosen, "Discrete Mathematics and its Applications", 7/E, McGraw Hill, 2012.
3) Kolman B & Busby R C, "Discrete and Mathematical Structures for Computer Science", 5/E, Prentice Hall of India 2004.
4) Thomas Kosay, "Discrete Mathematics with Applications", Elsevier, 2005, Reprint 2008.

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 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	**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	**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	15
Mapping Level	-	-	-	-	-	2.5	3.0	3.0	2.0	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Introduction to 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. **4 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. **2 Hrs**

Unit-III

Understanding Harmony at various levels: Harmony in the Self – Understanding myself, Understanding human being as a co-existence of the sentinent 'I' and the material 'Body'. The needs of Self ('I') and 'Body' – Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer, and enjoyer). **3 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 Nyaya and program for its fulfillment to ensure Ubhaya – tripti, Trust (Visvasa) and Respect (Samman) as the foundational values of relationship. **2 Hrs**

Unit-V

Understanding Intention and Competence: Distinguish between intention and competence, Understanding the meaning of Nine Values. **2 Hrs**

Reference Books:

1) 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

22UCSE321	UNIX Shell Programming	(0-0-2) 1

Contact Hours: 26

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

- To provide the student with an exposure on UNIX platform so that various domain specific project activities can be performed with ease and comfort.
- To provide the student with an exposure on the structure and working principles of UNIX operating system at introductory level, focusing on OS services, commands, and scripting language for administration of UNIX operating system.

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	**Explain** the structure and working principles of UNIX operating system.	-	-	13
CO-2	**Use** different UNIX commands and system calls to perform system administration and user specified tasks.	-	14, 15	-
CO-3	**Write** shell scripts to perform different system administrative tasks.	-	5, 13, 14, 15	-
CO-4	**Write** awk and perl scripts to perform different system administrative tasks.	-	5, 13, 14, 15	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	-	-	-	-	2.0	-	-	-	-	-	-	-	1.7	2.0	2.0

Pre-requisites: None

List of Experiments that cover the following aspects:

1. **Filters in Unix:** Paginating Files, head: Displaying the Beginning of a File, tail: Displaying the End of a File, cut: Splitting a File Vertically, paste: Pasting Files, sort Ordering a File, uniq Locate Repeated and Non repeated Lines, tr Translating Characters, An Example: Displaying a Word count List. grep Searching for a Pattern, Basic Regular Expressions (BRE) – An Introduction, Extended Regular Expressions (ERE) and egrep.

2. **Shell Programming:** Environment Variables, Aliases (bash), Command History (bash). Shell Scripts, read and readonly commands, Using Command Line Arguments, exit and Exit Status of Command, The Logical Operators && and || Conditional Execution, The if Conditional, Using test and [ ] to Evaluate Expressions, The case Conditional, expr: Computation and String Handling, $0: Calling a Script by Different names, while: Looping, for: Looping with a List, set and shift: Manipulating the Positional Parameters.
3. **Awk Scripting Language:** awk program line and script structure, awk's operational mechanism, Records and fields, special variables $0, $1, $2, etc., patterns, The BEGIN and END, Variables, built in variables, built in functions, length, split, getline, print, printf, sprintf, index, system, substr, etc., control structures, operators in awk, associative arrays, writing simple awk scripts, Running awk scripts from the shell.
4. **Perl - The Master Manipulator:** Preliminaries, The chop function, Variables and Operators, String handling functions, Specifying filenames in a command line, $_, $. and .., Lists and arrays, argv[]: command line arguments, foreach, split, join, grep, associative arrays.

Reference Books:

1) Sumitabha Das, "UNIX Concepts and Applications", 3/E, Tata McGraw Hill, 2003
2) Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, "Operating System Principles", 8/E, Wiley India, 2009.
3) Behrouz A. Forouzan and Richard F.Gilberg, "UNIX and Shell Programming A Text book", Thomson, 3/E, 2003.

22UMBA301	**Mathematics**	**(3-0-0) Audit**

Contact Hours: 39

Course Learning Objectives (CLOs): This course will enable the students to master the basic tools of differential & integral calculus, differential equations and partial differential equations. Further, it will make the students to 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) / PSOs (13-15)**		
		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 co-efficients and variable co-efficients.	-	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	15
Mapping Level	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Knowledge of Differentiation and Integration of functions

Course Contents:

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).

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 $\int_0^{\pi/2} \sin^n x\, dx$, $\int_0^{\pi/2} \cos^n x\, dx$ and $\int_0^{\pi/2} \sin^n x \cos^m x\, dx$ (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. **5 Hrs**

Unit-IV

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 **8 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. **6 Hrs**

Reference Books:

1) B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44/E, 2017.
2) H. K. Dass & Rajnish Verma, "Higher Engineering Mathematics", 3/E, 2014.

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

1. The mandatory non – credit course Mathematics for III Semester is to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs. The students shall attend the classes 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. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of degree.

22UNSK307	National Service Scheme	(0-0-2) Audit

Contact Hours: 26

Course Learning Objectives:

1. Understand the community in which they work.
2. Identify the needs and problems of the community and involve them in problem-solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony.

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	Understand the importance of his / her responsibilities towards society.	12	6	8
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.	12	6	8
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.	12	6	8
CO4	Implement government or self-driven projects effectively in the field.	12	6	8

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

Activity list:

1. Waste management– Public, Private and Govt organization.
2. Setting of the information imparting club for women leading to contribution in social and economic issues.
3. Water conservation techniques – Role of different stakeholders– Implementation.
4. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
5. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
6. Developing Sustainable Water management system for rural areas and

implementation approaches.

7. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
8. Spreading public awareness under rural outreach programs. (minimum 2 programs).
9. Social connect and responsibilities.
10. Plantation and adoption of plants. Know your plants.
11. Organize National integration and social harmony events /workshops/ seminars. (Minimum 02 programs).
12. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Students have to take up at least three activities on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.

Note: Activities must be unique (Not repeat) across semesters for each student.

CIE will be evaluated based on their presentation, approach and implementation strategies.

Reference Books:
NSS Course Manual, Published by NSS Cell, VTU Belagavi

ASSESSMENT AND EVALUATION PATTERN		
	Time Schedule	CIE (50)
Presentation: on Selected topic	Before the IA-3	50 Marks

Note: Implementation strategies of the project with report duly signed by the Department NSS Coordinator and HoD

IV Semester

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

Contact Hours:39 **CIE:50 Marks** **SEE: 100 Marks** **Exam Duration:3 Hrs.**

Course Learning Objectives (CLOs): to Provide an insight into applications of conformal mapping. Integration of complex functions. **Apply** probability distributions in various 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.			1,2,12
CO-4	**Estimate** the correlation, covariance using joint probability distributions. **Recite** Markov chains and describe stochastic process.			1,2,12
CO-5	**Use** student's t-distribution, Chi-square distribution as a test of goodness of fit.			1,2,12

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

Pre-requisites: Knowledge of fundamentals of calculus, Basics of statistics and 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 o fanalytic functions: Milne-Thomson method-Problems. **8 Hrs.**

Unit-II

Conformal transformations

Introduction. Discussion of conformal transformations:

w= $e^z; w = z^2, w = z + \frac{1}{z}, z \neq o.$ 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-IV

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. **7 hrs.**

22UCSC400	**Analysis and Design of Algorithms**	**(3-0-0) 3**

Contact Hours: 39

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

- Analyze the performance of algorithms.
- Demonstrate familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.

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	**Explain** the importance of algorithmic/mathematical approach in solving different types of problems.	-	1	-
CO-2	**Analyze** time and space complexity for a given algorithm.	2	-	1
CO-3	**Apply** and **analyze** brute force technique and compare it with other techniques.	2	5	3,13
CO-4	**Apply** and **analyze** divide and conquer technique and compare it with other techniques.	2	5	3,13
CO-5	**Apply** and **analyze** greedy technique and compare it with other techniques.	2	5	3,13
CO-6	**Apply** and **analyze** dynamic programming technique and compare it with other techniques.	2	5	3,13
CO-7	**Apply** and **analyze** backtracking and branch & bound technique and compare it with other techniques.	2	5	3,13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	1.5	3.0	1.0	-	2.0	-	-	-	-	-	-	-	1.0	-	-

Pre-requisites: Knowledge of Discrete Mathematics and Data Structures

Contents:

Unit-I

Introduction: Algorithm, Fundamentals of problem solving, Problem types, Principles of Algorithm Design. Analysis framework, Asymptotic notations, Mathematical analysis of Non recursive algorithms, Recurrence relations; Mathematical analysis of recursive algorithms.

Brute force strategy: Selection Sort, Bubble sort, String matching **7 Hrs**

Unit-II

Divide and Conquer: Introduction and General method, Binary search, Merge sort, Quick sort, Matrix multiplication using Stressen's Matrix multiplication.

Basic Traversal and search techniques: Depth First search, Breadth First Search, Topological Sorting. **8 Hrs**

Unit-III

Dynamic Programming: Introduction and General method, Computing a binomial coefficient, Warshall's algorithm, Floyd's algorithm, Knapsack problem. **8 Hrs**

Unit-IV

Greedy Strategy: Introduction and General Method, Job sequencing with dead-lines, min cost spanning tree (Prim's & Kruskal's), Single Source Shortest Path. Huffman Tree. **8 Hrs**

Unit-V

Back tracking and Branch and Bound: Introduction General Method for both strategies Back Tracking: Sum of Sub sets, Knapsack problem, Traveling Sales person (TSP).
Limitations of Algorithm Power: Lower bound arguments, decision trees, P, NP and NP Complete Problems**.** **8 Hrs**

Reference Books:

1) Anany Levitin, "Introduction to the Design and analysis of algorithms", 3/E, Pearson Education, 2011
2) Horowitz, Sahani et.al "Fundamentals of Computer Algorithms", 2/E, Galgotia Publication, 2004.
3) Marks Allen Weiss, "Data Structure and Algorithm Analysis", 3/E, Pearson Education, 2009
4) Thomas H.Cormen, Charles E.Leiserson & Ronald L. Rivest, "Introduction to Algorithms", 2/E, Prentice Hall of India, 2003.

22UCSC401	Object Oriented Programming	(3-0-0) 3

Contact Hours: 39

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

- Object Oriented (OO) concepts/philosophy and its benefits and drawbacks in system development.
- Basic features of Java programming language to implement Object Oriented (OO) Key concepts like ADT/Encapsulation, reusability (Inheritance/Composite Objects), polymorphism etc., and other core basic features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Prepare** an abstract data type for the given scenario and **write** simple programs using basic features of Java.	13	1	-
CO-2	**Write** a program to solve given problem using packages and interfaces.	2, 14	1	3
CO-3	**Write** a program to solve given problem using exception handling and allow interleaved execution using threads.	2, 14	1	3
CO-4	**Use** streams in developing system that needs facility for storage and retreival of data.	2, 14	1	3
CO-5	**Write** Java programs to explore networking capabilities and build applications.	2, 14	1	3
CO-6	**Develop** a web-based application using J2EE features.	2, 14	1	3
CO-7	**Build** an appropriate graphical user interface for a given problem specification using Java FX feature.	2, 14	1	3
CO-8	**Write** a program using lambda expression to solve a given problem.	2, 14	1	3

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	2.0	3.0	1.0	-	-	-	-	3.0	-	-	-	-	3.0	3.0	-

Pre-requisites: Knowledge of Programming language (any)

Contents:

Unit-I

Basic Features of Java: Why object orientation? Key concepts of OOP, Classes: Introduction, Objects, Methods, Constructors, Abstraction, Encapsulation, Inheritance, Polymorphism in Java, String class in Java **9 Hrs**

Unit-II

Core Features - 1: Packages and Interfaces, Exceptions, Threads. **7 Hrs**

Unit-III

Core Features - 2: Concurrency Utilities, Streams, Generics **7 Hrs**

Unit-IV

Advanced Features - 1: JDBC, Java Networking, Servlets and JSP **9 Hrs**

Unit-V

Advanced Features - 2: Lambda Expressions, JavaFX **7 Hrs**

Reference Books:

1) Herbert Schildt, "Java-The Complete Reference", 9/E, Tata McGraw Hill, 2014.
2) Grady Booch, "Object-Oriented Analysis and Design with Applications", 3/E, Pearson Education, 2007.
3) Jim Keogh "J2EE – The Complete Reference", McGraw Hill Publications, 2007

22UCSC402	Programming Computer Peripherals and Interfacing	(3-0-0) 3

Contact Hours: 39

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

- Understand the Basic architecture and Peripherals associated with Micro-processers & Micro-controllers.
- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.
- Design & develop Assembly Language Program /& C program for a given real time application.
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

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	**Explain** the Basic architecture and Peripherals associated with Micro-processers & Micro-controllers	-	1	-
CO-2	**Explain** the features of embedded systems, architecture of ARM7 and applications.	-	1	-
CO-3	**Illustrate** the ARM and THUMB instruction sets.	-	2,5	13
CO-4	**Write** an ASM / Embedded C	-	3	-

	program using the instruction set of ARM and THUMB to solve the engineering problems.			
CO-5	**Design** and **Write** ARM (LPC2148) program for specific applications.	-	5	3,12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	2.0	2.0	1.5	-	2.0	-	-	-	-	-	-	1.0	1.0	-	-

Pre-requisites: Number systems, Digital systems and Computer Organization

Contents:

Unit-I

Introduction to Processor & Controllers: Evolution of Microprocessor, Block diagram and Features of Microprocessor & Micro-controller, Comparison of Microprocessor and Microcontroller, The RISC & CISC design philosophy. **7 Hrs**

Unit-II

Peripheral Interfacing with Microprocessor: Static and Dynamic memories, Vector interrupt table, Interrupt service routine, Interfacing of microprocessor with Programmable Interrupt Controller 8259, DMA controller 8257, Programmable peripheral Interface-8255. **9 Hrs**

Unit-III

ARM Embedded Systems and ARM Processor Fundamentals: ARM design philosophy, embedded system hardware- AMBA bus protocol, embedded system software- applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers. Pipeline- Characteristics **7 Hrs**

Unit-IV

ARM Instruction Set: Fundamentals of ARM instructions, Barrel shifter, Classification and explanation of instructions with examples-Data processing, Branch, Load-store, SWI and Program Status. IRQ and FIQ exceptions, Comparison between exception and interrupts. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design.

Introduction to THUMB and ARM Programming: Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives. Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan. **8 Hrs**

Unit-V

Peripheral Interfacing: Salient features of LPC2148 ARM CPU, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units. GPIO, PLL & Timers: Features, Register description with example and Applications. Interfacing of Stepper motor, DC Motor, LED interface. **8 Hrs**

Reference Books:

1) Ramakant A Gayakwad, “Microprocessor and Interfacing ", 4/E, Tata McGraw Hill, 2009
2) B.Ram, “Microprocessors and Interfacing”,
3) Atul P Godse and Mrs. Deepali A Godse, “Microprocessors and Interfacing”,
4) William Hohl, “ARM Assembly Language”, CRC Press.
5) Steve Furber, ARM System-on-chip Architecture, Pearson Education, 2012
6) LPC 2148 User Manual

22UCSL403 Object Oriented Programming Laboratory (0-0-2) 1

Contact Hours: 26

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

- Object Oriented (OO) concepts/philosophy and its benefits and drawbacks in system development.
- Basic features of Java programming language to implement Object Oriented (OO) Key concepts like ADT/Encapsulation, reusability (Inheritance/Composite Objects), polymorphism etc., and other core basic features.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Prepare** an abstract data type for the given business scenario and **write** simple programs to represent ADT and **use** in the given application scenario**.**	13	1	-
CO-2	**Write** programs to solve given problem using different reusability features like inheritance and composite objects.	2, 14	1	3
CO-3	**Write** a program to solve given problem using utility classes.	2, 14	1	3
CO-4	**Write** a program to solve given problem using abstract classes and differentiate with interfaces.	2, 14	1	3
CO-5	**Write** a program to solve given problem using packages.	2, 14	1	3
CO-6	**Write** a program to solve given problem using exception handling in construction of robust systems.	2, 14	1	3
CO-7	**Use** multithreading concept to solve conflicts due to interleaved execution of threads and write simple programs.	2, 14	1	3

CO-8	**Use** streams concept in developing system that needs facility for storage and retrieval of data.	2, 14	1	3
CO-9	**Design and Develop** GUI based system using applet, frames, events and other support available in AWT / Swings components.	2, 8, 14	1	3

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	2.0	3.0	1.0	-	-	-	-	3.0	-	-	-	-	3.0	3.0	-

Pre-requisites: Knowledge of: Registration/Completion of the course Object Oriented Programming.

Suggested Platforms:
Notepad (Non IDE), IDE (JCreator, Net Beans, Eclipse etc) in Windows OS and Linux OS

All programs should:

1. Be written to realize the Object Oriented Philosophy and core Java features.
2. Be written with Java Naming & Coding conventions and well documented.
3. Handle exceptions.
4. Be tested for all possible scenarios.

Course Contents:

Minimum one exercise to cover each course outcome specified above. Minimum 8 experiments to be completed by each student independently covering all course outcomes defined for this course. Course teacher has to publish list of experiments along with individual outcome for every experiments, on the first day of the semester. Examiner may set any problem based on the published term work during tests.

Reference Books:

1) Herbert Schildt, “Java: The Complete Reference: 7th Edition, Tata McGraw Hill, 2007.
2) Kathy Sierra & Bert Bates, “Head First Java”, 2nd Edition, O’Reilly, 2009
3) Patrick Niemeyer & Daniel Leuck, “Learning Java”, 4th Edition, O’Reilly, 2013
4) Laura Lemay & Charles L. Perkins, “Teach Yourself Java in 21 Days”, 7th Edition, Sams Publishing, 2016

22UCSL404 Programming Computer Peripherals and Interfacing Laboratory (0-0-2) 1

Contact Hours: 26

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

- Understand the internal architecture, instruction set of ARM7 microcontroller, assembling process & implement small programs.

- Design & develop Assembly Language Program /& C program for a given real time application.
- Understand the use of interrupts & other advanced concepts related to ARM7
- Demonstrate working knowledge of the necessary steps and methods used to interface ARM7 to devices such as motors, LCD, ADC, and DAC etc.

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	**Execute** assembly level codes for a given specific problem using ARM processor.	-	2, 4	3,15
CO-2	**Execute** embedded C programs for a given specific problem using ARM processor.	-	4,14	15
CO-3	**Implement** programs for interfacing with real world devices such as LCD's Keyboards, DAC, ADC, Relays Motors and Serial Interface - RTC, USB, UART, I2C.	13	4,5	3,12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	-	2.0	1.0	2.0	2.0	-	-	-	-	-	-	1.0	3.0	2.0	1.0

Course Contents:

PART A: Conduct the following experiments to learn ALP using ARM:

- Arithmetic and logical operations
- Interrupts related operations
- Timer related applications.

PART B: Conduct interfacing experiments to learn embedded C for ARM:

- LCD- interfacing
- Stepper Motor Interfacing
- Real time sensors Interfacing
- 7-segment LED interface
- Serial Interface (USB, UART, I2C)
- Timer /Counters
- Interrupt Controller

Reference Books:

1) William Hohl, "ARM Assembly Language", CRC Press.

2) Steve Furber, “ARM System-on-chip Architecture”, Pearson Education, 2012
3) James K. Peckol, “Embedded Systems: A Contemporary Design Tool”, 2008
4) Jonathan W. Valvano, Brookes & Cole, “Embedded Microcomputer Systems, Real Time Interfacing”, 1999
5) LPC 2148 User Manual.

22UPCSC405 Web Technology (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): This course emphasizes on practice-based learning. It enables the students to understand the web application architecture and use the state-of-the-art technology to provide web-based solutions.

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	**Design** and **develop** a static web pages using XHTML.	5	2,3,13,14,15	12
CO-2	**Design** and **develop** dynamic web application to validate and store data using markup languages like-XML, DTD & XSD.	5	2,3,13,14,15	12
CO-3	**Design** and **develop** an interactive web application using JavaScript and XHTML with CSS.	5	2,3,13,14,15	12
CO-4	**Design** and **develop** dynamic web application using server-side programming and Database connectivity.	5	2,3,13,14,15	12
CO-5	**Develop** a web service to represent the data in the standard formats for the given requirements.	5	2,3,13,14,15	12
CO-6	**Explain** the future of World Wide Web and its associated trending technologies.	-	5, 13	1,12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	1.0	2.0	2.0	-	3.0	-	-	-	-	-	-	1.0	2.0	2.0	2.0

Pre-requisites: Knowledge of

- Programming language (any)
- Database Management Systems

Contents:

Unit-I

Introduction to Web: WWW1.0, HTML, HTML5, XHTML, XML, XSD, DTD, DOM-XML. **8 Hrs**

Unit-II

Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.
Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts, Approaches to CSS Layout, Responsive Design, CSS Frameworks. **8 Hrs**

Unit-III

Introduction to JavaScript: Basics, Strings, Arrays, Functions, Objects in JavaScript, building simple applications using JavaScript and HTML. **8 Hrs**

Unit-IV

Introduction to PHP: Introduction to PHP, Datatypes, Control Statements, Loops, Functions, Embedding PHP in HTML & MySQL. **8 Hrs**

Unit-V

Introduction to Web 2.0: Overview of WWW 2.0, JSON, Web Services - SOAP & WSDL, RESTful.
Introduction to AJAX: Basics of AJAX, Asynchronous and Synchronous message transformation.
Future of Web: Overview of Semantic Web, Applications of Semantic Web, Virtual Reality, Web OS. **7 Hrs**

Reference Books:

1) Robert W. Sebesta, “Programming the World Wide Web”, 7/E Pearson Education, 2012.
2) Luke Welling and Laura Thomson, “PHP and MySQL Web Development”, 5/E, Pearson Education, 2016.
3) Nicholas C Zakas, “Professional JavaScript for Web Developers”, 3/E, Wrox/Wiley India, 2012.
4) Nicholas C Zakas et al, “Professional AJAX”, Wrox, 2007.
5) Karin K. Breitman, Marco Antonio Casanova and Walter Truszkowski, “Semantic Web: Concepts, Technologies and Applications”, Springer International Edition, 2007.

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 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	**Recite** and **follow** interpersonal relations with peers and the others	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 charachersticis and activities of different orders existing in Nature and **demonstrtate** the role of human beings in mutual fulfilment 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**	**15**
Mapping Level	-	-	-	-	-	2.5	3.0	3.0	2.0	-	-	-	-	-	-

Pre-requisites: None

Contents:

Unit-I

Harmony in the Society: Understanding Universal Human Order, Undrestanding Human Goal, Appraisal of the Current Status, The Way Ahead, Dimensions of Human Order. **3 Hrs**

Unit-II

Harmony in the Nature: Nature as a collection of units, Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment 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 the Role of Human Being in Existence.

3 Hrs

Unit-IV

Ethical Human Conduct and Professional Ethics: Universal Human 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, Dilemmas, and Their Resolution. **2 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:

1) 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

22UCSE421	**Project Management Tools**	**(0-0-2) 1**

Contact Hours: 26

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

- Understand the fundamental principles of software project management.
- Gain knowledge of responsibilities of project manager.
- To be familiar with different methods, techniques and tools used for project management.

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	**Develop** pricing, estimating, and cost control strategies, including life-cycle costing and other quantitative tools.	-	1,2,3,5,11	-

CO-2	**Demonstrate** techniques for identifying, mitigating, and managing risk in projects.	-	1,2,3,5,11	15
CO-3	**Demonstrate** the usage of tools for managing the quality of projects.	-	1,2,3,5,11	14,15
CO-4	**Formulate** and **assemble** component ideas in order to successfully execute a project plan	-	1,2,3,5,9, 11	15

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	2.0	2.0	2.0	-	2.0	-	-	-	2.0	-	2.0	-	-	1.0	1.0

Suggested list of term works:

The list of experiments is based on the following concepts:

1. Pricing and Estimating
2. Risk Management
3. Cost Analysis
4. Quality Management

Operating Platform: GitHub, Trello, Smartsheet, Jira, etc.

Reference Books:

1) Harold Kerzner, “Project Management: A Systems Approach to Planning, Scheduling, and Controlling”, 12/E, John Wiley and Sons, Inc, 2019
2) Mike Cotterell and Bob Hughes, “Software Project Management”, 5/E, Tata McGraw-Hill, 2012.
3) Jalote P, “Sofware Project Management in Practice”, 2/E, Pearson Education, 2003.

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

Contact Hours: 13

Course Learning Objectives (CLOs): 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	13

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.	13	2,3	1
CO-4	Understand nature-inspired materials and mechansims.	13	2,3	1
CO-5	Understand the latest trends in bioengineering	2,3	1	13

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1.8	2.4	2.4	-	-	-	-	-	-	-	-	-	2.0	-	-

Pre-requisites: None

Course Contents:

Unit-I

Biomolecules and their applications: Carbohydrates, Nucleic acids, Proteins, Lipids, and Enzymes. **3 Hrs**

Unit-II

Human organ systems and Bio Designs – 1: Brain as a CPU system, Eye as a camera system, Heart as a pump system. **3 Hrs**

Unit-III

Human organ systems and Bio Designs – 2: Lungs as a purification system, Kidney as a filteration system, Muscular and Skeletol Systems as scaffolds **2 Hrs**

Unit-IV

Nature – bioinspired materials and mechanisms: Echolocation, Photosynthesis, Bird flying (GPS and aircrafts), Shark skin (Friction reducing swin suits), Kingfisher beak (Bullet train), Human Blood substitutes **3 Hrs**

Unit-V

Trends in Bioengineering: Bioprinting technique and materials, 3D printing of ear, bone, and skin, Electrical tongue and electrical nose in food science, Bioimaging and Artificial Intelligence for disease diagnosis. **2 Hrs**

Reference Books:

1) Stuart Fox and Krista Rompolski, **"**Human Physiology", McGraw-Hill ebook, 16/E, 2022
2) Thyagarajan S, Selvamurugan N, Rajesh M.P.et al, "Biology for Engineers", Tata McGraw-Hill, New Delhi, 2012.
3) Leslie Cromwell, "Biomedical Instrumentation", Prentice Hall 2011.
4) Sohini Singh and 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) Audit**

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 (13-15)**		
		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
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 $e^{at}f(t)$ Laplace transform of $t^n f(t)$, Laplace transform of $\frac{f(t)}{t}$,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 differentialequations 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, 44/E, 2017.
2) Rajesh Verma & H. K. Dass, "Higher Engineering Mathematics", 3/E, 2014.

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

1. The mandatory non – credit course Mathematics for IV Semester is to the lateral entry Diploma holders admitted to IV semester of BE/B.Tech., programs. The students shall attend the classes 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. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of degree.

22UNSK408	National Service Scheme	(0-0-2) Audit

Contact Hours: 26

Course Learning Objectives:

1. Understand the community in which they work.
2. Identify the needs and problems of the community and involve them in problem-solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony.

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	Understand the importance of his / her responsibilities towards society.	12	6	8
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.	12	6	8
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.	12	6	8,

CO4	Implement government or self-driven projects effectively in the field.	12	6	8

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

Activity list:

1. Waste management– Public, Private and Govt organization.
2. Setting of the information imparting club for women leading to contribution in social and economic issues.
3. Water conservation techniques – Role of different stakeholders– Implementation.
4. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
5. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
6. Developing Sustainable Water management system for rural areas and implementation approaches.
7. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
8. Spreading public awareness under rural outreach programs. (minimum 2 programs).
9. Social connect and responsibilities.
10. Plantation and adoption of plants. Know your plants.
11. Organize National integration and social harmony events /workshops/ seminars. (Minimum 02 programs).
12. Govt. school Rejuvenation and helping them to achieve good infrastructure.

Students have to take up at least three activities on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.

Note: Activities must be unique (Not repeat) across semesters for each student.
CIE will be evaluated based on their presentation, approach and implementation strategies.

Reference Books:

NSS Course Manual, Published by NSS Cell, VTU Belagavi

ASSESSMENT AND EVALUATION PATTERN		
	Time Schedule	CIE (50)
Presentation: on Selected topic	Before the IA-3	50 Marks

Note: Implementation strategies of the project with report duly signed by the Department NSS Coordinator and HoD

CIE and SEE Evaluation (from 2023-24 batch)

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

Continuous Internal Evaluation (CIE):

- Two Internal Assessments 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 Assessments 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 Assessments 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.