Academic Program: UG

Academic Year 2025-26

Syllabus

Information Science and Engineering

III & IV Semester B.E.

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,
DHARWAD – 580 002
(An Autonomous Institution Approved by AICTE & Affiliated to VTU, Belagavi
Accredited by NBA under Tier-1(July 2023-June 2026)**)**

Ph: **0836-2447465Fax: 0836-2464638** **Web:** www.sdmcet.ac.in

SDM College of Engineering & Technology, Dharwad.

It is certified that the scheme and syllabus for III & IV semester B.E. in Information Science and Engineering is recommended by the Board of Studies of Information 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 2025-26 till further revision.

Chairman BoS & HoD Principal

College Vision and Mission

SDMCET- 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 Industrial Expertise for connecting classroom content to real life situations.
- To inculcate Ethics and impart soft-skill leading to

SDMCET- 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 VISION AND MISSION

Vision:

To develop competent Information Technology Engineers having complete knowledge and skills in contemporary Information Technology practices.

Mission:

- To develop contemporary curriculum in information technology delivered
- To provide facilities for relevant research and expose students to the best
- To inculcate the best moral values and professional ethics in students

Program Educational Objectives (PEOs):

- Develop into Information Technology Professionals with expertise in providing solutions to Information Engineering problems
- Pursue higher studies with the sound knowledge of basic concepts and skills in basic science, humanities and Information Technology disciplines
- Exhibit professionalism and team work by providing the environment for exploring current technology trends through collaborative and complementary work ethics

PO's and PSO's.

PO1.**Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO2.**Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3.**Design/Development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4.**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5.**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6.**The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7.**Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8.**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9.**Individual and Team work:** Function effectively as an individual and as a member or leader in diverse teams and individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10.**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such

as, being able to comprehend and write effective reports and design documentation, and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11.**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long Learning:** long learning: Recognize the need for and have the Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSO13. An ability to develop logical reasoning, coding skills, analysis and mathematical modeling.

PSO14. An ability to modify, debug, test and adapt software modules for varied applications.

SDM College Of Engineering And Technology
Department of Information Science and Engineering
III Semester
Scheme of Teaching And Examination 2025-26

Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical / Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	ASC	22UMAC300	Engineering Mathematics-III	MA	2	2	0	03	50	100	100	3
2	PCC	22UISC300	Logic Design and Computer Organization	ISE	4	0	0	04	50	100	100	4
3	PCC	22UISC301	Finite Automata and Formal Languages	ISE	3	0	0	03	50	100	100	3
4	PCC	22UISC302	Software Engineering	ISE	3	0	0	03	50	100	100	3
5	PCCL	22UISL303	Digital Circuits Laboratory	ISE	0	0	2	03	50	50	100	1
6	PCCL	22UISL304	Data Structures Laboratory	ISE	0	0	2	03	50	50	100	1
7	PLC	22UPISC305	Data Structures	ISE	3	0	0	03	50	100	100	3
8	UHV	22UHVK306	Universal Human Values-I	ISE	1	0	0	01	50	50	100	1
9	SEC	22UISE321	Introduction to Web Programming	ISE	0	0	2	03	50	50	100	1
10	ASC	22UMBA301	Mathematics	MA	3	0	0		50		50	Audit
11	MC	22UNSK307	National Service Scheme(NSS)	NSS	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: 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 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 NSSactivities. This course 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
Department of Information Science and Engineering
III Semester
Scheme of Teaching And Examination 2025-26

Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	ASC	22UMAC400	Engineering Mathematics-IV	MA	2	2	0	03	50	100	100	3
2	PCC	22UISC400	Microcontroller	ISE	3	0	0	03	50	100	100	3
3	PCC	22UISC401	Design and Analysis of Algorithms	ISE	3	0	0	03	50	100	100	3
4	PCC	22UISC402	Operating System	ISE	3	0	0	03	50	100	100	3
5	PCCL	22UISL403	Object Oriented Programming System Laboratory	ISE	0	0	2	03	50	50	100	1
6	PCCL	22UISL404	Microcontroller Laboratory	ISE	0	0	2	03	50	50	100	1
7	PLC	22UPISC405	Object Oriented Programming System with C++	ISE	3	0	0	03	50	100	100	3
8	UHV	22UHVK406	Universal Human Values-II	ISE	1	0	0	01	50	50	100	1
9	SEC	22UISE421	Introduction to Web Content Management System Tools	ISE	0	0	2	03	50	50	100	1
10	MC	22UBEK407	Biology for Engineers	ISE	1	0	0	01	50	50	100	1
11	ASC	22UMBA401	Mathematics	MA	3	0	0	-	50	-	50	Audit
12	MC	22UNSK408	National Service Scheme(NSS)	NSS	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

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12
Mapping Level	1.4	1.4	-	-	-	-	-	-	-	-	-	2

Pre-requisites: Knowledge of fundamentals of calculus, Statistical averages

Contents:

Unit-1

Fourier Series: Periodic functions, Dirich let'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-2

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 **Z**-equations. **9 Hrs.**

Unit-3

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-4

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

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 external problems-Lagrange's multiplier method. **7 Hrs.**

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition,2017.
2. E.Kreyszig: Advanced Engineering Mathematics, John Wiley &Sons, 10th Edition.(Reprint), 2016.
3. Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd Edition, 2016.
4. Er.Prem Kumar Gupta, Dr.D.S.Hira, "Operation Research " S.Chand&CompanyPvt.Ltd. 7thEdition, 2014.

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22UISC300 Logic Design and Computer Organization (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

This course will enable students to: Make use of simplifying techniques in the design of combinational circuits, illustrate combinational and sequential digital circuits, demonstrate the use of flip-flops and apply for registers, Design and test counters.

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 basic elements of logic circuits and choose appropriate technique for solving the problem and design various combinational Circuits Analyze the problem.	3	-	1,13
CO-2	**Describe** different types of basic building for sequential circuits.	3	2	1
CO-3	**Design** various sequential circuits for a given problem, analyze and compare different sequential circuit.	-	1	13,14
CO-4	**Explain** the function of computer components, instruction types andDescribe and design memory units for given specifications and analyze the design issues in terms of speed, technology, cost, performance and the performance of cache memory.	-	2,3	13,14
CO-5	**Describe** the operation of a computer in terms of the fetch-decode-execute cycle, architecture of large computer systems and write Control sequence for the given instruction.	-	1	-

POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Po11	PO12	PSO13	PSO14
Mapping Level	1.5	2.0	2.67	-	-	-	-	-	-	-	-	-	1.0	1.0

Pre-requisites: 1. Fundamental arithmetic
2. Digital Electronic circuits

Contents:

Unit I

Combinational Logic Circuits: Boolean laws and Theorems**,** Circuit Designing Techniques: SOP, POS, Karnaugh Map, Simplification by Quine- McClusky, Petrick‟s method and table reduction and Variable entered Karnaugh map. **Combinational Building Block:** half and full adder, carry look ahead adder, Subtractor, Multiplexers, Demultiplexers, Code Converter, Decoder, Encoders, Parity Generators and Checkers, Magnitude Comparator. **10 Hrs.**

Unit II

Sequential Building Blocks: Flip- Flops**:** Basic bi-stable element, latches, RS Flip-Flops, Edge- triggered D FLIP-FLOPs, Edge-triggered JK FLIP-FLOPs, JK Master- slave FLIP-FLOP, Characteristic equation, Flip-flop conversion. **10 Hrs.**

Unit III

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, and Universal Shift Register. **Counters:** Asynchronous Counters, Synchronous Counters and Design of Counter. **10 Hrs.**

Unit IV

Introduction: Definition of Computer Organization and Architecture, Computer types, Functional units: Input unit, Memory unit, Arithmetic & logic unit, Output unit, Control unit, Basic Operational Concepts, Bus Structures, Performance: Processor clock, Basic Performance equation, Pipelining. **Memory System:** Concepts of Memory, RAM, ROM, PROM, EPROM, EEPROM, Flash memory, Memory hierarchy, Cache Memories: Mapping functions. **10Hrs.**

Unit V

Arithmetic: Arithmetic and Logic Unit, Multiplication of Positive numbers, Signed-Operand Multiplication- Booth Algorithm, Fast Multiplication- Bit-pair Recoding of Multipliers, Integer division, Floating point operations. **Basic Processing Unit:** Some Fundamental Concepts: Register Transfers, Performing an Arithmetic or Logic operation, fetching a Word from Memory, Storing a Word in Memory; Branch instruction: Multiple-Bus Organization. **12Hrs.**

Reference Books:

1. Donald P Leach, Albert Paul Malvino & Goutam Saha," Digital Principles and Applications", 8th Edition, Tata McGraw Hill, 2015.
2. Morris Mano, "Digital Design", 4th Edition, Pearson Prentice Hall, 2008.
3. Charles H. Roth. "Fundamentals of Logic Design", 5th Edition, Cengage Learning, 2004.
4. Carl Hamacher, Zvonko Vranesic, SafwatZaky, "Computer Organization", 5th Edition, McGraw-Hill Higher Education, 2015.

22UISC301	Finite Automata and Formal Languages	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

This course focuses on Study abstract computing machines, Language representation techniques, regular expressions, grammar constructions and associated theories and tools to realize formal languages, employ different types of automata machines to solve problems in computing.

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	**Construct** a finite automaton for a given pattern and **explain** its working principles.	-	1,2,3,13	-
CO-2	**Explain** regular expressions for given patterns, different techniques, principles used and language properties. **Verify** the properties of given languages .	-	1,2,3,13,14	2,4
CO-3	**Design** grammar for a given language specification and **explain** the design principles.	-	1,2,3,13	-
CO-4	**Write** lexical analyzer and parser for the simple programming **construct** using standard compiler writing tools.	-	1,2,3,5	-
CO-5	**Design** and verify Pushdown Automata and, Turing Machine for a given language specification. Explain its underlying working principles.	-	1,2,3,14	-

POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO13	PSO14
Mapping Level	2.0	2.0	2.0	1.0	2.0	-	-	-	-	-	-	-	2.0	2.0

Pre-requisites: 1.Discrete mathematical structures that include set theory, elements of mathematical reasoning, functions and relations.
2. Any high-level programming language (commonly C).
3. Knowledge of data structures and algorithms is an advantage.

Contents:

Unit I

Introduction to Finite Automata: Structural Representation. The central concepts of Automata theory – Alphabet, Strings & Languages. Finite Automata: Introduction, Deterministic Finite Automata (DFA), Non-Deterministic Finite Automata (NFA), Equivalence of NFA and DFA, Applications of Finite automata, FA with Epsilon (€) transitions. **8 Hrs.**

Unit II

Regular Expressions and languages: Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions. Properties of Regular Languages (RL): Proving Languages not to be Regular. Closure properties of Regular Languages, Equivalence and Minimization of Automata. **8 Hrs.**

Unit III

Context-Free Grammars (CFG) and Languages (CFL): Context-Free Grammars, Parse Trees, Applications of Context-Free Grammars, Ambiguity in Grammars and Languages. Properties of Context Free Languages: Normal forms for Context Free Grammar, Closure properties of Context Free languages. **8 Hrs.**

Unit IV

System Applications & Tools- Lex and Yacc: The Simplest Lex Program, Recognizing Words with Lex, Grammars, Running Lex and Yacc, Lex vs. Hand Written Lexers Using Lex: Regular Expressions, A Word count program, parsing a Command Line , A C Source Code Analyzer Using Yacc: Grammars, A Yacc Parser, the Lexer, Arithmetic Expressions and Ambiguity Parser: The Role of the Parser. **8 Hrs.**

Unit V

Push Down Automata (PDA): Definition of Pushdown Automata, The languages of a PDA, Equivalence of PDA's and CFG'S, **Introduction to Turing Machines (TM):** Problems that computer cannot solve, Turing Machine, Programming Techniques for Turing Machine, Extensions to Basic Turing Machine. **7 Hrs.**

Reference Books:

1. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, “Introduction to Automata Theory, Languages, and Computation”, 3rdEdition, Pearson Education, 2013.
2. John C Martin, “Introduction to Languages and The Theory of Computation” 3rdEdition, Tata McGraw Hill, 2013.
3. Peter Linz, “An Introduction to Formal Languages and Automata”,3rdEdition, Narosa Publishers, 1998.
4. John Levine, Doug Brown, Tony Mason, “lex&yacc”, 2ndEdition, O’Reilly Media, 1992.

22UISC302	Software Engineering	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

Student should understand the need for a process of software development complexity of system development, types of systems and quality requirements, analysis of any problem domain and formulation of requirements and assessment of quality, contemporary modeling, designing, development and validation techniques, fundamental aspects of software testing techniques.

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 need for Software Engineering and software process.	1	-	12
CO-2	Analyze the system to be automated for identifying the software requirements.	-	2	-
CO-3	Design High-level and Low-level design of an application from the identified software requirements.	10	3	-
CO-4	Apply the methods of test generation from requirements and structural testing.	-	4,14	-
CO-5	Adapt software testing techniques.	-	13,14	10

POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	3.0	2.0	2.0	2.0	-	-	-	-	-	2.0	-	1.0	2.0	1.0

Pre-requisites: 1. Basics of Computer Programming

Contents:

Unit I

Overview FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems. Critical Systems: A simple safety critical system; System dependability; Availability and reliability. **Software Processes:** Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering. **8 Hrs.**

Unit II

Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document. **Requirements Engineering Processes**: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

8 Hrs.

Unit III

Software Design: Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles. **Object Oriented design**: Objects and Object Classes; An Object-Oriented design process; Design evolution. UI Design Issues. Development: Rapid Software Development: Agile methods; Extreme programming; Rapid application development. **8 Hrs.**

Unit IV

Basics of Software Testing: Human Errors and Testing; testing levels types of testing, verification and validation. **Software testing**: System testing; Component testing; Test case design; Test automation. **Testing Techniques:** Defect testing, Integration testing, Incremental integration testing, Release testing, performance testing, Structural testing, path testing, Stress testing, Object class testing, Interface testing, requirement based testing. **8 Hrs.**

Unit V

Structural (White Box) Testing: Introduction coverage testing, statement coverage ,branch and decision coverage, path coverage **Fault Based Testing**: Overview, Assumptions in fault based testing, Mutation analysis, **Black Box Testing:** Introduction Equivalence Partitioning; Boundary Value Analysis; Category-Partition Method, Cause-Effect Graphing. comparison of black box white box testing **7 Hrs.**

Reference Books:

1. Ian Somerville, "Software Engineering",10th Edition, Pearson Education, 2017
2. Rogers S Pressman, "Software Engineering: A Practitioners Approach",7thEdition, McGraw-Hill, 2007.
3. Foundations of Software Testing - Aditya P Mathur, Pearson Education, 2008
4. Software Testing and Analysis Process Principles and Techniques – Mauro Pezze, Michal Young, Wiley India, 2008

22UISL303	Digital Circuits Laboratory	(0-0-2) 1

Contact Hours: **26**

Course Learning Objectives (CLOs):

This Laboratory course is designed to strengthen the students to understand the basic concepts of Combinational circuit & Sequential circuit simplification and implementation and its 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	**Verify** truth table of logic Gates and Boolean functions	-	1, 2	8
CO-2	**Design** Logic Circuits for given Problem and simulate using Knowledge of Boolean, K-map, decoders, multiplexer.	1, 13	2, 3, 5,14	8
CO-3	**Design**& implement the Combinational circuits.	1, 13	2, 3, 5,14	8
CO-4	**Design** & implement the Sequential logic circuits.	1, 13	2, 3, 5,14	8

POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2.75	2.0	2.0	-	2.0	-	-	1.0	-	-	-	-	3.0	2.0

Prerequisites: Number system and logical design

Contents:

1. Design of Multiplexer Circuits.
2. Design of De-Multiplexer Circuits.
3. Design of Comparator Circuits
4. Design of Flip-Flop Circuits
5. Design of Shift Register Circuits
6. Design of Counter Circuits

Reference Books:

1) Donald P Leach, Albert Paul Malvino & GoutamSaha," Digital Principles and Applications", 8th Edition, Tata McGraw Hill, 2015.
2) M. Morris Mano, "Digital Design", 4th Edition, Pearson Prentice Hall, 2008.
3) Clarence W. De Silva," Sensors and Actuators: Engineering System Instrumentation",2nd Edition.

22UISL304	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/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	1.0	3.0	-	2.0	-	-	-	1.0	-	-	-	1.0	3.0	2.6

Prerequisites: 1. 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
6. Graph: Adjacency matrix representation, Depth First Search, Breadth First Search, Transitive closure of a graph.

Reference books:

1) Programming in ANSI C, E Balagurusamy, McGraw Hill Education India Private Limited, 7thEdition, 2017.
2) Data Structures using C, Aaron M Tenenbaum, YedidyahLangsam and Moshe J Augenstein, Pearson Education, 13th impression 2019.
3) Data structures using C, ReemaThareja , OXFORD university press, second Edition, 13th impression 2018.
4) YashwantKanetkar, "Data Structures through C", 3rdEdition, BPB Publications, 2019.

22UTISC305 Data Structures (2-2-0) 3

Contact Hours: 39

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 dynamic memory allocation and recursive solutions and Write programs on that.	1	2,13	12,14
CO-2	Implement various linked structures and use them in applications.	1,2,13	-	12,14
CO-3	Implement stack, queue and use them in various applications.	1,2,13	-	12,14
CO-4	Implement binary trees and use them in various applications.	1,2,13	-	12,14
CO-5	Implement graph and use them in various applications.	1	2,13	12,14

POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	3.0	2.6	-	-	-	-	-	-	-	-	-	1.0	2.6	1.0

Prerequisites: Knowledge of C programming

Contents:

Unit I

Dynamic Memory Allocation- Revisited, **Recursion:** Concept of recursion, solving problems using recursive functions. **7 Hrs.**

Unit II

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. **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. **8 Hrs.**

Unit-IV

Trees: Basic concept of trees, binary tree, applications, Basic Tree Terminologies and different types of binary trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, Construction of Binary search tree, different operations on binary search tree and their applications. **8 Hrs.**

Unit V

Graph: Basic concept, Graph terminologies and applications, Representation of Graph, DFS (Depth First Search), BFS(Breadth First Search)**,** Transitive closure of a graph. **8 Hrs.**

Reference Books:

1) "Data Structures using C", Aaron M Tenenbaum, Yedidyah Langsam and Moshe J.Augenstein, Pearson education, Thirteenth Impression 2019.
2) "Data structures using C",Reema Thareja, OXFORD university press, 2nd Edition, 13thimpression 2018.
3) "Data Structures, A Pseudocode Approach with C",RicharF. Gilberg and BehronzA.Forouzan, Thomson, 2ndEdition,5thIndian Reprint 2015.

22USCK306	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)		
		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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
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 fulfilment. **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. **2Hrs.**

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). **3Hrs.**

Unit VI

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 fulfilment to ensure Ubhaya – tripti; Trust (Visvãsa) and Respect (Sammãna) 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.

2Hrs.

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.

22UISE321	Introduction to Web Programming	(0-0-2) 1

Contact Hours: **26**

Course Learning Objectives (CLOs): Student 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	8,12
CO-2	**Illustrate** the application of CSS to style the web pages	5	2,3,13,14	8,12
CO-3	**Apply** the constructs of JavaScript to perform event handling	2,3,5	13,14	8,12
CO-4	**Create** dynamic web pages using JavaScript	2,3,5	13,14	8,12

POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	-	4.5	4.5	-	3.0	-	-	1.0	-	-	-	1.0	2.0	2.0

Contents:

1. Web page creation
2. Cascading Style Sheet Syntax, Location of CSS
3. Styling the web pages using CSS
4. Validating the HTML forms using JavaScript

Reference Books:

1. Robert W. Sebesta : Programming the World Wide Web, 4th Edition, Pearson Education
2. Mark Pilgrim, "HTML5 – Up and Running: Dive Into the Future of Web Development", 1st Edition, O'Reilly Google Press
3. Thomas Powell, "HTML & CSS: The Complete Reference", 5th Edition, McGraw Hill Education, India

22UMBA301	Mathematics	(3-0-0) 3

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 bendiness 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/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	1.6	1.6	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites:

1. Differentiation of function
2. Integration of function.

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). 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 $\int_0^{\pi/2} sin^n\, xdx, \int_0^{\pi/2} cos^n\, xdx$ and $\int_0^{\pi/2} sin^n\, xcos^m xdx$(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).

10Hrs.

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 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. **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, 44thEdition,2017.
2. H.K.Dass&RajnishVerma,Higher Engineering Mathematics,3rdEdition, 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 tofulfil 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.

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

Contact Hours: 24

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/PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Mapping Level	-	-	-	-	-	2	-	1	-	-	-	3

Activity list:

1. Waste management– Public, Private and Government 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 stake holders–Implementation.
4. Preparing an action able 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 nation all eve initiative of Government to India. For eg.DigitalIndia,SkillIndia,SwachhBharat,AtmanirbharBharath,Makein India, Mudra scheme, Skill development programs etc.
8. Spreading public awareness under rural outreach programs. (minimum 2programs).
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 Rajeev nation and helping the 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 value ted based on their presentation, approach and implementation strategies.

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

ASSESSMENTANDEVALUATIONPATTERN		
	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

Course Learning Objectives (CLOs):

Provide an insight into applications of conformal mapping. Integration of complex functions. **Apply** 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.	-	-	1,2,12
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/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 of analytic functions: **8 Hrs.**

Milne-Thomson method-Problems**.**

Unit-II

Conformal transformations:

Introduction. Discussion of conformal transformations: $\mathbf{w}= e^z; w = z^2, w = z + \frac{1}{z}, z \neq o$. 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. **8 Hrs.**

Reference Books:

1**.**B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44thEdition., 2017.

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

3.PeterV.O'Neil: Advanced Engineering Mathematics, International students Edition, 2011.

4. Kishor S. Trivedi: Probability& Statistics with Reliability, Queuing, and Computer Science Applications, Prentice-Hall of India, 2005.

5. N. P Bali and Manish Goyal: "A textbook of Engineering Mathematics" LaxmiPublications,10th Ed., 2022.

22UISC400	Microcontroller	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course is designed to expose the students to the architecture of ARM Processor and ATmega328P. The course focuses on the study of basic architecture including addressing modes, instructions, memory design. This course also focuses on the

interfacing of Microcontroller with external devices using Embedded C Programming skills.

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 features of embedded systems and architecture of ARM7 Processor.	1	2	12
CO-2	**Illustrate** the ARM Instruction set and write Programs using ARM Instruction set.	3	13	1,14
CO-3	**Illustrate** the THUMB Instruction set and write the ALP program using THUMB instruction set.	-	3,13,14	1
CO-4	**Describe and Compare** various Exception and interrupt handling Schemes and Demonstrate interfacing of various Peripherals.	-	2	-
CO-5	**Illustrate** the features and architecture of ATmega328P.	-	-	1

PO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	1.5	2.0	1.5	-	-	-	-	-	-	-	-	1.0	2.0	1.5

Pre-requisites: 1. Background of computer organization.
2. Exposure to programming in C

Contents:

Unit I

Evolution of Microcontroller, ARM Processor Fundamentals: The RISC design philosophy, RISC and CISC comparison, embedded system hardware, embedded system software- applications.LPC2148 ARM CPU Salient features and its applications. ARM core data flow model, Registers, CPSR-Processor modes, Banked registers, pipeline-characteristics. **8 Hrs.**

Unit II

ARM Instruction Set: Fundamentals of ARM instructions, Types of ARM instruction (Data processing, Branch, Load-store, SWI and Program Status) And Programming. **8 Hrs.**

Unit III

Introduction to THUMB and Programming: Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking, Assembler directives and Programming. **8 Hrs.**

Unit IV

Exception and Interrupt handling schemes: Exception handling- ARM processor exceptions and modes, vector table, exception priorities, link register offsets. Interrupts- assigning interrupts, interrupt latency. Interrupt handling schemes- nested interrupt handler, non-nested interrupt handler. Basic interrupt stack design.**LPC2148 ARM CPU, Peripherals:** GPIO, PLL & Timers Features. **8 Hrs**

Unit V

Case Study: Features and Architecture of ATmega328P Microcontroller. **7 Hrs.**

Reference Books:

1. Andrew N. SLOSS, "ARM System Developer's guide", Elsevier Publications, ISBN 978-81-8147-646-3, 2016.
2. William Hohl, Steve Furber, "ARM System-on-chip Architecture", Pearson Education,ISBN978-81- 317-0840-8, 2nd Edition,2012.
3. Sepehr Naimi, Sarmad Naimi, Muhammad Ali Mazidi, "The AVR Microcontroller and Embedded Systems Using Assembly and C: Using Arduino Uno and Atmel Studio", 1st Edition, 2017.

22UISC401 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-	1	2,13	12,14

	recursive algorithms.			
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

PO's/PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 13	PSO 14
Mapping Level	2.2	2.8	2.0	-	-	-	-	-	-	-	-	1.0	2.8	1.0

Pre-requisites: Knowledge of Data Structures and programming skills

Contents:

Unit I

Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data structures. **Fundamentals of Analysis of Algorithm Efficiency:** The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-Recursive and Recursive algorithms, Examples.

7Hrs.

Unit II

Brute Force: Selection Sort and Bubble Sort, Sequential Search and String Matching, Exhaustive Search. **Divide-and-Conquer**: Merge sort, Quick sort.

8

Hrs

Unit III

Decrease-and-Conquer: Algorithm for generating combinatorial objects, Decrease by a constant factor algorithms. **Transform-and-Conquer**: Balanced Search Trees, Heaps and Heap sort. **8Hrs**

Unit IV

Space and Time Tradeoffs- Sorting by Counting, Input Enhancement in String Matching. **Dynamic Programming**: Warshall's and Floyd's Algorithms, Multistage Graph. **8Hrs**

Unit V

Greedy Technique: Prim's Algorithm, Dijkstra's Algorithm, Huffman Trees. **Coping with the Branch and Bound**: Limitations of Algorithm Power-Backtracking, Branch and Bound. **8Hrs**

Reference Books:

1) AnanyLevitin, "Introduction to The Design and Analysis of Algorithms", 2nd Edition, Pearson Education, 2011.
2) Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest and Clifford Stein, "Introduction to Algorithms", 2nd Edition,Prentice-Hall India, 2009.
3) Horowitz E., Sahni S., RajasekaranS., "Computer Algorithms",
4) 2nd Edition, Universities Press, 2013.

22UISC402	Operating System	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): Student should identify the concepts, principles and services of operating system, all fundamentals of operating system abstractions and demonstrate them, to explain protection and security requirements of operating systems analyze basic resource management techniques in job and process scheduling compare different memory management techniques and apply concurrency and synchronization techniques to write concurrent programs.

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	**Describe** the role of operating system in their management. Illustrate the process management communication, threads and scheduling of processes by CPU.	2	1	12,13,14
CO-2	**Evaluate** the requirement for process synchronization and coordination handled by	2	1	12

	operating system.			
CO-3	**Implement** memory allocation policies and Comprehend the use of different memory management technologies.	4	2	5
CO-4	**Implement** main memory allocation.	1,2	4	5
CO-5	**Illustrate** the use of signals and IPC in UNIX/LINUX.	1,2	4	5,13,14

PO's/PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO 14
Mapping Level	2.75	2.5	-	2.5	1.0	-	-	-	-	-	-	1.0	1.0	1.0

Prerequisites: 1. Knowledge of Computer organization
2. Basic concepts of Unix/Linux programming

Contents:

Unit I

Introduction to operating systems, Process, inter process Communication, Threads & CPU Scheduling: OS Services, System calls, Process concept, Process scheduling, Operation on processes, Cooperating processes, Threads - Overview, Multithreading models, Threading issues, Pthreads, CPU scheduling - Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Real time scheduling. **8 Hrs.**

Unit II

Process Synchronization and handling Deadlocks: The Critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, monitors. Deadlock - System model, Deadlock characterization, Methods for handling deadlocks - Deadlock prevention, deadlock avoidance, Deadlock detection and recovery from deadlock. **8 Hrs.**

Unit III

Memory Management: Main memory management - Background, Swapping, Contiguous allocation, Paging, Segmentation, Segmentation with paging. Virtual memory - Background, Demand paging, Process creation, Page replacement algorithms, Allocation of frames, Thrashing. **8 Hrs.**

Unit IV

Process Control in UNIX/LINUX: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions,

exec Functions, Changing User IDs and Group IDs, User Identification, Process Times. **Process Relationships:** Terminal Logins, Network Logins. Process groups, sessions ,controlling terminals.

8 Hrs.

Unit V

Signals & Inter-process communication in UNIX/LINUX: Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction, sigchlild signal Kill ,Alarm, Interval Timrers. Socket: Overview Inter process communication. Methods, API functions - socket, bind, listen, accept, connect, close. **7 Hrs.**

Reference Books:

1) Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", 9thEdition, John Wiley& Sons, 2012.
2) Milan Milankovic, "Operating system concepts and design",2ndEdition, McGraw Hill 2008.
3) W. Richard Stevens, Stephen A. Rago," Advanced Programming in the UNIX Environment", 2ndEdition, Addison-Wesley, 2005.
4) Terrence Chan," Unix System Programming Using C++", Prentice Hall India, 1999.

22UISL403 Object Oriented Programming System Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): Understand the fundamentals of object-oriented programming in C++, including defining classes, invoking methods, using class libraries etc. Develop the ability to write a computer program to solve specified 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 (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Implement** the concepts of object-oriented programming, inheritance, memory management, polymorphism, stream handling and operator overloading in C++.	13, 14	2, 3	1, 8, 12
CO-2	**Design** classes and template functions for a given scenario.	13, 14	2, 3	1, 8,12
CO-3	**Demonstrate** the ability to use exception handling mechanisms in C++ programs.	-	13, 14	1, 8,12

POs/PSOs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	1.0	2.0	2.0	-	-	-	-	1.0	-	-	-	1.0	2.67	2.67

Prerequisites: Basic programming skills

Contents:

1. Programs on Class and Objects
2. Programs on Dynamic Memory Management
3. Programs on Inheritance
4. Programs on Virtual Functions and Dynamic Polymorphism
5. Programs on Stream Handling
6. Programs on Operator Overloading
7. Programs on Templates
8. Programs on Exception Handling

Reference Books:

1. E. Balagurusamy, “Object Oriented Programming with C++”,8/e, McGraw-Hill, 2020.
2. SouravSahay, “Object-Oriented Programming with C++”,2/e, Oxford University Press, 2012.
3. Lippman, Lajoie and Moo, “C++ Primer”, 5/e, Addison-Wesley, 2012.
4. HerbertSchildt, “The Complete Reference C++”, 7/e, TMH, 2014.

22UISL404 Micro Controller and IoT Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The course is designed to strengthen the analytical and programming skills of students through assembly and embedded C programming. The lab provides a platform for the student to develop and debug the problems related to microcontroller applications. Student completing this course will have a framework for developing, implementing and integrating microcontroller-based 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 (13-14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the instruction set of ARM and write programs using this instruction set.	2, 13	1,14	8

CO-2	**Illustrate** Interfacing external devices and I/O with ARM and write controlling programs.	2, 13	1, 5,14	8
CO-3	**Develop** C language programs and library functions for embedded system applications.	2, 13	1, 5,12,14	8

PO's/PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2.0	3.0	-	-	2.0	-	-	1.0	-	-	-	2.0	3.0	2.0

Prerequisites: 1. Basics of assembly language
2. C programming

Contents:

PART-A: Conduct the following Experiments to learn ALP using ARM.

1) Arithmetic and logical operations
2) Interrupt related operations
3) Timer related operations

PART-B: Conduct interfacing experiment to learn embedded C for ARM.

1) LCD interfacing
2) Stepper motor interfacing
3) Real time sensor interfacing
4) 7 Segment LED interfacing

Reference Books:

1. Andrew N. SLOSS, "ARM System Developer's guide", ELSEVIER Publications, ISBN 2016.
2. William Hohl, "ARM Assembly Language", CRC Press, ISBN:978-81-89643-04-1.

22UPISC405 Object Oriented Programming with C++ (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

Understand the fundamentals of object-oriented programming in C++, including defining classes, invoking member methods, using class libraries, etc. Students will be able to handle exceptions in the programs using appropriate mechanisms.

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 concepts of object-oriented programming, C++ language constructs and **design** classes for any given problem.	1, 2	3, 13	12,14
CO-2	**Illustrate** and **apply** dynamic memory management, constructors and destructors.	1	13	12,14
CO-3	**Illustrate** and **implement** inheritance and dynamic polymorphism.	1, 2	3, 13	12,14
CO-4	**Apply** the concepts of stream handling in programming and **implement** operator overloading.	1, 2	13	12,14
CO-5	**Design** template functions and **use** exception handling mechanisms.	3	1, 2	12,13,14

POs/PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
Mapping Level	2.8	2.75	2.33	-	-	-	-	-	-	-	-	1.0	1.8	1.0

Pre-requisites: 1. Basic programming skills

Contents:

Unit I

Introduction to C++: A Review of Structures, Procedure- Oriented Programming Systems, Object-Oriented Programming Systems, Comparison of C++ with C, Console Input/Output in C++, Variables in C++, Reference Variables in C++, Function Prototyping, Function Overloading, Default Values for Formal Arguments of Functions, Inline Functions. **Class and Objects:** Introduction to Classes and Objects Member Functions and Member Data, Objects and Functions, Objects and Arrays. Namespaces, Nested Classes. **8 Hrs.**

Unit II

Dynamic Memory Management: Introduction, Dynamic Memory Allocation, Dynamic Memory Deallocation, The set new _ handler () function. **Constructors and Destructors**: Constructors – Zero argument constructor, Parameterized constructors, Copy constructor, Destructors. **8 Hrs.**

Unit III

Inheritance: Introduction to Inheritance, Base Class and Derived Class Pointers, Function Overriding, Base Class Initialization, The Protected Access Specifier, Deriving by Different Access Specifiers, Different Kinds of Inheritance, Order of Invocation of Constructors and Destructors. **Virtual Functions and Dynamic Polymorphism**: The Need for Virtual Functions, Virtual Functions, The Mechanism of Virtual Functions, Pure Virtual Functions, Virtual Destructors.

8 Hrs.

Unit IV

Stream Handling: Streams, The Class Hierarchy of Handling Streams, Text and Binary Input/Output, Text Versus Binary Files, Text Input/Output, Binary Input/Output, Opening and Closing Files, Files as objects of the fstream Class, File Pointer, Random Access to Files, Object Input/Output through Member Functions, Error Handling, Manipulators.**Operator Overloading**: Operator Overloading, Overloading the Various Operators, Type conversion. **8 Hrs.**

Unit V

Templates: Introduction, Function Templates, Class Templates.
Exception Handling: Introduction, C-style Handling of Error generating codes, C++ Style Solution - the try/throw/catch constructs. Limitation of Exception Handling.

7 Hrs.

Reference Books:

1. E. Balagurusamy, “Object Oriented Programming with C++”, 8th Edition, McGraw-Hill, 2020.
2. SouravSahay, “Object-Oriented Programming with C++”,2nd Edition, Oxford University Press, 2012.
3. Lippman, Lajoie and Moo, “C++ Primer”, 5th Edition, Addison-Wesley, 2012.
4. HerbertSchildt, “The Complete Reference C++”, 7th Edition, TMH, 2014.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO13	PSO14
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 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 Role of Human Being in Existence.

3 Hrs.

Unit IV

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 Book(s):

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

22UISE421	Introduction to Web Content Management System Tools	(0-0-2) 1

Contact Hours:**26**

Course Learning Objectives (CLOs):

In this era of digitalization digital presence is very vital for all, be it a business, organization or a person. Being able to create websites is crucial to ensure digital presence. This course helps the students learn to create and maintain websites using the Content Management System (CMS) tools like WordPress and Joomla.

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	Describe and demonstrate the installation of CMS tool	5	-	-
CO-2	Create pages, posts and manage	5	2, 3, 9,10	8,12,13,14

	content using CMS templates			
CO-3	Use plug-in to extend the functionality of websites	5	2	8,12,13,14

POS/ PSO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 13	PSO 14
Mapping Level	-	2.0	2.0	-	3.0	-	-	1.0	2.0	2.0	-	1.0	1.0	1.0

Contents:

1. Installing the CMS
2. Creating a local server
3. Navigating around the dashboard provided by CMS tool
4. Installing themes / templates
5. Creating posts and pages
6. Adding and removing comment capabilities
7. Managing the appearance of web pages
8. Understand the need for plug-in, install them to extend the functionality of websites
9. Managing user roles and permissions

Reference Books and Resources:

1. Brian Messenlehner and Jason Coleman, "Building Web Apps with WordPress: WordPress as an Application Framework", 2nd Edition, O'Reilly

2..Media, Inc.Matthew MacDonald, "WordPress: The Missing Manual", 2nd Edition, O'Reilly Media, Inc.

3. Ron Severdia, Jennifer Gress, "Using Joomla!", 2nd Edition, O'Reilly Media, Inc.

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

Contact Hours: 13

Course Learning Objective (CLO):

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 bio-molecules.	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 mechanisms.	13	2,3	1
CO-5	Understand the latest trends in bioengineering.	2,3	1	13

POs/PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 13**	**PSO 14**
Mapping Level	1.8	2.4	2.4	-	-	-	-	-	-	-	-	-	2.0	-

Contents:

Unit I

Bio molecules 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 purification system, Kidney as a filtration system, Muscular and Skeletal Systems as scaffolds. **2 Hrs.**

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. **3 Hrs.**

Unit V

Trends in bioengineering: Bio printing techniques and materials, 3D printing of ear, bone, and skin. Electrical tongue and electrical nose in food science, Bio imaging and Artificial Intelligence for disease diagnosis. **2 Hrs.**

Reference Books:

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022.
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
3. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011. • Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
4. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
5. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016.

22UMBA401	**Mathematics**	**(3-0 -0)**

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 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/PSO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Mapping Level	1.6	1.6	-	-	-	-	-	-		-	-	-

Pre-requisites : Knowledge of fundamentals of calculus.

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). 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 $\int_0^{\pi/2} sin^n\, xdx, \int_0^{\pi/2} cos^n\, xdx$ and $\int_0^{\pi/2} sin^n\, x cos^m xdx$(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, 44thEdition,2017.
2. **H.K.Dass&RajnishVerma**, Higher Engineering Mathematics,3rdEdition, 2014.

Note: 1. Grades (i) PP (ii) NP

2. No semester End Examination

3. Audit (Bridge course).

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 fulfil 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

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

Contact Hours: 26

Course Learning Objectives:

1. Understand the community in which they work.
2. Identifytheneedsandproblemsofthecommunityandinvolvetheminproblem-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/PSO'S	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 stake holders–

4. Implementation.
5. Preparing an action able business proposal for enhancing the village in come and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
7. Developing Sustainable Water management system forural areas and implementation approaches.
8. Contribution to any nation all eve initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India , Mudrascheme, Skill development programs etc.
9. Spreading public awareness derrural out reach programs. (minimum 2programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants .Know your plants.
12. Organize National integration and social harmony events/workshops/ seminars. (Minimum 02 programs).
13. Govt.school Rajeev nation and helping them to achieve good in restructure.

Students have to take up at least three activities south 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 value ted based on their presentation, approach and implementation strategies.

Reference Books:

NSS Course Manual, Published by NSS Cell ,VTU Belagavi.

ASSESSMENTANDEVALUATIONPATTERN		
	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 2022-23 batch)CIE for Non-integrated Courses: With LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

- Two tests + One Improvement test : (20+20+20 each of one hour duration)
- Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- CTA: Minimum two components such as assignments, quiz, seminar, written assignment, any technical activity related to course etc. each of 5 marks. Total CTA marks- 10
- CIE= 40(from tests)+10(from CTA) = 50 marks
- SEE: Exam will be conducted for 100 marks with 3 hour's duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions.

CIE for Integrated Courses: With LTP 2-0-2 and 3-0-2 and 2-2-2

Theory CIE component:

- Two tests + One Improvement test (20+20+20 each of one hour duration)
- Two higher scores from three tests are taken representing 40 marks
- QP pattern: 3 questions- Q.3 is compulsory and one question to be answered from Q.1 and Q.2, each question can be with maximum of two sub divisions.
- Practical CIE component (CTA): Laboratory component. 5 marks for conduction, regularity, involvement, journal etc. Lab Test -5 marks. A test as per the schedule announced will be conducted at the end for 50 marks and scaled down to 5 marks. 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.
- CIE= 40(from tests) +10(from CTA i.e. lab component) = 50 marks
- SEE: Exam will be conducted for 100 marks with 3 hour's duration and will be scaled down to 50 marks. Five modules with built in choice. Each question can be with maximum of three sub divisions. The questions shall be asked to test practical understanding for maximum of 30 marks.

CIE for AEC/HSMS/SDCCourses:With LTP 1-0-0 for 1 Credit

- CIE for 1 credit AEC/HSMS Courses with LTP 1-0-0
- Two tests + One Improvement test
- 20+20+20 each of one hour duration
- QP pattern for IA: MCQ 15 questions
- Two higher scores from three tests are taken representing 40 marks
- CTA: Minimum two components such as assignments ,quiz, seminar, written assignment, any learning activity related to the course etc. each of 5 marks.
- CIE= 40(from tests)+10(from CTA)= 50 marks
- SEE: Exam will be conducted for 50 marks with 1 hour duration. There will be 50 MCQs. The question paper will contain 10 MCQ questions from each module.