Academic Program: UG

Academic Year 2024-25

III & IV Semester B.E.

Syllabus

Under NEP 2022

Branch: Electronics and Communication Engineering

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

Ph: **0836-2447465 Fax: 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 Electronics and Communication Engineering is recommended by the Board of Studies of Electronics and Communication 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 2024-25 till further revision.

Chairman BOS & HOD Principal

SDM College of Engineering & Technology, Dharwad-02

Department of Electronics & Communication Engineering

College – Vision and Mission

VISION:

To develop competent professionals with human values

MISSION:

1. To have contextually relevant Curricula.
2. To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
3. To enhance Research Culture.
4. To involve Industrial Expertise for connecting classroom content to real life situations.
5. To inculcate Ethics and impart soft-skills leading to overall Personality Development.

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.

SDMCET- Core Values

- Competency
- Commitment
- Equity
- Team work and
- Trust

Department- Vision and Mission

Vision

Fostering excellence in the field of Electronics & Communication Engineering, showcasing innovation, research, and performance with continuous Industry – Institute Interaction with the blend of Human values.

Mission

M1: To provide quality education in the domain of Electronics & Communication Engineering through state of the art curriculum, effective teaching learning process and the best of laboratory facilities.

M2: To encourage innovation, research culture and team work among students.

M3: Interact and work closely with industries and research organizations to accomplish knowledge at par.

M4: To train the students for attaining leadership with ethical values in developing and applying technology for the betterment of society and sustaining the global environment.

Program Educational Objectives (PEOs)

The Graduates, after a few years of Graduation will be able to:

I. **Apply** the latest in-depth knowledge in the field of Electronics and Communication Engineering with Mathematical applications to address real life challenges.

II. **Exhibit** the confidence for independent working and / or spirit to work cohesively with group.

III. **Readily** be accepted by the Industry globally.

IV. **Develop** design skills, fault diagnosis skills, communication skills and create research orientation.

V. **Inculcate** professional, social ethics and to possess awareness regarding societal responsibility, moral and safety related issues

Programme Outcomes (POs):

Engineering Graduates will be able to:

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 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 teamwork: 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. Design economically and technically sound analog and / or digital systems based on the principles of signal processing, VLSI and communication Engineering (PO-13)

14. Integrate hardware – software and apply programming practices to realize the solutions in electronics domain. (PO-14).

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD

Department of Electronics and Communication Engineering

III Semester

Scheme of Teaching and Examinations 2024 – 25

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	Maths	2	2	0	03	50	100	100	3
2	PCC	22UECC300	Network Analysis	ECE	4	0	0	03	50	100	100	4
3	PCC	22UECC301	Digital Circuit Design		3	0	0	03	50	100	100	3
4	PCC	22UECC302	Analog Electronic Circuits		3	0	0	03	50	100	100	3
5	PCCL	22UECL303	Digital Circuit Design Laboratory		0	0	2	03	50	50	100	1
6	PCCL	22UECL304	Analog Electronic Circuits Laboratory		0	0	2	03	50	50	100	1
6	ESC	22USECC305	Signals and Systems		2	2	0	03	50	100	100	3
7	UHV	22UHVK306	Universal Human Values-I		1	0	0	01	50	50	100	1
8	AEC	22UECE3XX	Ability Enhancement Course		1	0	0	01	50	50	100	1
9	ASC	22UMBA301	Mathematics	Maths	3	0	0	-	50	-	50	Audit
10	MC	22UNSK307	National Service Scheme (NSS)	NSS	0	0	2	-	50	-	50	Audit
								Total			1000	20
Ability Enhancement Course												
1	AEC	22UECE321	Computer Organization	ECE	1	0	0	01	50	50	100	1
2	AEC	22UECE322	Linear ICs and Applications	ECE	1	0	0	01	50	50	100	1

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 courses 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 NSS activities. This courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of 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 Electronics and Communication Engineering
IV Semester
Scheme of Teaching and Examinations 2024 – 25

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	Maths	2	2	0	03	50	100	100	3
2	PCC	22UECC400	Analog and Digital Communication	ECE	3	0	0	03	50	100	100	3
3	PCC	22UECC401	Control Systems		2	2	0	03	50	100	100	3
4	PCC	22UECC402	HDL Programming		3	0	0	03	50	100	100	3
5	PCCL	22UECL403	Communication Systems Laboratory		0	0	2	03	50	50	100	1
6	PCCL	22UECL404	HDL Programming Laboratory		0	0	2	03	50	50	100	1
7	ESC	22USECC405	Microcontroller		2	2	0	03	50	100	100	3
8	UHV	22UHVK406	Universal Human Values-II		1	0	0	01	50	50	100	1
9	AEC	22UECE4XX	Ability Enhancement Course		1	0	0	01	50	50	100	1
10	MC	22UBEK407	Biology for Engineers		1	0	0	01	50	50	100	1
11	ASC	22UMBA401	Mathematics	Maths	3	0	0	-	50	-	50	Audit
12	MC	22UNSK408	National Service Scheme (NSS)	NSS	0	0	2	-	50	-	50	Audit
								Total			1100	20
Ability Enhancement Course												
1	AEC	22UECE421	Sensors and Instrumentation	ECE	1	0	0	01	50	50	100	1
2	AEC	22UECE422	Basics of Data Science	ECE	1	0	0	01	50	50	100	1

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

Contact Hours: 39

Course Learning Objectives (CLOs):

To have an insight into Fourier series, Fourier transforms, Z-transforms. To solve algebraic, transcendental, and ordinary differential equation 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)/ PSOs (13,14)**		
		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	-
CO-5	Formulate LPP and obtain optimal solutions using different tools.	-	1,2	-

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.4	1.4	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Differentiation of function, Integration of function, 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 $= ax + b; y = ax^2 + bx + c; y = ax^b$..

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

Unit-V

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

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

Reference Books:

1) B.S. Grewal, Higher Engineering Mathematics, 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.

22UECC300	Network Analysis	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The course focuses on mesh and nodal techniques, network theorems and topology, responses of RLC network, AC networks and two port network parameters.

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	**Determine** currents and voltages using mesh / nodal analysis.	-	2	1
CO-2	**Solve** network problems by applying various network theorems to reduce circuit complexities.	2	5	1
CO-3	**Calculate** current and voltages for the given circuit under transient conditions.	2	1	-
CO-4	**Apply** various analysis and simplification techniques for AC networks.	2	1	13
CO-5	**Solve** for currents and voltages using the concept of network equilibrium equations and **determine** the various parameters of two port networks.	2,3	1,13	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.6	2.8	3	-	2	-	-	-	-	-	-	-	1.5	-

Pre-requisites: Engineering Mathematics, Basic Electrical Engineering.

Contents:

Unit-I

Basic Nodal and Mesh Analysis: Node analysis, Super-node, Mesh Analysis, Super-mesh, Nodal Vs Mesh analysis.

Network Theorems: Linearity, Superposition, Source Transformations, Thevenin and Norton equivalent circuits, Maximum power transfer theorem and Delta-Wye and Wye-Delta conversions. **10 Hrs**

Unit-II

Basic RL and RC circuits: Source-free RL circuit, Properties of exponential response, Source-free RC circuit, General perspective, Unit-step function, Driven RL circuits, Natural and forced response, Driven RC circuits, Source-free parallel circuits. **10 Hrs**

Unit-III

Basic RLC circuits: Source-free series RLC circuits, complete response of RLC circuit.

Circuit analysis in frequency domain: Sinusoidal response, Passive circuit elements in frequency domain, *Kirchhoff's* laws in frequency domain, Series,

Parallel and delta-to-Y simplifications, Source transformations and Thevenin-Norton equivalent circuits, Node-voltage method, Mesh-current method**.** **12 Hrs**

Unit-IV

Laplace transforms: Review of Laplace transforms, Nodal and mesh analysis in s-domain.

Frequency Response: Series resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity, Parallel resonance: Resonant frequency and admittance variation with frequency, Bandwidth, and selectivity. **10 Hrs**

Unit-V

Network Topology: Graph of a network, Concept of tree and co-tree, Incidence matrix, Tie-set and cut-set schedules, Branch voltage and current equations, Examples on network equilibrium equations.

Two-Port Networks: Admittance parameters, Impedance parameters, Hybrid parameters, Transmission parameters**,** Interrelationship between parameters. 1**0 Hrs**

Reference Books:

1) William H Hayt. Jr., Jack E Kemmerly, Steven M Durbin, “Engineering Circuit Analysis”, Sixth Edition, Tata-McGraw Hill, 2006.
2) Roy Choudhury, “Networks and Systems”, Second Edition, New age International Publications, 2010.
3) James W. Nilsson, Susan A. Riedel, “Electric Circuits”, Eighth Edition, Pearson Edu. 2008.
4) John D Ryder, “Networks, Lines and Fields”, Second Edition, Prentice-Hall of India, 2005.

22UECC301 Digital Circuit Design (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on the study of various simplification techniques of Boolean expressions and designing of optimized combinational circuits and sequential circuits. It also focuses on application of Digital circuits.

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	**Apply** various techniques to simplify Boolean expressions.	-	2,3	12

CO-2	**Design** combinational circuits using MSI components.	-	2,3	13
CO-3	**Analyze** and **design** combinational circuits using PLDs.	3	-	12
CO-4	**Realize** flip flops and its applications.	3	13	-
CO-5	**Design** of synchronous sequential networks.	-	13	12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	2	2.5	-	-	-	-	-	-	-	-	1	1.67	-

Prerequisites: Basic Electronics

Contents:

Unit-I

Boolean algebra: Canonical forms, prime implicants and irredundant disjunctive expressions prime implicates and irredundant conjunctive expressions. Simplification of Boolean expressions: Karnaugh maps, Quine-McClusky, map entered Karnaugh maps techniques. **08 Hrs**

Unit-II

Logic Design with MSI Components: Binary adders and subtractors, decimal adders, comparators, encoders, decoders, multiplexers, and de-multiplexers. Design of combinational circuits using decoders and multiplexers. **08 Hrs**

Unit-III

Programmable logic devices for Combinational circuits: Introduction, programmable read only memory, programmable logic array, programmable array logic.

Introduction to Logic families: RTL, DTL, TTL, CMOS, ECL. **07 Hrs**

Unit-IV

Flip–flops and its applications: Latches, S-R flip flop, J-K flip flop, D and T flip flop, Master-slave flip-flops, edge triggered flip-flops, registers, counters: asynchronous counters, design of synchronous counters: MOD counters, up/down counters, self-correcting counter. **09 Hrs**

Unit-V

Synchronous sequential networks: Structure and operation of clocked

synchronous sequential networks, analysis of synchronous sequential networks, serial binary adder as a Mealy/Moore network (FSM), sequence recognizer.

07 Hrs

Reference Books:

1) Donald D Givone, "Digital Principles and Design", Tata McGraw Hill Edition,2002.
2) John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.
3) Charles H Roth Jr; "Fundamentals of logic design", Thomson Learning, 2004.
4) Mono and Kim, "Logic and computer design Fundamentals", Pearson, 2nd edition 2001.

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22UECC302 Analog Electronic Circuits (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on the understanding of electrical characteristics, working and applications of analog electronic devices and the design/analysis of various analog electronic circuits.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design** and **analyze** various wave shaping circuits using Diodes.	1,2	3	-
CO-2	**Discuss** the working, electrical characteristics, and biasing techniques for an FET.	-	1,2	13
CO-3	**Perform** small signal analysis of FET.	1,2	4	-
CO-4	**Analyze** the various characteristics of feedback mechanism in amplifiers and oscillators.	1,2,3	-	4,5
CO-5	**Explain** the working of different analog electronic devices and their applications.	-	1,3,4	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.6	2.8	2.3	1.7	1	-	-	-	-	-	-	-	1	-

Pre-requisites: Basic Semiconductor Physics, Basic Electronics

Contents:

Unit-I

Wave Shaping Circuits using Diodes: Clippers, Clampers.

Field-Effect Transistors: Introduction, construction and working of JFET, transfer characteristics, depletion type MOSFET and enhancement type MOSFET. **08 Hrs**

Unit-II

FET biasing: Fixed bias, self-bias, voltage divider bias, biasing in Depletion type MOSFETs and Enhancement type MOSFETs.

FET Amplifiers: JFET small signal model, small signal analysis of JFET based fixed bias, self-bias, voltage divider bias and source follower configurations. small signal models of depletion type MOSFETs and enhancement type MOSFETs. **08 Hrs**

Unit-III

Feedback: Feedback concepts, feedback connection types, practical feedback circuits.

Oscillator circuits: Oscillator operation, FET based phase-shift oscillator, Wein Bridge oscillator, Tuned oscillator circuits: FET Colpitts oscillator, FET Hartley oscillator, Crystal oscillator. **08 Hrs**

Unit-IV

Thyristors: Introduction, construction, working and characteristics of SCR, TRIAC, UJT.

Power amplifiers: Introduction, classification of power amplifiers, series fed and transformer coupled Class A, Class B amplifier circuits: Push Pull operation, Class C and Class D amplifier circuits, Amplifier distortion. **07 Hrs**

Unit-V

Other Two terminal Devices: Light emitting diode (LED), Liquid crystal displays (LCD), Photo conductive cell, Photo diode and Solar cell, Phototransistors, Schottky barrier diodes, Varactor diodes, Power diodes, Tunnel diodes, IR Emitters, Thermistors. **08 Hrs**

Reference Books:

1) Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10/e, PHI, 2012.
2) Jacob Millman and Christos C. Halkias, - “Integrated Electronics”, 8/e, McGraw Hill, 1999.
3) D. A. Bell, “Electronic Devices & Circuits”, 4th Edition, PHI, 2007.
4) M. H. Rashid, “Power Electronics”, Pearson Education 3rd Edition, 2009.

22UECL303	Digital Circuit Design Laboratory	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The course focuses on design and implementation of optimized combinational and sequential circuits.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design** and **realize** the digital circuits for given Boolean equations.	2	13	12
CO-2	**Design** and **implement** arithmetic circuits, encoder, decoder, multiplexer, and other combinational circuits.	2,3	13	-
CO-3	**Implementation** of code converters and **realization of** flip flops.	2	3,13	-
CO-4	**Design** and **implement** sequential circuits**.**	2,3	13	-
CO-5	**Realize** shift registers.	2	3	13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	-	3	2.5	-	-	-	-	-	-	-	-	1	1.8	-

Prerequisites: Basic Electronics

List of Experiments:

1) Realization of adder / subtractor using basic gates and universal gates.
2) i) Code conversion using logic gates.
   ii) Realization of parallel adder and parallel subtractor / BCD to excess 3 converter and vice-versa using IC 7483.
3) i) Design and implementation of comparator using logic gates.
   ii) Implementation of comparator using 7485 IC.
4) i) Realization of MUX using universal gates.
   ii) Realization of DEMUX using universal gates.
5) i) Implementation of the given function using MUX IC 74153.
   ii) Design and implementation of adders and subtractors using decoderIC 74139.

6) i) Verification of priority encoder IC74148.
   ii) Use of BCD to seven segment decoder IC 7447 to drive the LEDdisplay.
7) i) Verification of flip-flops using logic gates and IC's.
   ii) Conversion of flip-flops.
8) Realization using IC 7476
   i) Ring counter
   ii) Johnson Counter
9) Design and implementation of synchronous counters.
10) Design and implementation of asynchronous counters.

Reference Books:

1) Donald D Givone, "Digital Principles and Design", Tata McGraw Hill Edition,2002.
2) JohnM Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.
3) Charles H Roth Jr; "Fundamentals of logic design", Thomson Learning, 2004.
4) Mono and Kim, "Logic and computer design Fundamentals", Pearson, 2nd edition 2001.

22UECL304 Analog Electronic Circuits Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The course focuses on conducting experiments to determine characteristics, understand the working and applications of analog electronic devices and circuits.

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	**Conduct** experiments to determine characteristics of analog electronic devices such as BJTs and FETs.	1	3	5,13
CO-2	**Design** and **Analyze** the wave shaping circuits using diodes.	1,2	3	13
CO-3	**Design** and **Analyze** RC coupled amplifier.	1,2	3	13
CO-4	**Demonstrate** the working of oscillator circuits.	3	1,2	13
CO-5	**Design** and **Analyze** Power amplifiers.	1,3	5	13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.8	2.66	2.4	-	1.33	-	-	-	-	-	-	-	1	-

List of Experiments:

1) Implementing AND, OR Logic using Diode circuits.
2) Full Wave Rectifier Circuit Operation (with and without filter).
3) Clipping Circuits using Diodes.
4) Clamping Circuits using Diodes.
5) Bipolar Junction Transistor (BJT) Characteristics.
6) Single stage RC Coupled (CE) Amplifier.
7) Oscillator circuits using BJT/FET.
8) Junction Field Effect Transistor (JFET) Characteristics.
9) Complementary Symmetry class B push-pull power amplifier.
10) Transistor as switch/ Relay driver.

Reference Books:

1) Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10/e, PHI, 2012.
2) Jacob Millman and Christos C. Halkias, “Integrated Electronics”, 8/e, McGraw Hill, 1999.
3) D. A. Bell, “Electronic Devices & Circuits”, 4th Edition, PHI, 2007.
4) M. H. Rashid, “Power Electronics”, Pearson Education 3rd Edition, 2009.

22USECC305 Signals and Systems (2-2-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on learning mathematical model for a signal, properties of a system, system representation in different domains, relation between Fourier representations, sampling, and reconstruction of a signal.

Course outcomes (COs):

Description of the Outcome - Upon completion 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	**Analyze** different types of signals	1	2	-
CO-2	**Perform** time domain **analysis** of signal.	1	-	-
CO-3	**Perform** Frequency domain **analysis** of signal.	1	2	-

CO-4	**Relate** different Fourier representations and apply the same for various applications**.**	1	2	3, 13
CO-5	**Apply** the Z- transform to **analyze** discrete-time signals and systems.	1	2	-

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

Pre-requisites: Engineering Mathematics-I and II.

Contents:

Unit-I

Introduction: Definitions of signals and systems, Sampling, Classification of signals, Basic operations on signals, Elementary signals, Properties of systems.

8 Hrs

Unit-II

Time Domain Representation: Convolution, Interconnection of LTI systems, Relations between LTI system properties and impulse Response, Solving Differential and Difference Equations, Block diagram representation.

8 Hrs

Unit-III

Frequency domain Representation: Complex Sinusoids and Frequency response of LTI Systems, Fourier Representations for four classes of signals - DTFS, FS, DTFT, FT. **8 Hrs**

Unit-IV

Properties of Fourier transform, Frequency response of LTI systems.

Applications of Fourier Representations: Relating FT to FS, DTFT to DTFS, FT to DTFT, FT to DTFS, convolution and multiplication with mixtures of periodic and non-periodic signals, sampling, and reconstruction of continuous time signals.

8 Hrs

Unit-V

Z–Transforms: Z-Transform, Properties of region of Convergence, Properties of the z-transform, Inversion of z-transform: Partial fraction expansion method and power series method, Unilateral z–transform, Transfer function. **7 Hrs**

Reference Books:

1) Simon Haykin, Barry Van Veen, “Signals and Systems”, 2/e, Wiley Publications, reprint 2009.
2) Alan V Oppenheim, Alan S, Willsky and A HamiNawab, “Signals and Systems”, Pearson Education Asia / PHI, 2/e, 1997. Indian Reprint 2002.
3) H. P Hsu and R. Ranjan, “Signals and Systems”, Schaum’s outlines, TMH, 2006.
4) M. J. Roberts, “Fundamentals of Signals and Systems”, 1/e, McGraw Hill Higher Education, 2007.

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

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

Contents:

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Unit-V

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

Reference Book:

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

22UECE321	Computer Organization	(1-0-0) 1

Contact Hours: 13

Course Learning Objectives (CLOs):

The course focuses on how the Computer Systems work and its basic principles, Instruction Level Architecture and Instruction Execution, memory system design, principles of I/O devices and Instruction Level Parallelism.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** and **analyze** basic functional units of Computer.	1	2	-
CO-2	**Identify** and **analyze** various operations in Computer.	2	3	-
CO-3	**Identify** and **analyze** parts of Central Processing Unit.	2	-	1
CO-4	**Identify** and **analyze** organization of Memory.	1	-	2
CO-5	**Identify** and **analyze** Peripheral Devices connected to Computer.	3	-	1

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2	2.25	2.5	-	-	-	-	-	-	-	-	-	**-**	**-**

Pre-requisites: Digital Electronics

Contents:

Unit I

Basic Structure of Computers: Functional units, basic Operational concepts, Bus structures. Software, Performance, Multiprocessors, Multicomputer. **03 Hrs**

Unit II

Register Transfer Language and Micro Operations: RTL- Registers, Register transfers, Bus and memory transfers. Micro operations: Arithmetic, Logic, and Shift micro-operations, Arithmetic logic shift unit. **03 Hrs**

Unit III

Central Processing Unit organization: General Register Organization, Stack organization, Instruction formats, Addressing modes, Data Transfer and Manipulation. **03 Hrs**

Unit IV

Memory Organization: Semiconductor Memory Technologies, Memory hierarchy, Interleaving, Main Memory-RAM and ROM chips, Address map. **02 Hrs**

Unit V

Input–Output Organization: Peripheral devices, Input-output subsystems, I/O device interface, I/O Processor. **02 Hrs**

Reference Books:

1) Carl Hamacher, Zvonks Vranesic, SafeaZaky, "Computer Organization", 5th Edition, McGraw Hill, 2002.
2) M.Moris Mano, "Computer Systems Architecture", 3rd Edition, Pearson/PHI.
3) John P. Hayes, "Computer Architecture and Organization", 3rd Edition, WCB/McGraw- Hill.
4) William Stallings, "Computer Organization and Architecture: Designing for Performance", 10th Edition, Pearson Education.

22UECE322 Linear ICs and Applications (1-0-0) 1

Contact Hours: 13

Course Learning Objectives (CLOs):

The course focuses on understanding fundamentals of Op-amp, its various applications. It also focuses on other linear IC- 555 Timer, 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	**Explain** the fundamentals of op-amp, Op-amp parameters	-	1	2
CO-2	**Explain** op-amp equivalent circuit and open loop configurations.	-	1,3	2
CO-3	**Design** and explain the active filters and phase shift oscillator.	-	13	1,2,3
CO-4	**Describe** the working of analog to digital and digital to analog converters.	-	13	1
CO-5	**Design** and **explain** comparator and converter circuits, 555 Timer.	3	1,2	-

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.6	1.25	2	-	-	-	-	-	-	-	-	-	2	-

Pre-requisites: Transistor biasing and analysis, Network analysis.

Contents:

Unit-I

Differential Amplifiers: Operational amplifier Fundamentals: Block diagram representation of Op-amp, The ideal Op-amp, Equivalent circuit of an Op-amp, Ideal voltage transfer curve.

Op-amp parameters: Input offset voltage, Input offset current, Input bias current, CMRR, SVRR, Slew rate and Gain-bandwidth product. **03 Hrs**

Unit-II

Op-amp configuration: Open Loop and closed loop Op-Amp configurations with derivation, summer circuit. **02 Hrs**

Unit-III

Active filters and Oscillators: Types of Active filters, First and second order low pass and high pass Butterworth filter. Phase shift oscillator, Wein-Bridge Oscillator. **02 Hrs**

Unit-IV

Comparators and Converters: Basic comparator, Zero crossing detector, Schmitt trigger, A/D and D/A converters. **03 Hrs**

Unit-V

Specialized IC applications: 555 timer-Basic timer circuit, 555 timer used as astable and mono-stable multivibrator. **03 Hrs**

Reference Books:

1) Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, 3/e, PHI.
2) D. Roy Choudhury and Shail B. Jain, “Linear Integrated Circuits”, 3/e, New Age International, Reprint 2006.
3) Robert. F. Coughlin & Fred. F. Driscoll, “Operational Amplifiers and Linear Integrated Circuits”, 5/e PHI, 2006.
4) William D. Stanley, “Operational Amplifiers With Linear Integrated Circuits”, 4/e, Pearson

22UMBA301	Mathematics	(3 -0 -0) Audit

Contact Hours: 39

Course Learning Objectives (CLOs):

This course will enable students to master the basic tools of differential & integral calculus, differential equations and partial differential equations and become skilled in formulating, solve and analyzing 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 (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Apply** the knowledge of calculus to solve problems related to polar curves, curvature, and its applications in determining the bentness of a curve.	-	-	1,2
CO-2	**Solve** multiple integration and use Beta and Gamma function to solve definite integrals	-	1,2	-
CO-3	**Solve** first order linear differential equations analytically using standard methods.	-	1,2	-
CO-4	**Solve** higher order differential equations with constant coefficients and variable coefficients.	-	1,2	-
CO-5	**Learn** partial differentiation to calculate rates of change of multivariate functions. Solve problems related to composite functions and Jacobians. Solve problems on partial differential equations by method of separation of variables.	-	-	1,2

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

Pre-requisites: Differentiation of function, Integration of function.

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 $\int_0^{\pi/2} sin^n\, x\, dx$, $\int_0^{\pi/2} cos^n\, x\, dx$ 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 Book:

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

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	**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

Course Learning Objectives (CLOs):

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

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Construct** and use the concepts of analytic function to solve the problems arising in Engineering field.	-	-	1,2
CO-2	**Utilize** conformal transformation and complex integral to transform irregular domain onto a relatively simple domain.	-	-	1,2
CO-3	**Apply** discrete and continuous probability distributions in analyzing the probability models arising in engineering field.	-	-	1,2
CO-4	**Estimate** the correlation, covariance using joint probability distributions. **Recite** Markov chains and describe stochastic process.	-	-	1,2
CO-5	**Use** student's t-distribution, Chi-square distribution as a test of goodness of fit.	-	-	1,2

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

Pre-requisites: Differentiation of function, Integration of function, Basic Probability theory.

Contents:

Unit-I

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

Unit-II

Conformal transformations: Introduction. Discussion of transformations: $\mathbf{w}= e^z; w = z^2, w = z + \frac{1}{z}, z \neq o$. 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, 44th Ed., 2017.
2) E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed. (Reprint).2016.
3) Peter V. O'Neil, Advanced Engineering Mathematics, International student's edition, 2011.
4) Kishor S. Trivedi, Probabilty & Statistics with Reliabilty, Queuing, and Computer Science Applications, Prentice-Hall of India,2005.

22UECC400 Analog and Digital Communication (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course deals with various types of analog, digital and spread spectrum modulation techniques. For analog modulation schemes, time and frequency domain description, generation, detection, bandwidth, and power relations are studied with mathematical analysis. The course also explains the theoretical bounds on sampling rates, practical aspects of sampling, quantization, and various source encoding methods. Applications of all modulation schemes are also covered.

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 **analyze** various analog modulation techniques in time and frequency domain	1,2	-	-
CO-2	**Describe** the generation and detection of various analog modulation schemes with mathematical analysis and their applications	-	1,3,13	12
CO-3	**Apply** theoretical bounds on sampling rates to convert signal from analog to digital and practical aspects of sampling	1,2	3	-
CO-4	**Explain** the types of quantization and various source encoding techniques	1,2	3	-
CO-5	**Describe** various digital modulation and spread spectrum modulation schemes and their applications	-	1,2,3,13	12

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.6	2.7	2	-	-	-	-	-	-	-	-	1	2	-

Pre-requisites: Fourier analysis, Analog Electronic Circuits.

Contents:

Unit-I

Amplitude Modulation: Introduction to communication system, Need for modulation, Amplitude Modulation (AM), Double Side Band Suppressed Carrier (DSBSC), Single Side Band (SSB), Vestigial Side Band(VSB) modulation techniques: time domain description, frequency domain description, modulation index, bandwidth, power relations, modulation by several sine waves, generation and detection, comparison of various amplitude modulation techniques,.

Applications: Quadrature carrier multiplexing, frequency translation, frequency division multiplexing, AM radio. **08 Hrs**

Unit-II

Angle Modulation: Phase modulation, Frequency modulation, time domain description, spectrum analysis of FM waves, transmission bandwidth, narrowband FM, wideband FM, generation of FM waves: indirect FM, direct FM, detection: balanced frequency discriminator, zero crossing detector.
Applications: FM radio, FM stereo multiplexing. **08 Hrs**

Unit-III

Sampling Process: Introduction, sampling theorem, signal distortion in sampling, practical aspects of sampling and signal recovery: natural sampling, flat top sampling, sample and hold circuit, PAM-TDM system.
Applications: Time division multiplexing. **07 Hrs**

Unit-IV

Quantization: Quantization, quantization noise, signal to quantization noise ratio, robust quantization.
Waveform Coding Techniques: Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation.
Applications: Digital Multiplexers, T1 carrier system. **08 Hrs**

Unit-V

Digital modulation techniques: Gram-Schmidt orthogonalization procedure, geometric interpretation of signals, coherent binary modulation techniques, ASK, FSK, PSK: generation, detection, error probabilities, coherent quadrature modulation techniques, QPSK, MSK: generation, detection, error probabilities, non-coherent binary modulation techniques, M-ary modulation techniques, comparison, bandwidth efficiency.
Spread Spectrum Modulation: A notion of spread spectrum, Pseudo Noise sequences, direct sequence spread spectrum, processing gain, frequency hop spread spectrum.
Applications: Code Division Multiplexing **08 Hrs**

Reference Books:

1) Simon Haykin, “An introduction to analog and digital communications”, John Wiley India Pvt. Ltd., 2008.
2) Simon Haykin, “Digital Communications”, John Wiley India Pvt. Ltd., 2009.
3) Upamanyu Madhow, “Introduction to Communication Systems”, Cambridge university press.
4) B. P. Lathi, “Modern digital and analog communication systems”, Oxford University Press, 4/e, 2010.

22UECC401	Control Systems	(2-2-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on mathematical modeling, arriving at system transfer function from signal flow graph, finding out time and frequency response of the control systems, various methods of finding out stability of a system, state model representation and its solution for electrical systems. Numerical examples are taken up for discussing these topics.

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	**Classify** different Control Systems with examples and **Analyze** electromechanical systems by mathematical modeling.	1	2	-
CO-2	**Develop** transfer function of a control system using signal flow graph method.	1,2	-	-
CO-3	**Determine** Transient and Steady State behavior of systems using standard test signals and it's time response specifications.	1,2	-	13
CO-4	**Analyze** and **investigate** the stability of different control systems using graphical and mathematical techniques in time domain and frequency domain.	2	13	3
CO-5	**Understand** the modeling of linear-time-invariant systems using state-space representation.	-	1,2	13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.7	2.6	1	-	-	-	-	-	-	-	-	-	1.3	-

Pre-requisites: Laplace Transform, Partial Fractions, Matrix Algebra

Contents:

Unit-I

Modeling of Systems: The control system, Mathematical models of Physical systems: Differential equations of physical systems - Mechanical systems, Translational systems, Rotational systems, Electrical systems, Transfer Function, Analogous systems. **8 Hrs**

Unit-II

Signal Flow graph: Block diagram to Signal Flow graph conversion**,** To find Transfer Function using Mason's Gain Formula.

Time Response of feedback control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Steady-State Errors and Error Constants, Types of Control Systems, Dominant Poles of Transfer Functions. **8 Hrs**

Unit-III

Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh-stability criterion, Relative stability analysis.

Root-Locus Techniques: Introduction, the root locus concepts, Construction of root loci, numerical examples **8 Hrs**

Unit-IV

Frequency response analysis: Introduction, Correlation between time and frequency response, Bode plots, All pass and minimum phase systems, Experimental determination of transfer functions. **8 Hrs**

Unit-V

Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations, Transfer Function from the State Model. **7 Hrs**

Reference Books:

1) I.J.Nagarath and M.Gopal, "Control Systems Engineering", 5/e, New Age International (P) Limited, Publishers, 2007.
2) A. Anand Kumar, "Control Systems", PHI, 2013.
3) K. Ogata, "Modern Control Engineering", 4/e, Pearson Education Asia/PHI, 2002.
4) A.K. Jairath, "Solutions and Problems of Control Systems", 2/e, CBS Publishers & Distributors, 1997.

22UECC402	HDL Programming	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on HDL programming concepts and various verilog modeling constructs. The course helps to implement digital system design applications on FPGA platform and its validation using Hardware description language.

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	**Recognize** the need for HDL and **describe** typical design flow and designmethodologies of VLSI.	-	3	1
CO-2	**Identify** and **illustrate** various terminologies, data types and system tasks of verilog language.	-	2, 14	-
CO-3	**Apply** the knowledge of various design models and techniques in verilog programming to describe the digital systems.	-	1,4,13, 14	2,3
CO-4	**Analyze** the given task and **develop** the program using subroutines.	-	14	2,3,4
CO-5	**Identify** the useful modeling techniques in verilog and **illustrate** the concept of synthesis, mapping, and optimization	-	2,14	1,3,4

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.33	1.5	1.25	1.33	-	-	-	-	-	-	-	-	2	2

Prerequisites: Digital circuit design, Programming fundamentals

Contents:

Unit-I

Overview of Digital Design with Verilog HDL: Typical VLSI Design Flow, Design Methodologies, 4-bit Ripple Carry Counter, Modules, Instances, Components of a Simulation, Examples. Basic Concepts: Lexical Conventions, Data types, System Tasks and Compiler Directives, Modules, Ports, Examples. **08 Hrs**

Unit-II

Gate Level Modeling: Gate types And/ Or gates, Buffer / Not gates, Examples, Gate Delays, Rise, Fall and turn –off delays, Minimum / Typical /Maximum values. **Dataflow Modeling:** Continuous Assignments, Delays, Expressions, Operations,and Operands, Operator types. **08 Hrs**

Unit-III

Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multi-way Branching, Loops, Sequential and Parallel blocks, Generate block. **08 Hrs**

Unit-IV

Design Examples: BCD to 7-Segment Display Decoder, Traffic Light Controller, Stepper motor, Waveform generation.

Tasks and Functions Difference between Tasks and Function, Tasks declaration and invocation, Function declaration and invocation. **08 Hrs**

Unit-V

Useful modeling techniques: Time Scales, Useful System tasks.

Logic Synthesis with Verilog HDL: Logic Synthesis, Synthesis information from module inputs / Outputs, Synthesis Design Flow, RTL Description, translation, Logic Optimization, Technology Mapping and Optimization. **07 Hrs**

Reference Books:

1) Samir Palnitkar, “Verilog HDL”, Second edition, Pearson Education, IEEE 1364-2001 Compliant, 2015.
2) Charles Roth, Lizy K. John, Byeong Kil Lee, “Digital Systems Design UsingVerilog”, First edition, Cengage Learning, 2015.
3) Nazeih M Botros, “HDL Programming, VHDL and Verilog”, Deamtech Press,2007.
4) Peter J. Ashenden, “Digital Design: An Embedded Systems Approach Usingverilog”, Elsevier, 2007.

22UECL403	Communication Systems Laboratory	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The course focuses on experiments highlighting the design and demonstration of filters, tuned amplifiers, generation and detection of various analog, pulse, and digital modulation techniques. It also includes experiments related to microwave communication.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Design** of first and second order filters.	1,3	2,13	9,12
CO-2	**Design** and plot the frequency response of class C tuned amplifier	1,3	13	9,12
CO-3	**Generation** and **detection** of various amplitude modulation techniques.	1,3	13	9,12
CO-4	**Generation** and **detection** of various pulse modulation techniques.	1,3	13	9,12
CO-5	**Generation** and **detection** of various digital modulation techniques	-	1,13	9,12

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

Prerequisites: Digital circuit design, Programming fundamentals.

Contents:

List of Experiments

1) Design of second order Low pass filter and High pass filter
2) Design of first order Band pass filter and Notch filter
3) Design tuned amplifier, find centre frequency, bandwidth and quality factor
4) Amplitude modulation using transistor/FET and detection using envelop detector.
5) DSBSC generation using Ring Modulator
6) Verification of sampling theorem using flat top sampling and reconstruction

7) Pulse Amplitude Modulation and demodulation
8) Pulse Width Modulation
9) ASK modulation and demodulation
10) FSK, PSK modulation

Reference Books:

1) Simon Haykin, “An introduction to analog and digital communications”, John Wiley India Pvt. Ltd., 2008.
2) Simon Haykin, “Communication systems”, 5/e, John Wiley India Pvt. Ltd., 2009.
3) Simon Haykin, “Digital Communications”, John Wiley India Pvt. Ltd., 2009.
4) B. P. Lathi, “Modern digital and analog communication systems”, Oxford University Press, 4/e, 2010.

22UECL404 HDL Programming Laboratory (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The course focuses on a list of experiments based on HDL programming for digital circuit design. Also, the course contemplates the interfacing programs to interface different peripherals using Field programmable device (FPGA).

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	**Relate** the need for HDL in Typical design flow of VLSI Technology.	-	14	1
CO-2	**Apply** appropriate techniques, resources, and EDA tools for modeling, simulation, and synthesis of various digital systems.	5,14	3,4,13	1,2
CO-3	**Design** combinational and Sequential Circuits using various programming techniques.	-	3,4,5,13, 14	1,2
CO-4	**Build** the HDL model to interface FPGA kits with various peripherals	14	5	1,2,3,4
CO-5	**Generate** the test vectors for the HDL model using stimulus block.	-	3,4,5,13, 14	1,2

PO’s/PSO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**

Mapping Level	1	1	1.75	1.75	2.25	-	-	-	-	-	-	-	2	2.4

Prerequisites: Digital circuit design, Programming fundamentals.

Contents:

List of Experiments

1) Write a Verilog code to implement Encoders and Decoders, Multiplexers and De-multiplexers. (Using Dataflow, Behavioral and Structural style of modelling).
2) Write a Verilog code to implement Code converters and comparator. (Using Dataflow, Behavioral and Structural style of modelling).
3) Write a Verilog code to implement Half and Full Adder/Subtractor, Ripple Carry adder, Look ahead adder.
4) Write a Verilog Code to implement 4-bit ALU. Verify the same by generating the test vectors for various operations. Write the test bench (stimulus block) for functional verification of ALU.
5) Write a Verilog code to implement an Array Multiplier.
6) Write the verilog code to implement the SR, D, JK, and T Flip-flop.
7) Write the verilog code to implement the 4-bit Shift register (Right shift and left shift), 4-bit Ring counter, Johnson counter, Random sequence counter (4-bit)
8) Write the verilog code to implement the 4-bit up counter, 4-bit down counter, 4-bit up-down counter and BCDup-down Counter.
9) Write a verilog code to interface stepper motor to rotate it in clockwise and anti-clockwise Direction.
10) Write a verilog code to interface to generate any given waveforms using DAC kit.

Reference Books:

1) Samir Palnitkar, “Verilog HDL”, Second edition, Pearson Education, IEEE 1364-2001 Compliant, 2015.
2) Charles Roth, Lizy K. John, Byeong Kil Lee, “Digital Systems Design UsingVerilog”, First edition, Cengage Learning, 2015.
3) Nazeih M Botros, “HDL Programming, VHDL and Verilog”, Deamtech Press,2007.
4) Peter J. Ashenden, “Digital Design: An Embedded Systems Approach Using verilog”, Elsevier, 2007.

22USECC405 Microcontroller (2-2-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

This course focuses on architectural features and instruction set of 8051 microcontrollers. It also focuses on programming using assembly language of 8051 and C language, programming the timers in different modes, programming for serial communication, interrupts and interfacing devices.

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	**Explain** the architectural features of microcontrollers 8051.	-	14	1
CO-2	**Explain** the operations of data movement, logical and arithmetic instructions.	-	1,14	-
CO-3	**Write** programs on branch instructions in assembly Language.	2,3,4	13,14	-
CO-4	**Program** the timers in different modes using assembly and C programming and for serial communication between 8051 and peripherals.	-	2,3,14	-
CO-5	**Analyze and Implement** a program for 8051 interrupts and other peripherals.	3,4	1,14	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.66	2.5	2.66	3	-	-	-	-	-	-	-	-	2	2

Pre-requisites: Digital Circuits and basic programming skills.

Contents:

Unit-I

The 8051 Architecture : Introduction, difference between Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. The 8051 Architecture-Block diagram, Pin Configuration, 8051 port structure. **8 Hrs**

Unit-II

Addressing Modes and Operations: Introduction, Addressing modes, External data transfer, Code Memory, Read Only Data transfer / Indexed Addressing modes, PUSH and POP opcodes, Data exchanges, Example Programs; Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing,

Addition, Subtraction, Multiplication and Division, Example-programs. **8 Hrs**

Unit-III

Jump and Call Instructions : The JUMP and CALL Program range, Jumps, calls and Subroutines, Interrupts and Returns, Examples.

8051 programming in C : Data types and time delays in C for 8051, I/O programming, logic operations, data conversion programs. **7 Hrs**

Unit-IV

Timer/Counter Programming in 8051: Programming 8051 Timers, Counter Programming, programming timers 0 and 1 in C and ALP.

8051 Serial Communication: Basics of Serial Communication, 8051 Serial communication Programming, Serial port programming in C and ALP. **8 Hrs**

Unit-V

Interrupts Programming: 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051, interrupt programming in C and ALP. **8 Hrs**

Reference Books:

1) Kenneth J. Ayala, “The 8051 Microcontroller Architecture, Programming and Applications”, 3rd Edition, Cengage Learning, 2011.
2) Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay, “The 8051 Microcontroller and Embedded Systems – using assembly and C”, 2nd Edition, Pearson, 2008.
3) Predko, “Programming and Customizing the 8051 Microcontroller”, TMH, 2005.
4) Dr. Ramani Kalpathi and Ganesh Raja, “Microcontroller and its applications”, Sanguine Technical Publishers, 2005.

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	**Mapping to POs (1-12)/ PSOs (13,14)**

to:		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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	-	-	-	-	-	2.5	3	3	2	-	-	-	-	-

Contents:

Unit-I

Harmony in Society: Understanding Universal Human Order: Understanding Human Goal, Appraisal of the Current Status, The Way Ahead Dimensions of Human Order. **02 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. **03 Hrs**

Unit-III

Harmony in Existence: Understanding Co-existence at Various Level: 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. **03 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. **03 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. **02 Hrs**

Reference Book:

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

22UECE421 Sensors and Instrumentation (1-0-0) 1

Contact Hours: 13

Course Learning Objectives (CLOs):

This course focuses on the study of various sensors used in the measurement of various physical parameters in instrumentation. It also discusses the construction and operation of various measuring devices and instruments.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** and **analyze** various characteristics of sensors and instruments.	2	-	-
CO-2	**Design** systems for measurement of basic electrical quantities such as current, voltage, resistance, etc.	2	13	1
CO-3	**Identify** and **apply** various passive electrical sensors in instrumentation.	3	1	14

CO-4	**Identify** and **apply** various display systems and recorders in instrumentation.	1	-	14
CO-5	**Identify** and **utilize** various instruments in different areas.	5	6	-

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

Pre-requisites: Analog and Digital Electronics Circuits, Network Analysis, Signals and Systems, Linear ICs and Applications

Contents:

Unit-I

Measurement, Instrumentation and Calibration: Measurement, Instrument, Instrumentation, Performance characteristics, Calibration and Standards **03 Hrs.**

Unit-II

Electrical Measurement Systems: measurement of current, measurement of voltage, measurement of Resistance, Measurement of Impedance **03 Hrs.**

Unit-III

Passive Electrical Transducers: Resistance Thermometers, Hot-wire Resistance Transducers, Resistive Displacement Transducers, Resistive Strain Transducer, Resistive Pressure Transducer, Resistive Moisture Transducers, Resistive Magnetic-flux Transducers, Resistive Optical Radiation Transducers

03 Hrs

Unit-IV

Data Display and Recording Systems: Data Loggers, Analog Indicators, Digital Readout systems, Analog Recorders. **02 Hrs**

Unit-V

Sophistication in Instrumentation: Thermometry and Thermography, Nano Instrumentation, Condition Monitoring **02 Hrs**

Reference Books:

1) DVS Murthy, “Transducers and Instrumentation”, PHI, 2nd Edition, 2013.
2) A. K. Sawhney, “Sensor and Instrumentation”, Dhanpat Rai & Co. Publishers, 2014.
3) R. K. Rajaput, “Electrical and Electronic Measurements and Instrumentation”, S. Chand Publishers, 4th Edition, 2015.

4) J P Navani, Sonal Sapra, “Sensors and Instrumentation”, S. Chand Publishers, 2012.

22UECE422	Basics of Data Science	(1-0-0) 1

Contact Hours: 13

Course Learning Objectives (CLOs):

The course focuses on the theory and applications of Data Science. The course concentrates on the gathering data, cleaning data, generating hypothesis, making inferences, visualizing data, assessing solutions, 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 (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	To get **insight** of the tools that data scientists use and the significance of Python and its libraries for data scientists.	1	5,14	2
CO-2	**Apply** the concepts of descriptive statistics to explore a dataset.	1,2	-	5,14
CO-3	**Analyze** and **address** the problem of statistical inference.	1	4	-
CO-4	To **build** a model to predict the response from the variables by **analyzing** the behavior of data and **assessing** the importance of variables for the model.	3,4,14	2,5	-
CO-5	To **utilize** techniques that seek to **summarize and explain** key features or structures of the data-by-data mining methods used to preprocess data and **tackle** the various problems.	3,4,14	2,5	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3	2	3	2.7	1.75	-	-	-	-	-	-	-	-	2.25

Pre-requisites: Mathematics, Basic Programming skills.

Contents:

Unit-I

Introduction to Data Science: What is data science? Why Python?, Fundamentals of python libraries for data scientists, Data Science Ecosystem, Web Integrated Development Environment (WIDE), Python for Data Scientist. **3 Hrs**

Unit-II

Descriptive Statistics: Introduction, Data Preparation, Exploratory Data-Summarizing the Data, Data Distributions. **3 Hrs**

Unit-III

Statistical Inference: Introduction, Statistical Inference: The Frequentist Approach, Measuring the Variability in Estimates, Hypothesis Testing. **3 Hrs**

Unit-IV

Regression Analysis: Introduction, Linear Regression, Logistic Regression. **2 Hrs**

Unit-V

Unsupervised Learning: Introduction, Clustering, Case Study. **2 Hrs**

Reference Books:

1) Laura Igual & Santi Segui, "Introduction to Data Science", Springer, ISBN 978-3-319-50016-4.
2) John V. Guttag ,"Introduction to Computation and Programming Using Python", The MIT Press, ISBN 978-0-262-52500-8.
3) Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", Second Edition, Oreilly, ISBN 97801491912133.
4) Peter Bruce, Andrew Bruce, Peter Gedeck, "Practical Statistics for Data Scientists", Second Edition, Oreilly.

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 (13,14)**		
	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 mechanisms.	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**
Mapping Level	1.8	2.4	2.4	-	-	-	-	-	-	-	-	-	2	-

Pre-requisites:

Contents:

Unit-I

Biomolecules and their applications: Carbohydrates, Nucleic acids, Proteins, lipids, and Enzymes. **03 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 **03 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. **02 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. **03 Hrs**

Unit-V

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

Contact Hours: 39

Course Learning Objectives (CLOs):

This course will enable students to use Laplace transform to solve differential equations. Analyze and Solve system of linear equation. 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 (13,14)**		
		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** Line integrals, Surface integrals and Volume integrals	-	-	1,2

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**

Mapping Level	1.2	1.2	-	-	-	-	-	-	-	-	-	-	-	-

Pre-requisites: Differentiation of function, Integration of function, Elementary row transformation of matrix, Vector algebra.

Contents:

Unit-I

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

Unit-III

Elementary Linear Algebra: Rank of a 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 Calculus, 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 Book:

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

22UNSK408	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	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	-	-	-	-	-	2	-	1	-	-	-	3

Activity list:

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

19. 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.
20. Spreading public awareness under rural outreach programs. (minimum 2 programs).
21. Social connect and responsibilities.
22. Plantation and adoption of plants. Know your plants.
23. Organize National integration and social harmony events /workshops/ seminars. (Minimum 02 programs).
24. 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 2024-25 batch)

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

Continuous Internal Evaluation (CIE):

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

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub-divisions.
- Two questions are to be set from each unit with built in choice, for example Q.1 or Q.2 in unit -I, Q.3 or Q.4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

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

Continuous Internal Evaluation (CIE):

Theory CIE component:

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

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

Laboratory component assessment:

- 5 marks: for conduction, regularity, involvement, journal writing, etc. Minimum 75% of attendance is compulsory. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- 5 marks: Lab Test. A Lab test as per the class time table has to be conducted at the end for 50 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 Q.1 or Q.2 in unit -I, Q.3 or Q.4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

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

Continuous Internal Evaluation (CIE)

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

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

Semester End Examination (SEE):

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

For NSS/Physical Education/Yoga Audit Courses with LTP 0-0-2

Continuous Internal Evaluation (CIE)

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