|| Jai Sri Gurudev ||

Sri Adichunchanagiri Shikshana Trust (R)

SJB Institute of Technology

An AUTONOMOUS INSTITUTION UNDER VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Approved by AICTE, 2(f) and 12(B) recognized by UGC, New Delhi

Accredited by NAAC, Accredited by NBA, Certified by ISO 9001 - 2015

B.E.

Autonomous Scheme & Syllabus

Department of Electronics and Communication Engg.

Third Year

Academic Year 2025-2026

V and VI Semesters

2023-2027 Batch

SERVICE TO MANKIND IS SERVICE TO GOD

His Divine Soul Padmabhushana
Sri Sri Sri Dr. Balagangadharanath MahaSwamiji
Founder President, Sri Adichunchanagiri Shikshana Trust®

Belief in God is not ignorance or illusion. It is a belief that there is an unseen, ineffable Power that transcends all our powers of muscles, mind and lives.

His Holiness Parama Pujya
Sri Sri Sri Dr. Nirmalanandanatha MahaSwamiji
President, Sri Adichunchanagiri Shikshana Trust ®

True richness is the generosity of heart. Cultivate it and work to help the less fortunate ones in life.

Revered Sri Sri Dr. Prakashanatha Swamiji
Managing Director, BGS & SJB Group of Institutions & Hospitals

People and prosperity follow the path which the leaders take. So the elders and leaders should make sure that they give the right lead and take the right path.

VISION of the Institute

To become a recognized technical education center with a global perspective.

MISSION of the Institute

To provide learning opportunities that foster students' ethical values, intelligent development in science technology and social responsibility so that they become sensible and contributing members of society.

Department Vision

Empowering Electronics and Communication engineers to meet the advancements in technological and societal needs.

Department Mission

M1: To facilitate students in acquiring proficiency & providing eminence in Technical education.

M2: To imbibe value based education that contributes to the human values, ethics and societal relevance.

M3: To foster culture of innovation, industry and research in developing intellectual professionals and entrepreneurs.

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2023 Scheme - UG

Syllabus Book for Electronics & Communication Engineering

Syllabus for 5th & 6th Semester

The syllabus, scheme and guidelines are provided in detail.
The syllabus, scheme and guidelines are subjected to changes if any needed.
The updates will be done timely.
Regularly access the institution website for the updated information.

The Syllabus book is available on	www.sjbit.edu.in
For any queries, please write to	academicdean@sjbit.edu.in

UPDATES

Release / Revision	Date	Remarks
Release	29/03/2025	First release

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Autonomous Scheme of Teaching & Examinations (ST&E) (Tentative) UG - BE 3rd Year ECE

SCHEME: 2023 **SEM: V** **Revision date:** 29/03/2025

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	O	CIE Marks	SEE (Dur. & Marks)			
								Lecture	Tutorial	Practical	PBL/ABL / SL/etc.		Dur.	Th.	Lab	Tot.
1	PCC	3	23ECT501	Electromagnetic Field Theory	ECE	ECE	3	3	0	0		50	03	50	-	100
2	IPCC	5	23ECI502	Analog & Digital Communication	ECE	ECE	4	3	0	2		50	03	50	-	100
3	IPCC	6	23ECI503	Digital Signal Processing	ECE	ECE	4	3	0	2	@	50	03	50	-	100
4	PCCL	3	23ECL504	Advanced Digital Communication Lab	ECE	ECE	1	0	0	2		50	03	-	50	100
5	PEC	1	23ECP51y	Professional Elective Course - 1	ECE	ECE	3	3	0	0	@	50	03	50	-	100
6	ETC	3	23ECE53y	Emerging Technology Course - 3	ECE	ECE	3	3	0	0	@	50	03	50	-	100
7	HSMC	6	23SFHH06	Bioscience	any dept	any dept	1	0	2	0	@	50	02	50	-	100
8	AEC	5	23ECAE5y	Ability Enhancement Course - 5	ECE	ECE	1	1	0	0		50	02	50	-	100
								(or)								
								0	0	2		50	02	-	50	100
9	NCMC	4	23PASN01	Physical Education - Sports and Athletics	PED	PED	PP/ NP	-	-	-	2	50	-	-	-	50
			23YOGN02	Yoga	PED	PED										
			23NSSN03	NSS - National Service Scheme	NSS	NSS										
			23NCCN04	NCC - National Cadet Corps	NCC	NCC										
			23IKSN05	Indian Knowledge System	HSS	HSS										
Total							**20**	**16**	**2**	**8**	**2**	**450**		**350**	**100**	**850**

PCC: Professional Course; IPCC: Integrated Professional Core Course; PCCL: Professional Core Course Laboratory; AEC: Ability Enhancement Course; HSMC: Humanities, Social Sciences & Management Course; NCMC: Non Credit Mandatory Course;
{@ - Compulsory one activity during the semester};
{I.E.-Industry Experts}.
PBL: project Based learning; ABL: Activity Based Learning; SL: Self-Learning

ETC (Emerging Technology Course):
For ETC (L:T:P:O) can be planned by the depts considering practicality & possibility of conduction, same shall be indicated along with course title in the list, if altered than above. If planned altering the prescription, the same shall be approved at the department BOS & authorities. Atleast one activity is mandatory during the delivery of the course. The guidelines is applicable to all the semesters III to VI semesters (ETC-1 to ETC-4).

Bioscience & UHV-Universal Human Values:
1) Any one of the course will be offered by the departments in each semester of IV & V based on the institutional planning.
2) Both the courses shall be studied and completed by the students registering each in the two semesters. For example, if Bioscience is offered in the IV semester, UHV-Universal Human Values is offered in the V semester.

Ability Enhancement Course-5: 23xxAE5y - 1 Credit course
1) The courses and the syllabus shall be defined by the respective dept. BOS.
2) SEE will be MCQ if offered as theory course. If offered as LAB course, SEE will be practical, with two internal examiners. Handled by Controller of Examinations.

NCMC (Non-Credit Mandatory Course) for course type series-4: Refer to guidelines in III SEM.

Professional Elective Course - 1		Emerging Technology Course - 3		Ability Enhancement Course - 5	
Course Code	**Course Title**	**Course Code**	**Course Title**	**Course Code**	**Course Title**
23ECP511	Data Structure using C++	23ECE531	Automotive Electronics and Hybrid Vehicles	23ECAE51	Data Structure using C++ Lab
23ECP512	Information Theory & Coding	23ECE532	FPGA based System design using Verilog	23ECAE52	FPGA Based System design Lab Using Verilog
23ECP513	Fundamentals of Artificial Intelligence	23ECE533	Cloud Computing & IoT Analytics	23ECAE53	Data Acquisition using Labview
23ECP514	Real Time Operating System	23ECE534	Block Chain Technology	23ECAE54	PLC & Sensorics Lab

BOS Chairman/HOD **Academic Dean** **Principal** **Academic Director**

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Autonomous Scheme of Teaching & Examinations (ST&E) (Tentative) UG - BE 3rd Year ECE

SCHEME: 2023 SEM:VI **Revision date:** 29/03/2025

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	O		SEE (Dur. & Marks)			
								Lecture	Tutorial	Practical	PBL/ABL / SL/etc.	CIE Marks	Dur.	Th.	Lab	Tot.
1	PCC	4	23ECT601	VLSI Design & Testing	ECE	ECE	**3**	3	0	0	@	50	03	50	-	100
2	IPCC	7	23ECI602	Microwave & Antennas	ECE	ECE	**4**	3	0	2	@	50	03	50	-	100
3	PCCL	4	23ECL603	VLSI Design & Testing Lab	ECE	ECE	**1**	0	0	2		50	03	-	50	100
4	PEC	2	23ECP62y	Professional Elective Course - 2	ECE	ECE	**3**	3	0	0		50	03	50	-	100
5	OEC	1	23ECO61y	Open Elective Course - 1	Any dept.	Any dept.	**3**	3	0	0		50	03	50	-	100
6	ETC	4	23ECE64y	Emerging Technology Course - 4	ECE	ECE	**3**	3	0	0	@	50	03	50	-	100
7	AEC	6	23RMAE61	Research Methodology & IPR	ECE	ECE	**3**	3	0	0	@	50	03	50	-	100
8	PRJ	1	23ECPRJ1	Major Project - Phase I	ECE	ECE	**2**	0	0	4	@	50	03	-	50	100
9	HSMC	7	23SCRH08	Social Connect & Responsibility	Any dept	Any dept	**1**	1	0	0	@	50	-	-	-	50
10	NCMC	4	23PASN01	Physical Education - Sports and Athletics	PED	PED	**PP/ NP**	-	-	-	2	50	-	-	-	50
			23YOGN02	Yoga	PED	PED										
			23NSSN03	NSS - National Service Scheme	NSS	NSS										
			23NCCN04	NCC - National Cadet Corps	NCC	NCC										
			23IKSN05	Indian Knowledge System	HSS	HSS										
Total							**23**	**19**	**0**	**8**	**2**	**500**		**300**	**100**	**900**

PCC: Professional Course; IPCC: Integrated Professional Core Course; PCCL: Professional Core Course Laboratory; PEC: Professional Elective Course; OEC: Open Elective Course; HSMC: Humanities, Social Sciences & Management Course; AEC: Ability Enhancement Course; NCMC: Non Credit Mandatory Course; PRJ: Project work.
{@ - Compulsory one activity during the semester};
{I.E.-Industry Experts};
PBL: project Based learning; ABL: Activity Based Learning; SL: Self-Learning

Open Elective Courses (OEC):
1) Open Electives listed here are to offer for other department students.
2) Students shall select open elective courses offered from other departments, separate consolidated list of courses offered from various departments will be published time to time.

ETC (Emerging Technology Course):
For ETC (L:T:P:O) can be planned by the depts considering practicality & possibility of conduction, same shall be indicated along with course title in the list, if altered than above. If planned altering the prescription, the same shall be approved at the department BOS & authorities. Atleast one activity is mandatory during the delivery of the course. The guidelines is applicable to all the semesters III to VI semesters (ETC-1 to ETC-4).

NCMC (Non Credit Mandatory Course) for course type series-4: Refer to guidelines in III SEM.

Professional Elective Course – 2 (23ECP62y)		**Open Elective Course - 1 (23ECO61y)**		**Emerging Technology Course - 4 (23ECE64y)**	
Course Code	**Course Title**	**Course Code**	**Course Title**	**Course Code**	**Course Title**
23ECP621	Satellite Communication	23ECO611	Electronic Communication Systems	23ECE641	Robotics and Its Applications
23ECP622	DSP Algorithm and Architecture	23ECO612	Basic VLSI Design	23ECE642	Natural Language Processing
23ECP623	Hardware Software Co-Design	23ECO613	Consumer Electronics	23ECE643	Principles of Machine Learning
23ECP624	Digital Image Processing	23ECO614	Digital System Design using Verilog	23ECE644	Nano Technology for Engineers

5th Semester Syllabus

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Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	PCC		
Course Title: Electromagnetic Field Theory					
Course Code:	**23ECT501**			**Credits:**	03
Teaching Hours/Week (L: T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

This course will enable students to:

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb 's law and Gauss law to different charge distributions and the applications of Laplace 's and Poisson 's Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart 's, Ampere's Law and Stokes 'theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell 'equations and applications for Plane waves for their behaviour in different media
- Acquire knowledge of Poynting theorem and its application of power flow.

II. Teaching-Learning Process :

- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.

III. COURSE CONTENT

Module-1: Coulomb's Law & Electric flux density	8 Hrs

Coulomb's Law, Electric Field Intensity and Flux density Experimental law of Coulomb, Electric field intensity, Electric field due to line charge, sheet charge and volume charge, Electric flux density.
Text1: Chapter 2: Sections: 2.1 to 2.5, Chapter 3: Sections: 3.1

Pre-requisites: Vector Analysis: Vector Algebra, Unit vector, Dot product and cross product, Different Coordinate system. **Self-Learning:** Streamlines and sketches of fields	
RBT Levels: L1, L2, L3	
Module-2: Gauss's law and Divergence	8 Hrs
Gauss 'law, Application of Gauss' law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell 's First equation (Electrostatics), Vector Operator and divergence theorem, Energy expended, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Current and Current density, Continuity of current. Text1: Chapter 3: Sections: 3.2 to 3.6, Chapter 4: Sections: 4.1 to 4.4 and 4.6, Chapter 5: Sections: 5.1, 5.2	
Pre-requisites: Electrostatic theory **Self-Learning:** Energy density in theelectrostatic field, the potential field of a system of charges, conservative property, energy density in the electrostatic field,	
RBT Levels: L1, L2, L3	
Module-3: Poisson's and Laplace's Equations	8 Hrs
Derivation of Poisson 's and Laplace 's Equations, Uniqueness theorem Biot-Savart Law, Ampere 's circuital law, Curl, Stokes 'theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials. Text1: Chapter 6: Sections: 6.6, 6.7, Chapter 7: Sections: 7.1 to 7.6	
Pre-requisites: Integration and differentiation, partial derivatives **Self-Learning:** Derivation of the steady-magnetic-field laws	
RBT Levels: L1, L2, L3	
Module-4: Magnetic Forces & Magnetic materials	8 Hrs
Force on a moving charge, differential current elements, Force between differential current elements. Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance**.** Faraday' law of Induction. Text1: Chapter 8: Sections: 8.1 to 8.3, 8.5 to 8.10, Chapter 9: Sections: 9.1 to 9.5	
Pre-requisites: Inductance and capacitor behaviour for the applied electric field **Self-Learning:** Force and torque on a closed circuit	
RBT Levels: L1, L2, L3	
Module-5: Maxwell's equations & Uniform Plane Wave	8 Hrs
Continuity equation, Displacement current, Conduction current, Derivation of Maxwell 's equations in point form, and integral form, Maxwell's equations for different media, Retarded Potentials. Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Relation between E and H, Wave propagation in free space, Skin effect, Poynting 's theorem. Text1: Chapter 9: Sections: 9.1 to 9.5, Chapter 11: Sections: 11.1 to 11.5	
Pre-requisites: Solution to differential equation **Self-Learning:** Wave polarization, plane wave reflection and dispersion,	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Evaluate problems on electric field due to point, linear, volume charges by applying conventional methods or by Gauss law.
CO2	Determine potential and energy with respect to point charge and capacitance using Laplace equation.
CO3	Calculate magnetic field, force, and potential energy with respect to magnetic materials.
CO4	Apply Maxwell ‘s equation for time varying fields, EM waves in free space and conductors.
CO5	Evaluate power associated with EM waves using Poynting theorem.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	-

VI. Assessment Details (CIE & SEE)

General Rules: Refer to Annexure, SL #1

Continuous Internal Evaluation (CIE):): Refer to Annexure, SL #1
Rubrics: Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to Annexure, SL #1
Rubrics: Refer to Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Engineering Electromagnetics	W.H. Hayt and J.A. Buck,	8th Edition, 2010, ISBN 978-0-07-338066-7 MHID 0-07-338066-0	Tata McGraw-Hill,

VII(b): Reference Books:

1	Electromagnetics with applications	John Krauss and Daniel, A Fleisch	5th Edition, 2017 ISBN-10. 9780070702400 ISBN-13. 978-0070702400	Tata McGraw-Hill
2	Fundamentals of Electromagnetics for Engineering	N. Narayana Rao,	1st Edition, 2008	Pearson

VII(c): Web links and Video Lectures (e-Resources):

NPTEL Video lectures: https://youtu.be/pGdr9WLto4A
NPTEL Video lectures: https://youtu.be/xn2IpxI991M

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Group Discussion/Quiz
- Demonstration of Electromagnetic concepts.
- Case Study on Medical Imaging devices

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Semester:	V	**Course Type:**	**IPCC**		
Course Title: Analog & Digital Communication					
Course Code:	**23ECI502**			**Credits:**	04
Teaching Hours/Week (L: T:P:O)			(3:0:2:0)	**Total Hours:**	40 hours Theory + 10 Lab slots
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 hrs

I. Course Objectives:

This course will enable students to:

1. Understand and analyse concepts of Analog Modulation schemes viz; AM, FM.
2. Understand and analyse concepts of digitization of signals viz; sampling, quantizing and encoding.
3. Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
4. Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.

II. Teaching-Learning Process :

- To Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze in formation rather than simply Recall it.
- To Use videos for demonstration of the fundamental principles to students for better understanding of concepts.
- Discussing how each concept can be applied to the real world, and when that's possible, helps improve students understanding.
- Use software tools like MATLAB/Simulink to Demonstrate Analog and Digital modulation and demodulation techniques

III. COURSE CONTENT

III(a). Theory PART

Module-1: Amplitude modulation	8 Hrs

Introduction, Amplitude Modulation: Time & Frequency Domain description, switching modulator, Envelop detector.
Double Side Band-Suppressed Carrier Modulation: Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.
Single Side–band methods of Modulation: SSB Modulation, Frequency Division Multiplexing, Text 1 Chapter 3- Section 3.1 to 3.5, 3.8.

Pre-requisites: Knowledge of sine and cosine functions, Fundamentals of signals and systems, Basic communication system components**.** **Self-Learning:** Properties of the Fourier Transform, Dirac Delta Function**.**	
RBT Levels: L1, L2, L3	
Module-2: Angle Modulation	8 Hrs
Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver Text 1 Chapter 4 - Section 4.1 to 4.6	
Pre-requisites: Knowledge of sine and cosine functions, Basic communication system components. **Self-Learning:**FM Broadcasting System**.**	
RBT Levels: L1, L2, L3	
Module-3: Sampling and Quantization	8 Hrs
Introduction, Why Digitize Analog Sources, The Low pass Sampling process Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Width Modulation, Generation of PPM Waves, Detection of PPM Waves. Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation. Error Control Coding: Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, Types of Codes. Text 1 Chapter 7- Section 7.1 to 7.10 Text 2 Chapter 10 - Section 10.1 & 10.2	
Pre-requisites: Fundamentals of signals and systems, Discrete mathematics, calculus**.** **Self-Learning:** Digital Multiplexing.	
RBT Levels: L1, L2, L3	
Module-4: Bandpass Signal to Equivalent Lowpass	8 Hrs
Hilbert Transform, Pré-envelopes, Complex-envelopes of Band -pass signals, Canonical Representation of Band pass signals. Signalling over AWGN Channels: Introduction, Geometric representation of signals, Gram Schmidt Orthogonalization procedure, conversion of the Continues AWGN channel into a vector channel, Optimum receivers using coherent detection Decoding, Correlation receiver, matched filter receiver. Text 2 Chapter 2- Section 2.8 to 2.11, Chapter 7- Section 7.1 to 7.4	
Pre-requisites: Knowledge on Signal representation, Modulation and Demodulation. Self-Learning: Signalling schemes-RZ, NRZ, Bipolar, Manchester.	
RBT Levels: L1, L2, L3	
Module-5: Digital Modulation Techniques	8 Hrs
Phase shift keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M-Ary PSK, M-Ary QAM, Frequency shift keying techniques using coherent detection: BFSK generation, detection and error probability's using Non coherent detection, Differential phase shift keying. Text 2 Chapter 7- Section 7.6 to 7.8, 7.11 to 7.13	
Pre-requisites: Knowledge on Signal representation, Modulation and Demodulation. **Self-Learning:** BER Comparison of Signalling Schemes over AWGN channels**.**	
RBT Levels: L1, L2, L3	

III(b). PRACTICAL PART	
Sl. No.	**Experiments / Programs (Use MATLAB/Simulink/Modelsim/SCILAB/Trainer kit)**
1	Illustration of AM modulation and demodulation and display the signal and its spectrum.
2	Illustration of DSB-SC modulation and demodulation and display the signal and its spectrum.
3	Illustration of FM modulation and demodulation and display the signal and its spectrum.
4	Frequency synthesis using PLL.
4	Illustrate the process of sampling and reconstruction of low pass signals. Display the Signals and its spectrum of both Analog and sampled signals.
6	Simulate the Pulse code modulation and demodulation system and display the waveforms.
5	Illustration of Delta modulation and the effects of step size selection in the design of DM encoder.
8	Implementation and analysis of Amplitude shift keying
9	Implementation and analysis of Frequency shift keying
10	Implementation and analysis of Phase shift keying

IV. COURSE OUTCOMES	
CO1	Understand the amplitude and frequency modulation techniques and perform time and frequency domain transformations
CO2	Identify the schemes for amplitude and frequency modulation and demodulation of analog signals and compare the performance
CO3	Understand the characteristics of pulse amplitude modulation, pulse position modulation and pulse code modulation systems
CO4	Apply the concept of signal conversion to vectors in communication transmission and reception.
CO5	Perform the mathematical analysis of digital communication systems for different modulation techniques.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	3					1	1	1	1	1	2			
CO2	2	2	3					1	1	1	1	1	2			
CO3	2	2	3					1	1	1	1	1	2			
CO4	2	2	3					1	1	1	1	1	2			
CO5	2	2	3					1	1	1	1	1	2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #2

Semester End Examination (SEE): Refer to - Annexure, SL #2
Rubrics: Refer to - Annexure, SL #2

VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Communication Systems	Simon Haykins& Moher	2010	5th Edition, John Wiley, India Pvt. Ltd,
2	Digital Communication Systems	Simon Haykin	2014	John Wiley & Sons
VII(b): Reference Books:				
1	Modern Digital and Analog Communication Systems	B P Lathi and Zhi Ding	2010	Oxford University Press.,4th edition
2	An Introduction to Analog and Digital Communication	Simon Haykins	2008	John Wiley India Pvt. Ltd.,
3	Principles of Communication Systems	H Taub & D L Schilling	2011	TMH,
VII(c): Web links and Video Lectures (e-Resources):				
E Books: 1. https://gctjaipur.wordpress.com/wp-content/uploads/2015/08/an-introduction-to-analog-and-digital-communications-2nd-edition.pdf **MOOCs**: 1. https://nptel.ac.in/courses/117/105/117105143/ 2. NPTEL lecture series by Prof. Bikas Kumar Dey, IIT Bombay. 3. NPTEL lecture series on Digital Communications, IIT Madras.				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Mini Projects				

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	IPCC		
Course Title: Digital Signal Processing					
Course Code:	23ECI503			**Credits:**	04
Teaching Hours/Week (L:T:P:O)			3:0:2:@	**Total Hours:**	40 + 10 Lab sessions
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

1. Preparation: To prepare students with fundamental knowledge/ overview in the field of Digital Signal Processing

2. Core Competence: To equip students with a basic foundation of Signal Processing by delivering the basics of Discrete Fourier Transforms, their properties, efficient computations & the design of digital filters

II. Teaching-Learning Process :

- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
- Give Programming Assignments.

III. COURSE CONTENT

III(a). Theory PART

Module-1: Discrete Fourier Transforms	**08 Hrs**

The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry for real valued sequence, Multiplication of two DFTs, Circular Convolution, Time reversal of a sequence, Circular Time shift of a sequence, Circular frequency shift, Complex conjugate property, Circular Correlation, Multiplication of two sequences, Parseval's theorem.
Text 1: Chapter 7: Section: 7.1.2, 7.1.3, 7.2.1, 7.2.2, 7.2.3

Pre-requisites: Knowledge of DTFT, basic trigonometric functions.
Self-Learning: Applications of DFT

RBT Levels: L1, L2, L3

Module-2: Linear Filtering Methods and FFT Algorithms	**08 Hrs**
Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long data Sequences. Fast-Fourier-Transform (FFT) algorithms: Efficient Computation of the DFT: Direct computation of the DFT, Radix-2 FFT algorithms for the computation of DFT and IDFT–decimation-in-time and decimation-in-frequency algorithms. Text1: Chapter 7 Section:7.3, Chapter 8: Section: 8.1: 8.1.1, 8.1.3	
Pre-requisites: Knowledge of linear and circular convolutions. Self-Learning: Radix-4 FFT algorithms	
RBT Levels: L1, L2, L3	
Module-3: Design of FIR Filters	**08 Hrs**
Characteristics of practical frequency-selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR filters (Low Pass & High Pass) using windows - Rectangular, Hamming, Hanning and Bartlett. Text1: Chapter 10: Section: 10.1.2, 10.2.1, 10.2.2	
Pre-requisites: Basic knowledge of DTFT and Integration. Self-Learning: Frequency sampling method.	
RBT Levels: L1, L2, L3	
Module-4: IIR Filter Design	**08 Hrs**
Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Lowpass prototype transformation, Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design (Low Pass & High Pass) using BLT. Text 2: Chapter 8: Section: 8.1, 8.2, 8.3 (Butterworth filter design), 8.8.1	
Pre-requisites: Basic knowledge of Laplace and Z transforms. Self-Learning: Chebyshev Prototype, methods like Impulse Invariant Transformation.	
RBT Levels: L1, L2, L3	
Module-5: Structures for FIR and IIR	**08 Hrs**
Structure for FIR Systems: Direct form, Cascade form and Lattice structures. Structures for IIR Systems: Direct-Form Structures, Cascade-Form Structures, Parallel-Form Structures. Text1: Chapter 9: Section: 9.2.1, 9.2.2, 9.2.4, 9.3.1, 9.3.3, 9.3.4, 9.3.5	
Pre-requisites: Knowledge of FIR and IIR Filters. Self-Learning: Quantization of Filter Coefficients.	
RBT Levels: L1, L2, L3	

III(b). PRACTICAL PART

Sl. No.	**Programs**
1	Verification of sampling theorem (use interpolation function).
2	Program to perform convolution of two given sequences (without using built-in function) and display the signals.
3	Consider a causal system $y(n) = 0.9y(n-1) + x(n)$. a) Determine $H(z)$ and sketch its pole zero plot. b) Plot $\lvert H(e^{j\omega})\rvert$ and $\angle H(e^{j\omega})$ c) Determine the impulse response $h(n)$.

4	Computation of N point DFT of a given sequence (without using built-in function) and to plot the magnitude and phase spectrum.
5	Using the DFT and IDFT, compute the following for any two given sequences a) Circular convolution b) Linear convolution
6	Verification of Linearity property and Parseval's Theorem of DFT.
7	Verification of circular time shift property & circular frequency shift property of DFT.
8	Auto and cross correlation of two sequences and verification of their properties.
9	Develop decimation in time radix-2 FFT algorithm without using built-in functions.
10	Design and implementation of digital FIR filter using a window to meet the given specifications
11	Design and implementation of analog IIR Butterworth low pass and high pass filter to meet the given specifications.
12	Design and implementation of digital IIR Butterworth low pass and high pass filter to meet the given specifications.

Instructions for conduction of practical part:

- Use software tools like MATLAB/Simulink or other simulation software for system modelling and analysis.

IV. COURSE OUTCOMES

CO1	Determine response of LTI systems using time domain and DFT techniques.
CO2	Compute DFT of real and complex discrete time signals.
CO3	Evaluate the DFT using FFT algorithms and the linear filtering approach.
CO4	Design and realize FIR and IIR digital filters

V. CO-PO-PSO MAPPING (H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	
CO1	3	2	2	2	3	-	-	-	-	-	-	-	3	1		
CO2	3	2	2	2	3	-	-	-	-	-	-	-	3	1		
CO3	3	2	2	2	3	-	-	-	-	-	-	-	3	1		
CO4	3	2	2	2	3	-	-	-	-	-	-	-	3	1		

VI. Assessment Details (CIE & SEE)

General Rules:
Refer to – Academic regulations

Continuous Internal Evaluation (CIE):
Refer to Annexure, SL #2

Semester End Examination (SEE):
Refer to - Annexure, SL #2

Rubrics:
Refer to - Annexure, SL #2

VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Digital Signal Processing - Principles Algorithms & Applications	Proakis & Manolakis	4th Edition, 2007	Pearson Education, New Delhi
2	Digital Signal processing - Fundamentals and Applications	Li Tan, Jean Jiang	2nd Edition, 2013	Academic Press
VII(b): Reference Books:				
1	Digital Signal Processing, A Computer Based Approach	Sanjit K Mitra	4th Edition, 2017	McGraw Hill Education
2	Discrete Time Signal Processing	Oppenheim & Schaffer	3rd Edition, 2014	Pearson
3	Digital Signal Processing	D Ganesh Rao and Vineeth P Gejji	2017	Cengage India Private Limited
VII(c): Web links and Video Lectures (e-Resources):				
MIT OCW Digital Signal Processing by Prof. Alan V. Oppenheim- https://ocw.mit.edu/courses/res-6-008-digital-signal-processing-spring-2011/ NPTEL Digital Signal Processing, Prof. S C Dutta Roy, IIT Delhi. https://nptel.ac.in/courses/117102060				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Activities like seminar, assignments, quiz, case studies, mini projects, industry visit, self-study activities, group discussions, etc				

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Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	**PCCL**		
Course Title: Advanced Digital Communication Lab					
Course Code:	**23ECL504**			**Credits:**	01
Teaching Hours/Week (L: T:P:O)			0:0:2:0	**Total Hours:**	2 Hrs/Week
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	03

I. Course Objectives:

This laboratory course enables students to

- Design of basic digital modulation techniques using electronic hardware.
- Simulation of vector computations and derive the orthonormal basis set using Gram Schmidt procedure.
- Simulate the digital transmission and reception in AWGN channel
- Simulate the digital modulations using software and display the signals and its vector representations.
- To simulate Source coding and Error correcting and detecting codes using C/C++/ MATLAB code.

Sl. No.	Experiments / Programs
	Hardware Experiments
1	Generation and demodulation of the Amplitude Shift Keying signal
2	Generation and demodulation of the Phase Shift Keying signal
3	Generation and demodulation of the Frequency Shift Keying signal.
4	Generation of DPSK signal and detection of data using DPSK transmitter and receiver
	Simulation Experiments (Use MUKU:GO / MATLAB / Scilab /LabVIEW or any other suitable software
5	Simulate NRZ, RZ, half-sinusoid and raised cosine pulses and generate eye diagram for binary polar signalling
6	Gram-Schmidt Orthogonalization: To find orthogonal basis vectors for the given set of vectors and plot the Orthonormal vectors
7	Simulation of binary baseband signals using a rectangular pulse and estimate the BER for AWGN channelusing matched filter receiver.
8	Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and Compare them with their Performance curves.
9	Perform the QPSK Modulation and demodulation. Display the signal and its constellation.
10	Generate 16-QAM Modulation and obtain the QAM constellation
11	Encoding and Decoding of Huffman code.
12	Encoding and Decoding of binary data using a Hamming code.

II. COURSE OUTCOMES

CO1	Design and test the digital modulation circuits and display the waveforms.
CO2	Design of optimum communication receivers for AWGN channels
CO3	Simulate the digital modulation systems and compare the error performance of basic digital modulation schemes.
CO4	Illustration of different digital modulations using the signals and its equivalent vector representations
CO5	Implement the source coding and channel coding procedures using suitable software.

III. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	3	2	2	-	-	1	1	1	1	1	1	2	-	
CO2	3	2	3	3	2	-	-	1	1	1	1	1	1	2	-	
CO3	3	2	3	3	2	-	-	1	1	1	1	1	1	2	-	
CO4	3	2	3	2	2	-	-	1	1	1	1	1	1	2	-	
CO5	3	2	3	2	2	-	-	1	1	1	1	1	1	2	-	

IV. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #4

Semester End Examination (SEE): Refer to - Annexure, SL #4

V. Learning Resources

Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Modern Digital and Analog Communication Systems	B. P Lathi, Zhi Ding	4th Edition,2017 ISBJ:978-0-19-947628-2	Oxford University Press
2	Principles of Communication Systems	Herbert Taub, Donald L Schilling, GoutamSaha	2013 ISBN: 978-1-25-902985-1	McGraw Hill Education,
3	Digital Communication Systems"	Simon Haykin,	First Edition, 2014, ISBN 978-0 471-64735-5.	John Wiley & sons,

VI: Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/108102096

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	PEC		
Course Title: Data Structure Using C++					
Course Code:	**23ECP511**			**Credits:**	03
Teaching Hours/Week (L: T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

- Learn the Basic Concepts of C++
- Describe the concepts of Pointers and Arrays
- Concepts of Data Structures
- Understanding of the implementation of a linked list and Algorithms

II. Teaching-Learning Process :

1. Online coding platforms can be used to execute programs
2. Mobile applications can be used to execute the codes.
3. Presentation of concepts, videos.

III. COURSE CONTENT

III(a). Theory PART

Module-1: C++ Classes, Pointers & Array-based Lists — Hrs-8

OBJECT-ORIENTED DESIGN (OOD) AND C++
Inheritance, Polymorphism, Templates
Textbook:1- Chapter-2, Page No. 60-78,84-112

Pointers & Array-based Lists:
Pointer Data Type and Pointer Variables, Classes & Pointers, Inheritance Pointers &Virtual functions, Abstract Classes & Pure Virtual functions, Array-Based Lists

Textbook:1- Chapter-3, Page No. 131-183

Pre-requisites: C++ Basics with Arrays and Basic Data Structures.

RBT Levels: L1, L2

Module-2: Linked Lists &Stacks — Hrs-8

Linked List:
Linked List as an ADT, Unordered Linked List, ordered Linked List, Doubly Linked Lists

Textbook:1- Section-5, Page No. 265-320

Stack:
Stacks, Implementation of Stacks as Arrays, Linked Implementation of Stacks
Textbook:1- Chapter-7-Page No. 395-428

Pre-requisites:

- **Object-Oriented Programming (OOP) Concepts** *(Optional but Beneficial for Linked Lists)*
- Problem-solving and Logical Thinking
- Mathematics and Algorithm Basics

RBT Levels: L1,L2,L3

Module-3: Queues and Algorithms	Hrs-8

Queue Operations:

Implementation of Queues as Arrays, Linked Implementation of Queues, STL class queue, Priority Queues, Application of Queues: Simulation.

Textbook:1- Chapter-8, Page No. 451-490

Search Algorithms:

Hashing, Sorting Algorithms: Selection sort, Insertion sort, Shell Sort.

Textbook:1- Chapter-9&10, Page No. 497-524,533-550

Pre-requisites (Self Learning)

Basic knowledge of other data structures, such as:

- Queues for comparative understanding.
- Arrays to contrast with linked lists.

RBT Levels: L1,L2,L3

Module-4: **Binary Trees and B-Trees**	Hrs-8

Binary Tree Traversal, Binary Search Trees, Binary Search Tree: Analysis, Non-recursive Binary Tree Traversal Algorithms, Binary Tree Traversal and Functions as Parameters, AVL (Height-Balanced) Trees, B-Trees

Textbook:1- Chapter-11, Page No. 599-675

Pre-requisites:
Object-Oriented Programming (OOP) Concepts.
Problem-solving and Logical thinking.
Mathematics and Algorithm Basics

RBT Levels: L1,L2,L3

Module-5: Graphs	Hrs-8

Introduction, Graph Definitions and Notations, Graph Representation, Operations on Graphs, Graphs as ADTs, Graph Traversals, Shortest Path Algorithm, Minimum Spanning Tree, Topological Order, Euler Circuits

Textbook:1-Chapter-12, Page No.685-721

Pre-requisites:

Proficiency in programming languages like C++, Java, Python, or any other language that supports data structures.

RBT Levels: L1, L2, L3

IV. COURSE OUTCOMES

CO1	Apply advanced data structure strategies for exploring complex data structures.
CO2	Compare and contrast various data structures and design techniques in Performance
CO3	Implement data structure algorithms through C++. Incorporate data structures into the applications.
CO4	Implement all data structures, such as stacks, queues, trees, lists, and graphs, and compare their Performance and trade-offs.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	1	1	1								2			
CO2	2	2	1	1	1								1			
CO3	3	3	1	1	1								1			
CO4	3	2	1	1	1								1			

VI. Assessment Details (CIE & SEE)

General Rules: Refer to - Academic regulations.

Continuous Internal Evaluation (CIE):
Refer to – Annexure, SL #1

Semester End Examination (SEE):
Refer to – Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
01	Data Structures using C++	D.S.Malik	2nd Edition. Year: 2009	Cengage Learning, ISBN: 0324782012,9780324782011

VII(b): Reference Books:

01	Data Structures, Algorithms, and Applications in C++	Sartaj Sahni	2nd Edition Year: 2004	Silicon Press

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106106127
- https://nptel.ac.in/courses/106102064
- https://nptel.ac.in/courses/106106133

VIII: Activity Based Learning / Practical Based Learning/Experiential Learning:

Conduct different types of Programs and mini-projects.

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Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	**PEC**		
Course Title: Information Theory & Coding					
Course Code:	23ECP512			**Credits:**	3
Teaching Hours/Week (L: T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3 Hours

I. Course Objectives:

- Understand the concept of Entropy, Rate of information and order of the source with reference to dependent and independent source.
- Study various source encoding algorithm.
- Model discrete and continuous communication channels.
- Study various error control coding algorithm

II. Teaching-Learning Process:

- Chalk and Talk
- Demonstrate and visualize basic algorithms
- Videos

III. COURSE CONTENT

III(a). Theory PART

Module-1: Information Theory	8 Hrs

Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model for Information Sources, Entropy and Information rate of Mark off Sources

Textbook: 1, Chapter: 4, sections 4.1, 4.2

Pre-requisites (Self Learning): Probability theory

RBT Levels: L1, L2,L3

Module-2: Source Coding	**8 Hrs**

Encoding of the Source Output, Shannon's Encoding Algorithm, Shannon Fano Encoding Algorithm. Source coding theorem, Prefix Codes, Kraft McMillan Inequality property KMI, Huffman codes

Textbook:1 Chapter:4, sections:4.3,4.3.1
Textbook:2 Chapter:2, sections:2.2
Textbook:3 Chapter:2, sections:2.15

Pre-requisites (Self Learning): Probability theory

RBT Levels: L1,L2,L3

Module-3: Information Channels	**8 Hrs**
Communication Channels, Discrete Communication channels Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies. Mutual Information, Channel Capacity, Channel Capacity of Binary Symmetric Channel, Binary Erasure Channel, Muroga's Theorem **Textbook:1 Chapter:4, sections:4.5.1, 4.5.2** **Textbook:2 Chapter:2, sections:2.5,2.6** **Textbook:3 Chapter:2, sections:2.27,2.28**	
Pre-requisites (Self Learning): Probability theory	
RBT Levels: L1, L2, L3	
Module-4: Error Control Coding	**8 Hrs**
Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction capabilities of Linear Block Codes, Single error correction Hamming code, Table lookup Decoding using Standard Array. **Binary Cyclic Codes:** Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction **Textbook:1, Chapter:9 sections:** 9.1, 9.2,9.3,9.3.1,9.3.2,9.3.3	
Pre-requisites (Self Learning): Probability theory	
RBT Levels: L1, L2, L3	
Module-5: Convolution Codes	8 Hrs
Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm **Textbook:2, Chapter:8 sections:8.5.8.6**	
Pre-requisites (Self Learning) Probability theory	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Ability to **apply** the mathematical knowledge of probability to measure information in discrete message source
CO2	**Apply** source encoding algorithm such as Shannon coding, Huffman coding, Arithmetic coding to ensure transmission of information of a discrete message source
CO3	Ability to compute and **analyze** the capacity and efficiency of discrete and continuous time channels.
CO4	**Design** encoding and decoding techniques to ensure error free transmission of information of a discrete message source.

V. CO-PO-PSO MAPPING (H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2											2			
CO2	3	3											2			
CO3	3	3											2			
CO4	3	3	2										2			

VI. Assessment Details (CIE & SEE)
General Rules: Refer to Academic Regulations
Continuous Internal Evaluation (CIE):Refer to Annexure, SL #1 **Rubrics: Refer to Annexure, SL #1**
Semester End Examination (SEE): Refer to Annexure, SL #1 **Rubrics: Refer to Annexure, SL #1**

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Digital and Analog Communication Systems	K. Sam Shanmugam	1996	John Wiley India Pvt Ltd
2	Digital Communication	Simon Haykin	2008	John Wiley India Pvt Ltd
3	Information Theory and Coding	HariBhat, Ganesh Rao	2017	Cengage

VII(b): Reference Books:

1	lTC and Cryptography	Ranjan Bose	II edition, 2007	TMH
2	Error Correction Coding	Todd K Moon	2006	Wiley Std

VII(c): Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/108102096
https://archive.nptel.ac.in/courses/117104129/
https://archive.nptel.ac.in/courses/108104092/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, assignments, quiz, self-study activities, group discussions.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	PEC		
Course Title: Fundamentals of Artificial Intelligence					
Course Code:	**23ECP513**		**Credits:**		03
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

This course will enable students to:

- Understand the basics of ANN and comparison with Human Brain.
- Acquire knowledge on generalisation and function approximation various ANN architectures.
- Understand reinforcement learning using neural networks.
- Acquire knowledge of unsupervised learning using neural networks.

II. Teaching-Learning Process (General Instructions):

1. Chalk and Talk
2. Demonstrate and visualize basic algorithms.
3. Videos

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction to AI	8Hrs

Introduction: What is AI, Foundations and History of AI
Intelligent Agents: Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.
Textbook 1: Chapter 1, 2 **Sections:**1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 2.4

Pre-requisites: Basic concepts of Artificial Intelligence

RBT Levels: L1, L2

Module-2: Solving Problems by Searching	8Hrs

Problem-solving: Problem-solving agents, Example problems,
Uninformed Search Strategies: Breadth First search, Uniform-cost search, Depth First Search, Depth-limited search, Iterative deepening depth first search, Bidirectional search, Comparing uninformed search strategies.
Textbook 1: Chapter 3 **Sections:** 3.1, 3.2, 3.4

Pre-requisites
Concept of logic and discrete mathematics

RBT Levels: L1, L2

Module-3: Searching and Logical Agents	8Hrs
Informed Search Strategies: Greedy best first search, A*search, Memory-bounded, Bidirectional heuristic search, Heuristic functions, learning to search better. **Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Agents based on propositional logic. **Textbook 1:** Chapter 3,7 **Sections:** 3.5.1, 3.5.2, 3.5.5, 3.5.6, 3.6, 7.1, 7.2, 7.3, 7.4,7.7	
Pre-requisites Knowledge of Pseudo-algorithms. **Self-Learning:** Basics of Heuristic Functions	
RBT Levels: L1, L2	
Module-4: First Order Logic and Inference	8Hrs
First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic. **Inference in First Order Logic:** Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, **Textbook 1:** Chapter 8, 9 **Sections:** 8.1, 8.2, 8.3, 9.1, 9.2, 9.3, 9.4	
Pre-requisites Knowledge of statistical concepts	
RBT Levels: L1, L2	
Module-5: Uncertain Knowledge and Reasoning	Hrs
Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule, and its use: Applying Bayes' rule, Using Bayes' rule: Combining evidence, Wumpus World Revisited. **Textbook 1:** Chapter 12 **Sections:** 12.1, 12.2, 12.3, 12.4, 12.5, 12.7	
Pre-requisites Knowledge of logical reasoning	
RBT Levels: L1, L2	

IV. COURSE OUTCOMES

CO1	Describe the fundamental concepts of AI.
CO2	Apply the AI knowledge to solve problem on search algorithm.
CO3	Develop knowledge base sentences using propositional logic and first order logic.
CO4	Illustrate the application of probability in uncertain reasoning.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3											2			
CO2	3	3	2										3			
CO3	3	3											3			
CO4	3	2											2			

VI. Assessment Details (CIE & SEE)

General Rules: - Refer to academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1
Rubrics: Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Artificial Intelligence: A modern approach	Stuart J. Russell and Peter Norvig	4thEdition	Pearson

VII(b): Reference Books:(Insert or delete rows as per requirement)

1	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B Nair	3rd Edition, 2015	McGraw Hill Education
2	Introduction to Artificial Intelligence and Expert Systems	Dan W Patterson	2014	Pearson

VII(c): Web links and Video Lectures (e-Resources):

1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2. https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3. https://nptel.ac.in/courses/106/105/106105077/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, assignments, quiz, self-study activities, group discussions.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	PEC		
Course Title: Real Time Operating Systems					
Course Code:	**23ECP514**			**Credits:**	3
Teaching Hours/Week (L: T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

This course will enable students to:

- Understand the services provided by a RTOS.
- Explain task scheduling algorithms and resource sharing techniques of RTOS.
- Explain inter-task communication and memory management techniques.
- Know various benchmarking metrics used to evaluate the performance of a typical RTOS.

II. Teaching-Learning Process :

- Chalk and talk.
- Videos.

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction to RTOS	08 Hrs

Producing quality software, Modelling the software, Importance of time and timing, handling multiple jobs, Handling complex multiple jobs, Simple quasi concurrency, Basic features of RTOS, Executives, kernels and operating systems.

Textbook 1: Chapter 1 **Sections: 1.1 to 1.9**

Pre-requisites: Knowledge of Computer Organization and embedded system

RBT Levels: L1 and L2

Module-2: Task Scheduling in RTOS	08 Hrs

Introduction, Simple cyclic, timed cyclic and cooperative scheduling, round robin scheduling, Task priorities, using queues, Priority pre-emptive scheduling, Implementing queues, process descriptor, the tick, priorities, and system responsiveness.

Textbook 1: Chapter 2 **Sections: 2.1 to 2.10**

Pre-requisites: Knowledge of Computer Organization and Architecture

RBT Levels: L1 and L2

Module-3: Resource Sharing	08 Hrs
Problem of using shared resources, Mutual exclusion, Semaphores, Mutex, Dead lock problem in detail, producing deadlock free systems, preventing deadlocks, Priority inversion and task blocking. **Textbook 1:** Chapter 3 and 4 **Sections: 3.1 to 3.4** and **4.1 to 4.4**	
Pre-requisites: Knowledge of Computer Organization and Architecture	
RBT Levels: L1 and L2	
Module-4: Intertask Communication and Memory management	08 Hrs
Introduction, Task interaction without data transfer, Data transfer without task synchronization, Task synchronization with data transfer. storing digital information in embedded systems, Memory aspects, Eliminating intertask interference, Dynamic memory allocation and its problems, Memory management and solid-state drives. **Textbook 1:** Chapters 5 and 6 **Sections:5.1 to 5.4** and **6.1 to 6.5**	
Pre-requisites: Knowledge of Computer Organization and Architecture	
RBT Levels: L1 and L2	
Module-5: Performance and Benchmarking of RTOS	08 Hrs
Introduction, Measuring computer performance, Time overheads, OS performance, representative and synthetic benchmarks. setting the scene, Testing, and developing multitasking software, In-target-testing-practical tool features, mTarget system testing. **Textbook 1:** Chapters 11, 12 **Sections:11.1 to 11.5** and **12.1 to 12.4**	
Pre-requisites: Knowledge of Computer Organization and Architecture	
RBT Levels: L1 and L2	

IV. COURSE OUTCOMES

CO1	Describe the real time operating system concepts.
CO2	Apply RTOS algorithms to calculate performance metrics.
CO3	Analyze the performance of RTOS algorithms.
CO4	Determine the role of memory management in RTOS for a given set of tasks and target embedded system.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2											2			
CO2	3	3	2										2	1		
CO3	3	2											2			
CO4	3	2											3			

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations.

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to - Annexure, SL #1
Rubrics: Refer to - Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Real – Time Operating Systems Book 1– The Foundations	Jim Cooling	2018	Kluwer Academic

VII(b): Reference Books:

1	Hands-On RTOS with Microcontrollers	Brian Amos	2020	Packt Publishing
2	Embedded and Real-Time Operating Systems	K. C. Wang	2017	Springer

VII(c): Web links and Video Lectures (e-Resources):

1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
2. https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
3. https://nptel.ac.in/courses/106/105/106105077/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Demonstrate the use of operating systems in embedded systems.

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Department of Electronics & Communication Engineering

Semester:	**V**	**Course Type:**	**ETC**		
Course Title: Automotive Electronics and Hybrid Vehicles					
Course Code:	**23ECE531**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

Students will be able to

1. Gain knowledge to learn the concepts of developing basic skills necessary for importance Automotive Electronics in Automobile
2. Understand the basic concepts and various Operation using Sensor and Actuators used Automobile.
3. Illustrate the operation of various sensors and Actuators used in Automotive Electronics and Hybrid Vehicles
4. Diagnosis the problem related types of, Data Acquisition System and Communication Networks (Bus Systems) Control system using Standard Technology.

II. Teaching-Learning Process :

1. Chalk and Talk
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction to Automotive Electronics — **08 Hrs**

Automotive Fundamentals Overview: Four Stroke Cycle, Engine Control, Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Drive Train, Transmission, Brakes, Steering System, Battery, Starting System. Air/Fuel Systems Fuel Handling, Air Intake System, Air/ Fuel Management.
Text Book: 1 - Chapter: 5

Pre-requisites: Concepts of Mechanical Concepts.

RBT Levels: L1, L2

Module-2: Sensors — **08 Hrs**

Oxygen (O_2/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP)Sensors, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor – Strain gauge and Capacitor capsule, Engine Coolant Temperature (ECT) Sensor, Intake Air Temperature (IAT) Sensor, Knock Sensor, Airflow rate sensor, Throttle angle Sensor.
Text Book: 1 - Chapter: 6

Pre-requisites: Concepts of Sensors.

RBT Levels: L1, L2

Module-3: Actuators and Measurements	**08 Hrs**
Actuators: Fuel Metering Actuator, Fuel Injector, Ignition Actuator. Exhaust After-Treatment Systems – AIR, Catalytic Converter, Exhaust Gas Recirculation (EGR), Evaporative Emission Systems. Automotive Instrumentation and Communication: Sampling, Measurement & Signal Conversion of various parameters (Speed, fuel, pressure). Serial Data, Communication Systems, Protection, Body and Chassis is Electrical Systems, Remote Keyless Entry, GPS **Text Book: 1 - Chapter: 6 & 7**	
Pre-requisites: Concepts of Measurements	
RBT Levels: L1, L2, L3	
Module-4: Vehicle Motion Control	**08 Hrs**
Cruise control, Chassis, Power Brakes, Antilock Brake System (ABS), Electronic Steering Control, Power Steering, Traction Control, Electronically controlled suspension. Automotive Diagnostics –Timing Light, Engine Analyzer, On- board diagnostics, Off-board diagnostics, Expert Systems. Future Automotive Electronics Systems: Alternative Fuel Engines, Collision Avoidance Radar warning Systems, Low tire pressure warning system, Radio navigation, Advance Driver Information System. **Textbook: 1 - Chapter: 8**	
Pre-requisites: Concepts of Control System	
RBT Levels: L1, L2, L3	
Module-5: Introduction to Alternative Vehicles	**08 Hrs**
Electric Vehicle, Hybrid Electric vehicle, Electric Hybrid Vehicle, Vehicle components, Electric and Hybrid history EV/CEV Comparison. Alternative Vehicle Architecture: Electric Vehicles, Hybrid Electric Vehicles, Plug-in Hybrid Electric Vehicles, Power Train component Sizing, Mass Analysis & Packaging, Vehicle Simulation. **Textbook: 2 - Chapter: 1 Section 1.1-1.9**	
Pre-requisites: Concepts of Battery and Alternative fuels	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Determine the operation of Engine Parameters and a critical awareness of current problems within the automotive electronics domain using Various Measurement Technology.
CO2	Apply the fundamental Concepts of automotive electronics on various Engine parts, Sensor, Actuator, Communication and Measurement System.
CO3	Determine the extent and nature of electronic circuitry in automotive systems including monitoring and control circuits for engines, transmissions, brakes, steering, suspension
CO4	Analyze climate control, instrumentation and radios and accessories involved in Automotive Industry.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	3	2			1	1						3	2	
CO2	3	3	2			1	1						3	2	
CO3	3	2	2			1	1						2	3	
CO4	3	2	2			1	1						2	3	

VI. Assessment Details (CIE & SEE)				
General Rules: Refer to Academic Regulations				
Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1				
Semester End Examination (SEE): Refer to - Annexure, SL #1				
VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Understanding Automotive Electronics,	William B. Ribbens	7th Edition, 2012	SAMS/Elsevier Publishing.
2	"Electric and Hybrid Vehicles: Design fundamentals".	Iqbal Husain	3rd Edition 2011	CRC Press,
VII(b): Reference Books:				
1	Automotive Electronics Systems and Components	Robert Bosch GmbH:	5th Edition, 2007	John Wiley & Sons Ltd.
2	"Electric Vehicle Technology – Explained'	James Laminie and John Lowry.	2nd Edition, 2010.	CRC Press
VII(c): Web links and Video Lectures (e-Resources):				
1. https://youtu.be/UgtjRob5qMg?si=FMUQzl9UoU20HqGR 2. https://youtu.be/3E1SXG7VkQk?si=ZG3qEA49GdrRU5bP 3. https://youtu.be/FXpAhoZ13r0?si=GzwXO5xngccG7tGl 4. https://youtu.be/A3fHQsIkYeU?si=jo8jj_qdT_1-iz8Y 5. https://youtu.be/H0GTxbIejSM?si=PYMlMAeuHDHNzTvf				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Seminar, Quiz, Case Studies, Mini Projects, Self-Study Activities.				

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Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	ETC		
Course Title: FPGA Based System design Using Verilog					
Course Code:	**23ECE532**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- Understand the types programmable logic devices and building blocks of FPGA and thus implement the design using Xilinx FPGAs.
- Understand the concepts of Advanced Logic design and implementation using Verilog HDL
- Designing different Digital applications using SM chart.

II. Teaching-Learning Process :

1. Chalk and Board
2. Mini projects
3. Videos and online material

III. COURSE CONTENT

Module-1: Introduction to Programmable Logic Devices	8 Hrs

Brief overview of Programmable Logic Devices, Simple Programmable Logic Devices (SPLDs), Complex Programmable Logic devices (CPLDs), Field-Programmable Gate Arrays (FPGAs)

Text 1: chapter 3-Section -3.1,3.2, 3.3, 3.4

Pre-requisites: Combinational circuits

RBT Levels: L1, L2, L3

Module-2: Digital Design applications	8 Hrs

BCD to 7-Segment Display Decoder, BCD Adder, Traffic Light controller, Synchronization and debouncing, Shift-and-Add Multiplier Array Multiplier, Keypad Scanner (Excluding Test Bench)

Text 1: chapter 4-Section-4.1,4.2,4.4,4.7,4.8,4.9,4.11

Pre-requisites: Verilog HDL
Self-Learning: Test bench designing

RBT Levels: L1, L2, L3

Module-3: State Machine Charts and Microprogramming	8 Hrs
State Machine Charts, Derivation of SM Charts, SM chart for binary multiplier, Dice Game (Excluding Test Bench), Realization of SM Charts, Implementation of the Dice Game. Microprogramming **Text 1: chapter 5-Section- 5.1, 5.2, 5.3, 5.4, 5.5**	
Pre-requisites: Verilog HDL	
RBT Levels: L1, L2, L3	
Module-4: Floating-Point Arithmetic	8 Hrs
Representation of Floating-Point Numbers, Floating-Point Addition, Other Floating-Point Operations. Multivalued Logic and Signal Resolution, Built-in Primitives, User-Defined Primitives, SRAM Model, Rise and Fall Delays of Gates **Text 1: chapter 7-Section- 7.1,7.2, 7.3,7.4, chapter 8 – Section- 8.3, 8.4, 8.5,8.6,8.8**	
Pre-requisites: floating point number system, memory system	
RBT Levels: L1, L2, L3	
Module-5: Designing with Field Programmable Gate Arrays:	8 Hrs
Implementing Functions in FPGAs, Implementing Functions Using Shannon's Decomposition, Carry Chains in FPGAs, Cascade Chains in FPGAs, Examples of Logic Blocks in Commercial FPGAs, Dedicated Multipliers in FPGAs, FPGAs Capacity: Maximum gates versus Usable gates, Design Translation. **Text 1: chapter 6-Section- 6.1,6.2,6.3, 6.4 ,6.5, 6.7,6.10, 6.11**	
Pre-requisites: FPGA architecture	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Apply the concept of Programmable logic devices to implement digital design.
CO2	Construct and implementation of Advanced logic design using Verilog HDL
CO3	Explain the concept of SM Chart and design complex digital circuits using SM Chart
CO4	Performing the Floating-point arithmetic operations and designing of Memories
CO5	Designing and performance evaluation of advanced digital design using FPGAs

V. CO-PO-PSO MAPPING (H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3	3										2	2		
CO2	3	2	2	1	1								2	2		
CO3	3	2	2	1	1								2	2		
CO4	3	2	3	1	1								2	2		
CO5	3	2	3	1	1								2	2		

VI. Assessment Details (CIE & SEE)				
General Rules: Refer to Academic regulations				
Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1				
Semester End Examination (SEE): Refer to - Annexure, SL #1 **Rubrics: Refer to Annexure, SL #1**				
VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Digital Systems Design Using Verilog	Charles H. Roth, Jr.Lizy Kurian John , Byeong Kil Lee	First Edition,2014	Cengage Learning
VII(b): Reference Books:				
1	Advanced FPGA Design Architecture, Implementation, and Optimization	Steve Kilts	2007	John Wiley & sons
2	ASIC and FPGA Verification: A guide to component Modelling.	Richard Munden, Morgan Kaufmann	2004	Elsevier
3	Processor Design . System-on-Chip Computing for ASICs and FPGAs	Jari Nurmi	2007	Springer Publications
VII(c): Web links and Video Lectures (e-Resources): • https://www.youtube.com/watch?v=LbszOAzYWx8 • https://www.youtube.com/watch?v=iHg0mmIg0UU • https://www.youtube.com/watch?v=bTCQ7UPhTH4&list=PLUn6cqainH8jZxS3ppSGPi3rNScz9cFZf • https://www.youtube.com/watch?v=HjD5mVbbBK4				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Programming assignments / mini projects can be given to improve programming skills.				

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Department of Electronics and Communication Engineering

Semester:	V	Course Type:	ETC		
Course Title: Cloud Computing and IoT Analytics					
Course Code:	**23ECE533**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	**Theory**			**Exam Hours:**	3

I. Course Objectives:

1. Discuss the concepts, characteristics, delivery models and benefits of cloud computing.
2. Explore the key technical, organisational and compliance challenges of cloud computing.
3. Grasp the concepts of virtualisation efficiently.
4. Understand the fundamentals of the Internet of Things, its building blocks, and their characteristics.
5. Understand the recent application domains of IoT in everyday life.
6. Understand the protocols and standards designed for IoT and the current research on it.

II. Teaching-Learning Process:

1. Chalk And Talk
2. Mini Projects & Presentation
3. Videos And Online Material

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction to Cloud Computing:	08 Hrs

Introduction, Definition, Characteristics of Cloud Computing, Cloud Models- Service Models, Deployment Models, Cloud Services Examples, Cloud-Based Services & Applications.
Textbook 1: Chapter 1: Section:1.1-1.5.

Pre-requisites: Knowledge of memory and basics of cloud technology.

RBT Levels: L1, L2

Module-2: Cloud Concepts & Technologies	08 Hrs

Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring, Software Defined Networking, Network Function Virtualization, MapReduce, Identity and Access Management, Service Level Agreement, Billing.
Textbook 1: Chapter 2: Section: 2.1-2.12.

Pre-requisites: Basics of Cloud Technology & Networking.

RBT Levels: L1, L2

Module-3: Introduction to Internet of Things	08 Hrs
Introduction, Physical design, Logical design, Enabling technologies, Levels & deployment templates. **Textbook 2: Chapter 1: Section:1.1-1.5.**	
Pre-requisites: Sensors, Computer network.	
RBT Levels: L1, L2	
Module-4: Domain-Specific IoTs:	08 Hrs
Home automation, cities, environment, energy, retail, logistics, agriculture, industry, health & lifestyle. **Textbook 2: Chapter 2: Section: 2.1-2.10.**	
Pre-requisites: Different types of sensors.	
RBT Levels: L1, L2	
Module-5: IoT Devices and Networking Protocols	08 Hrs
IoT devices, networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, analysing data to infer protocol and device characteristics.	
Textbook 3: Chapter 2.	
Pre-requisites: Basics of Networking.	
RBT Levels: L1, L2	

IV. COURSE OUTCOMES

CO1	Define key concepts about cloud computing.
CO2	Explain the cloud computing concepts and technologies.
CO3	Describe the characteristics and applications of domain-specific IoTs.
CO4	Illustrate the characteristics, building blocks, and enabling technologies of the IoT systems.
CO5	Analysing IoT devices and networking protocols.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	1	1										1			
CO2	2	2	1										1			
CO3	2	2	1										1			
CO4	2	2	1										1			
CO5	2	2	1										1			

VI. Assessment Details (CIE & SEE)

General Rules:
Refer to SJBIT Autonomous Regulation.

Continuous Internal Evaluation (CIE):
Rubrics:
Refer to Annexure SL. # 01

Semester End Examination (SEE):
Rubrics:
Refer to Annexure SL. # 01

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
01	Cloud Computing – Hands-on Approach	Arshdeep and Vijay	2014	Universities Press, 2014.
02	Internet of Things	Arshdeep Bagha and Vijay Madisetti	2015	Universities Press, 2015.
03	Analytics for the Internet of Things (IoT)	Andrew Minteer	2017	Packet Publishing, 2017.

VII(b): Reference Books:

01	Cloud Computing Principles and Paradigms	Rajkumar Buyya James Broberg Andrzej Goscinski	2011	John Wiley & Sons.

VII(c): Web links and Video Lectures (e-Resources):

https://onlinecourses.nptel.ac.in/noc21_cs14/preview
https://onlinecourses.nptel.ac.in/noc25_cs12/announcements?force=true
https://onlinecourses.nptel.ac.in/noc25_cs44/preview
https://onlinecourses.swayam2.ac.in/ntr25_ed21/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Quiz, Mini Projects

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	**V**	**Course Type:**	**ETC**		
Course Title: Block Chain Technology					
Course Code:	**23ECE534**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

Students will be able to

1. Gain the knowledge of Distributed computing and Cryptography and its role in Blockchain.
2. Applications of Bitcoin and Cryptography and its role in Blockchain Technology
3. Illustrate the concepts of blockchain application using various Technology
4. Develop the operation Ethereum platform for blockchain application

II. Teaching-Learning Process :

1. Chalk and Talk
2. Presentation & Seminars
3. Videos and online material

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction to Blockchain	8 Hrs

Blockchain: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations.
Textbook 1: Chapter 1, 2

Pre-requisites: Network topologies

RBT Levels: L1, L2

Module-2: Introduction to Cryptography & Cryptocurrencies	8 Hrs

Introduction to Cryptography & Cryptocurrencies: Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, A Simple Cryptocurrency, How Bitcoin Achieves Decentralization: Distributed consensus, Consensus without identity using a block chain, Incentives and proof of work
Textbook 2: Chapter 1, 2

Self-Learning - MOOC Course of Block Chain

RBT Levels: L1 , L2

Module-3: Mechanics of Bitcoin	**8 Hrs**
Mechanics of Bitcoin: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The Bitcoin network, Limitations and improvements How to Store and Use Bitcoins: Simple Local Storage, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets. **Textbook 2: Chapter 3,4**	
Pre-requisites: Payments Services	
RBT Levels:L1, L2, L3	
Module-4: Bitcoin Mining	**8 Hrs**
Bitcoin Mining: The task of Bitcoin miners, Mining Hardware, Energy consumption and ecology, Mining pools, Mining incentives and strategies, Bitcoin and Anonymity: Anonymity Basics, How to De-anonymize Bitcoin, Mixing, Decentralized Mixing, Zerocoin and Zerocash. **Textbook 2: Chapter 5,6**	
Pre-requisites: Data Mining	
RBT Levels:L1, L2, L3	
Module-5: Smart Contracts and Ethereum 101	**8 Hrs**
Smart Contracts and Ethereum 101: Smart Contracts: Definition, Ricardian contracts. Ethereum 101: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts. Text Book 1: Chapter 10	
Self-Learning: Cryptography & Cryptocurrencies	
RBT Levels:L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Describe the concepts of Distributed computing and Cryptography and its role in Blockchain.
CO2	Apply the concepts of Bitcoin and Cryptography and its role in Blockchain Technology
CO3	Demonstrate the blockchain application using various Technology
CO4	Analyze the operation Ethereum platform to develop blockchain application

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	POS 1	POS 2	POS 3	POS4
CO1	3	3											3	2		
CO2	3	3	3										3	2		
CO3	3	2	3										2	3		
CO4	3	2	3										2	3		

VI. Assessment Details (CIE & SEE)

General Rules: Refer to Academic Regulations

Continuous Internal Evaluation (CIE): Refer to Annexure SL #1

Semester End Examination (SEE): Refer to Annexure SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Imran Bashir,	Imran Bashir,	Second Edition, ISBN 978-1-78712-544-5, 2017.	Packt Publishing Ltd,
2	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction. Princeton	Arvind Narayanan, Joseph Bonneau, Edward W. Felten, Andrew Miller, Steven Goldfeder and Jeremy Clark.,	University Press,	University Press,

VII(b): Reference Books: (Insert or delete rows as per requirement)

1	Mastering Bitcoins: Unlocking Digital Cryptocurrencies	Andreas Antonopoulos	O'Reilly Media, Inc, 2013.	O'Reilly Media, Inc, 2013.

VII(c): Web links and Video Lectures (e-Resources):

1. http://bitcoinbook.cs.princeton.edu/?_ga=2.8302578.1344744326.1642688462-86383721.1642688462
2. https://nptel.ac.in/courses/106/105/106105184/
3. https://ethereum.org/en/developers/
4. https://developer.ibm.com/components/hyperledger-fabric/tutorials/ Activity Based Learning

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Assignments, Quiz

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Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	V	**Course Type:**	HSMC		
Course Title: Bioscience					
Course Code:	**23SFHH06**			**Credits:**	01
Teaching Hours/Week (L:T:P:O)			0:2:0:@	**Total Hours:**	25 Hrs (Theory)
CIE Marks:	50	**SEE Marks :**	50	**Total Marks:**	50
SEE Type:	**Theory**			**Exam Hours:**	02

I. Course Objectives:

This course will enable students to:

- To know about Health and wellness..
- To Build healthy lifestyles for good health for a better future.
- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Explanation via real life problem, situation modelling, and deliberation of solutions, reflective and questioning /inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical/hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' seminars (in solo or group) /oral presentations

III. COURSE CONTENT

Module-1: Fundamentals of Good Health — 5Hrs

Good Health & It's balance for positive mindset: Health -Importance of Health, Influencing factors of Health, Health beliefs, Advantages of good health, Health & Behavior, Health & Society, Health & family, Health & Personality, Psychological disorders-Methods to improve good psychological health, Changing health habits for good health.

Textbook: 1 - Chapter: 1

Pre-requisites (Self Learning)

Foundational concepts in Biology

RBT Levels: L1, L2,L3

Module-2: Healthy lifestyles and Habits	5Hrs
Building of healthy lifestyles for better future: Developing healthy diet for good health, Food & health, Nutritional guidelines for good health, Obesity & overweight disorders and its management, Eating disorders, Food colour- ill effects. Fitness components for health, Wellness and physical function, How to avoid exercise injuries. Types of addictions, how to recovery from addictions. **Textbook:1 Chapter:- 2**	
Pre-requisites (Self Learning) Foundational concepts in Biology	
RBT Levels: L1, L2, L3	
Module-3: Adaptation of Physiological Principles in Bio-Engineering	5Hrs
Brain as a CPU system (signal transmission, BCI, EEG). Eye as a Camera system (rod and cone cells, optical corrections, lens materials, bionic eye). Heart as a pump system (electrical signaling - ECG monitoring, design of stents, pacemakers, defibrillators). Lungs as purification system (spirometry, Ventilators, Heart-lung machine, artificial lungs). **Textbook: 2 Chapter :- 5**	
Pre-requisites (Self Learning) Foundational concepts in Biology	
RBT Levels: L1, L2, L3	
Module-4: Bio-inspired materials and its mechanism	5Hrs
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). **Textbook:1 Chapter: 4**	
Pre-requisites (Self Learning) Foundational concepts in Biology	
RBT Levels: L1, L2, L3	
Module-5: Trends in Bioengineering	5Hrs
Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, Artificial Intelligence for disease diagnosis. Self- Self-healing-Bioconcrete and Bioremediation and Biomining via microbial surface adsorption. Bioplastic. **Textbook: 2 Chapter: 4**	
Pre-requisites (Self Learning) Biology : Foundational concepts in Biology	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Develop healthy lifestyles for good health
CO2	Elucidate the basic biological concepts and phenomena of natural processes.
CO3	Apply the principles of design and development, for exploring novel bioengineering projects.
CO4	Analyse and append the concepts of biomimetics for specific requirements.

V. CO-PO-PSO MAPPING(mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3
CO1	-	-	-	-	-	1	-	1	1	1	-	1	-	-	
CO2	1	-	-	-	-	-	-	1	1	1	-	1	-	-	
CO3	1	-	-	-	-	-	-	1	1	1	-	1	-	-	

VI. Assessment Details (CIE & SEE)

General Rules: ***Refer Academic regulations***

Continuous Internal Evaluation (CIE) & Rubrics: ***Refer to Annexure Section- 6***

Semester End Examination (SEE) & Rubrics: ***Refer to Annexure Section- 6***

VII. Learning Resources

VII(a): Textbooks :

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	"Scientific Foundations of Health"	Dr. L Thimmesha	ISBN-978-81-955465-6-5) published by– 2022.	Infinite Learning Solutions, Bangalore
2	Biology for Engineers	Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K	2012	Tata McGraw-Hill, New Delhi

VII(b): Reference Books:

1.	Yoseph Bar-Cohen. Biomimetics: Biologically Inspired Technologies D. Floreano and C. Mattiussi, Bio-Inspired Artificial Intelligence, CRC Press, 2018. ISBN: 1420037714, 9781420037715.
2.	Health Psychology (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O'Connor – Published by Routledge 711 Third Avenue, New York, NY 10017.
3.	HEALTH PSYCHOLOGY (Ninth Edition) by SHELLEY E. TAYLOR - University of California, Los Angeles, McGraw Hill Education (India) Private Limited - Open University Press.
4.	Guang Yang, Lin Xiao, and Lallepak Lamboni. Bioinspired Materials Science and Engineering. John Wiley, 2018. ISBN: 978-1-119-390336.
5.	M.A. Meyers and P.Y. Chen. Biological Materials, Bioinspired Materials, and Biomaterials Cambridge University Press, 2014 ISBN 978-1-107-01045.
6.	Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
7.	3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
8.	Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
9.	Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
10	Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
11	Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
12	Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/121106008

1. https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
   https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
2. https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
3. https://www.futurelearn.com/courses/biology-basic-concepts

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Group Discussion, Model Making and seminar/poster presentations, Case studies, Literature review, Role play /Street Play

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Autonomous Institute affiliated to Visvesvaraya Technological University, Belagavi
Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	AEC		
Course Title: Data Structure Using C++ Lab					
Course Code:	**23ECAE51**			**Credits:**	01
Teaching Hours/Week (L:T:P:O)			0:0:2:0	**Total Hours:**	02 hrs / Week
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	03

I. Course Objectives:

- To write and execute programs in C++ to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, and search trees.
- To write and execute programs in C++ to implement various sorting and searching methods.

II. Teaching-Learning Process :

1. Online coding platforms can be used to execute programs
2. Mobile applications can be used to execute the code.
3. Presentation of concepts

III. PRACTICAL PART

Sl No	Experiments / Programs / Problems
1.	Write a C++ program to implement recursive and non-recursive i) Linear search ii) Binary search
2.	Write a C++ program to implement i) Bubble sort, ii) Selection sort, iii) Quick sort, iv) Insertion sort
3.	Write a C++ program to implement the following using an array. a) Stack ADT b) Queue ADT
4.	Write a C++ program to implement a list ADT to perform the following operations: a) Insert an element into a list. b) Delete an element from the list c) Search for a key element in the list d) Count the number of nodes in the list
5.	Write C++ programs to implement the following using a singly linked list. Stack ADT b) Queue ADT
6.	Write C++ programs to implement the deque (double-ended queue) ADT using a doubly linked list and an array.

7.	Write a C++ program to perform the following operations: a) Insert an element into a binary search tree. b) Delete an element from a binary search tree. c) Search for a key element in a binary search tree.
8.	Write C++ programs for implementing the following sorting methods: Merge sort b) Heap sort
9.	Write C++ programs that use recursive functions to traverse the given binary tree in a) Preorder b) inorder, and c) postorder.
10.	Write a C++ program to perform the following operations a) Insertion into a B-tree b) Deletion from a B-tree
11.	Write a C++ program to perform the following operations a)Insertion into an AVL-tree b) Deletion from an AVL-tree
12.	Write a C++ program to implement all the functions of a dictionary (ADT)

I. COURSE OUTCOMES

CO1	The ability to identify the appropriate data structure for a given problem
CO2	implement various kinds of searching and sorting techniques.
CO3	A graduate able to design and analyse the time and space complexity of an algorithm or program.
CO4	Implement data structures such as stacks, queues and Search treesto solve various computing problems.

II. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	1	1	2								2			
CO2	2	2	1	1	2								1			
CO3	3	3	1	1	2								1			
CO4	3	2	1	1	2								1			

III. Assessment Details (CIE & SEE)

General Rules: Refer to - Academic regulations.

Continuous Internal Evaluation (CIE):
Refer to – Annexure, SL #4

Semester End Examination (SEE):
Refer to – Annexure, SL #4

IV. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
01	Data Structures, Algorithms and Applications in C++	S.Sahni,	2nd edition,	University Press (India) Pvt.Ltd,, Universities Press Orient Longman Pvt. Ltd.
02	Data structures and Algorithms in C++	Michael T.Goodrich, R.Tamassia and .Mount,	Wiley; 2nd edition (18 March 2011); 01149344934	John Wiley and Sons.

VII(b): Reference Books:				
01	Data structures using C and C++	Langsam, Augenstein and Tanenbaum	2nd edition (1 January 2015)	Pearson Education India;

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106106127
- https://nptel.ac.in/courses/106102064
- https://nptel.ac.in/courses/106106133

VIII: Activity Based Learning / Practical Based Learning/Experiential Learning:

Conduct Different Types of Programs and Mini-Projects.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	V	**Course Type:**	AEC		
Course Title: FPGA Based System design Lab Using Verilog					
Course Code:	**23ECAE52**			**Credits:**	01
Teaching Hours/Week (L:T:P:O)			0:0:2:0	**Total Hours:**	02 hrs / Week
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Practical			**Exam Hours:**	03

I. Course Objectives:

- Understand FPGA Design flow for VLSI Chip Design
- Understand the concept of Design and implementation of Advanced Digital System Design
- Learning the Implementation of advanced digital circuits on FPGA boards

II. Teaching-Learning Process :

1. Chalk and Board
2. Presentation of concepts
3. Videos and online material.

III. PRACTICAL PART

Sl. No.	Experiments / Programs / Problems
1.	Write a Verilog description for the following combinational logic, Verify the design using Verilog test bench and perform the synthesis by downloading the design on to FPGA device. a. Structural modelling of Full adder using two half adders and or Gate b. BCD to Excess-3 code converter
2.	Write a Verilog description for the following Sequential Circuits, Verify the design using Verilog test bench and perform the synthesis by downloading the design on to FPGA device. a. Mod-N counter b. Random sequence counter
3.	Write a Verilog description for the following Sequential Circuits, Verify the design using Verilog test bench and perform the synthesis by downloading the design on to FPGA device. a. SISO and PISO shift register b. Ring counter

4.	Write a Verilog description for the following Digital Circuits, Verify the functionality using Verilog test bench and perform the synthesis by downloading the design on to FPGA device. a.4-Bit Ripple Carry Adder b. 4-Bit Linear Feedback shift register
5.	Write a Verilog description for the following Digital Circuits, Verify the functionality using Verilog test bench and perform the synthesis by downloading the design on to FPGA device. a. 4-bitArray Multiplication b. 4-bit Booth Multiplication
6.	Write a Verilog description to design a clock divider circuit that generates 1/2, 1/3rd and 1/4thclock from a given input clock. Port the design to FPGA and validate the functionality using output device.
7.	Interface a Stepper motor to FPGA and write a Verilog description to control Stepper motor rotation.
8.	Interface a DAC to FPGA and Write a Verilog description to generate Square wave of frequency F KHz. Modify the code to down sample the frequency to F/2 KHz. Display the original and Down sampled signals by connecting them to an output device.

Instructions for conduction of practical part:
Verilog Program can be compile using any compiler, Verifying the functionality using suitable simulator. Download the programs on FPGA boards and Verify the Functionality

IV.COURSE OUTCOMES

CO1	Familiarize with the EDA tool to write HDL programs to understand simulation and synthesis of digital design.
CO2	Design, Simulation and Synthesis of Sequential and Combinational circuits using EDA tool
CO3	Interfacing DAC to FPGA device to generate different waveforms using Verilog HDL.
CO4	Interfacing Stepper motor to FPGA device to count the number of rotations of a stepper motor.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	2	2	2								2	2		
CO2	3	2	2	2	2								2	2		
CO3	3	2	2	2	2								2	2		
CO4	3	2	2	2	2								2	2		

VI. Assessment Details (CIE & SEE)

General Rules:
Refer to Academic regulations

Continuous Internal Evaluation (CIE):
Refer to Annexure, SL #4

Semester End Examination (SEE):
Refer to Annexure, SL #4

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	"Verilog HDL : A guide to digital design and synthesis"	SamirPalnitkar	II Edition.	Pearson Education
2.	"The Verilog hardware description Language",	Donald E Thomas, Philip R Moorby	5th Edition	Springer Science Business Media , LLC,

VII(b): Reference Books:

1.	"Advanced digital design with the Verilog HDL"	Michael D. Ciletti	II Edition	Pearson (PHI)
2.	"Design through Verilog HDL",	Padmanabhan, Tripura Sunadri,	2016	Wiley

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=XUISWiRW3A&list=PLrCDCmjBc7kCz5weAqGhVR-0F-XEQUt4X&index=2
- https://www.youtube.com/watch?v=f2VYQ0rmHYw
- https://www.youtube.com/watch?v=GuoW-PSpjas
- https://www.youtube.com/watch?v=meSn0UXmgac

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Mini Projects, Self-Study Activities, Group Discussions

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Department of Electronics and Communication Engineering

Semester:	**V**	**Course Type:**	**AEC**		
Course Title: Data Acquisition using Labview					
Course Code:	**23ECAE53**			**Credits:**	**01**
Teaching Hours/Week (L: T:P:O)			**0:0:2:0**	**Total Hours:**	**02 hrs / Week**
CIE Marks:	**50**	**SEE Marks:**	50	**Total Marks:**	**100**
SEE Type:	**Practical**			**Exam Hours:**	**03**

I. Course Objectives:

1. To impart basic understanding knowledge of LabVIEW components and various Controls palettes in the front panel and Summarize Functions palettes to manipulate nodes and wires in the block diagram.
2. To equip students to demonstrate the various toolbars from the pull- down menus for the purpose of implementing different applications
3. To impart students to Discover and utilize the context help window for using Functions and Controls in LabVIEW.
4. To provide practical exposure to learn the relationship between LabVIEW and plug-in devices for different applications using run on Virtual Instrument (VI) using LabVIEW
5. To develop the solution for the given problem and prepare the report for the particular real-time applications

II. Teaching-Learning Process:

1. Demonstration
2. Presentation
3. Videos and online material.

III. PRACTICAL PART

Sl. No.	Experiments / Programs / Problems
1	Develop a Data acquisition using LabVIEW for temperature measurement with thermocouple.
2	Develop a Data acquisition using LabVIEW for temperature measurement with AD590.
3	Develop a Data acquisition using LabVIEW for temperature measurement with RTD
4	Develop a Data acquisition using LabVIEW for temperature measurement with thermistor

5	Creation of a CRO using LabVIEW and measurement of frequency and amplitude from external source.
6	Create function generator using LabVIEW and display the amplitude and frequency on CRO (externally connected)
7	Demonstrate amplitude modulation considering modulation and carrier wave from external source.
8	Interface LEDs to DAQ output and implement counter.
9	Data acquisition using LabVIEW for load / strain measurement using suitable transducers.
10	Demonstrate binary to grey code converter (& vice versa) using DAQ card.
11	Data acquisition using LabVIEW for distance/humidity measurement using suitable transducers.
12	Reading audio input with Microphones and output using DAQ card.

Instructions for conduction of practical part:

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course.
- The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

IV. COURSE OUTCOMES

CO1	Describe the structured Lab VIEW programming concepts in developing Virtual Instruments
CO2	Apply the LabVIEW programming which employs simulating and visualizing the data for real-time automation
CO3	Analyse an application using tools available in LabVIEW for various experiments.
CO4	Design applications that use plug-in DAQ boards and built-in analysis functions to process the data.
CO5	Investigate and make an effective report based on real- time applications performed using LabVIEW

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3
CO1	3	3	2	2									3		
CO2	3	3	2	2	3								3		
CO3	3	3	3	2	3								3		
CO4	3	3	3	3	3								3		
CO5	3	3	3	3	3								3		

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #4
Rubrics: Refer to Annexure, SL #5

Semester End Examination (SEE): Refer to - Annexure, SL #4
Rubrics: Refer to - Annexure, SL #5

VII. Learning Resources

VII(a): Textbooks: (Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Virtual Instrumentation using LABVIEW	Jovitha Jerome	Second Edition, 2011.	2011
2	Virtual Instrumentation using LABVIEW	Sanjay Gupta, Joseph John,	Second Edition, 2011.	TMH, McGraw Hill,

VII(c): Web links and Video Lectures (e-Resources):

www.ni.com
https://learn.ni.com/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Mini Projects, Self-Study Activities.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	**V**	**Course Type:**	**AEC**		
Course Title: PLC & Sensorics Lab					
Course Code:	**23ECAE54**			**Credits:**	**1**
Teaching Hours/Week (L: T:P:O)			**0:0:2:0**	**Total Hours:**	**40**
CIE Marks:	**50**	**SEE Marks:**	**50**	**Total Marks:**	**100**
SEE Type:	**Practical**			**Exam Hours:**	**03**

I. Course Objectives:

This course will enable students to:

1. Understand the Characteristics of a PLC
2. Ability to develop PLC programming, ladder logic.
3. Acquire the knowledge on sensors used in automaton.
4. Learn to interface sensors and PLC to implement the real-world applications.

II. Teaching-Learning Process (General Instructions):

1. Chalk and Board
2. Presentation of concepts
3. Videos and online material.

III. COURSE CONTENT

III(A). PRACTICAL PART

Sl. No.	Experiments / Programs / Problem
1.	Draw ladder logic to implement start/stop using pushbutton concept.
2.	Draw ladder logic to implement Logic gates.
3.	Three lights L1, L2 and L3 in a room are to be turned ON/OFF based on the following. requirement – a. When no person is present in the room all the lights should be OFF b. When person A enters Switch ON L1 only. c. When person B enters Switch ON L2 and switch OFF L1. d. When Person C enters Switch ON L3, L1 and Switch OFF L2.
4.	Draw ladder logic to blink a lamp on/off for 30s.

5.	There are 3 mixing devices on a processing line A,B,C. After the process begin mixer-A is to start after 7 seconds elapse, next mixer-B is to start 3.6 second after A. Mixer-C is to start 5 seconds after B. All then remain ON until a master enable switch is turned off. Write PLC ladder diagram, timing diagram and realize the same.
6.	An indicating light is to go ON when a count reaches 23. The light is then go off when a count of 31 is reached. Design, construct, and test PLC circuits for this process.
7.	In certain process control application o/p is ON if the count is less than 34 or more than 41. Implement the same using PLC ladder diagram.`
8.	To study the characteristics of Inductive and Capacitive Sensors.
9.	To study the operating range of Indctive Sensors.
10.	To study the operating range of Capacitive Sensor.
11.	To study the Characteristics of Photoelectric Sensors (Through Beam Sensor, Retro Reflective Sensor, Direct detection Sensors)
12.	To program the Ultra Sonic Sensors for different distance conditions (a. $A_1 > A_2$, $A_1 < A_2$, $A_1 = \infty$ A2= Fixed Point, A_1 = Fixed Point A2= ∞)
13.	Write a program in PLC to count "n" number of metals and Nonmetals on the conveyor belt and segregate it by using Inductive and Capacitive sensors.

Instructions for conduction of practical part:

- On completion of every experiment/program in the laboratory, the students shall be evaluated, and marks shall be awarded on the same day. The **50 marks** are for conducting the experiment and preparation of the laboratory record, the other **50 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report.
- The laboratory test **(duration 03 hours)** at the end of the 15^{th} week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks
- Scaled-down marks of record evaluations and tests added will be CIE marks for the laboratory component of IPCC for **50 marks**

IV. COURSE OUTCOMES

CO1	Describe typical components of a Programmable Logic Controller.
CO2	Explain the basic concepts of a Programmable Logic Controller.
CO3	Analyse the characteristics and operating range of sensors
CO4	Design and program basic PLC circuits with sensors for entry-level PLC applications.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3															
CO2	3	2			3											
CO3	3	3	2	2	3								2	2		
CO4	3	3	3	3	3							2	3	2		

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations.

Continuous Internal Evaluation (CIE):

Refer Annexure - 4

Semester End Examination (SEE):

- **Refer Annexure - 4**

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Industrial Automation from scratch	Olushola Akande	2023, First Edition	Packt Publishers
2	Introduction to Industrial Automation	Stamatios Manesis George, Nikolakopoulos	2018	CRC Press

VII(b): Reference Books: (Insert or delete rows as per requirement)

1	Programmable Logic Controller	Vijay R. Jadhav	2017	Khanna Publishers
2	Industrial Automation and Process Control	Jon Stenerson	2003	PHI learning

VII(c): Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108105063
- https://archive.nptel.ac.in/courses/108/108/108108147/
- https://www.youtube.com/watch?v=IAqGCBCkurE
- https://www.youtube.com/watch?v=qaI48NCUvkA

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Interfacing of sensors and PLC and implement real world applications.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	V	**Course Type:**	NCMC		
Course Title: Physical Education –Sports and Athletics					
Course Code:	**23PASN01**			**Credits:**	00
Teaching Hours/Week (L: T: P: O)		0:0:0:2		**Total Hours:**	25 Hrs
CIE Marks:	50			**Total Marks:**	50

I. Course Objectives:

- To Improve the student's Physical and mental health.
- Understand the meaning, Importance and benefits of the fitness.
- To create awareness of fitness among the student's.

II. Teaching-Learning Process (General Instructions):

- Use lectures and demonstrations to introduce new concepts, techniques, and rules. this is especially important for explaining complex skills or strategies.
- Show correct techniques and movements for sports skills and exercises. allow students to observe and practice.
- Engage students through hands-on activities and drills. This includes practicing sports skills, participating in games, and performing fitness exercises.

III. COURSE CONTENT

Module-1:Sports Ethics	**5 Hrs**
A. Ethics in Sports	
RBT Levels: L2 & L3	
Module-2 :Specific GamesCourt Measurements	**5 Hrs**
A. Volley ball B. Throw ball C. Kabaddi	
RBT Levels:L1, L2 & L3	
Module-3: Athletics	**5 Hrs**
About Track Events	
RBT Levels: L2 & L3	
Module-4: Specific Games (Any one to be selected by the student)	**5 Hrs**
A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Throw ball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.	
Module-5: Role of Organisation and administration	**5 Hrs**
A. Organization and administration of Sports and Games.	

IV. COURSE OUTCOMES

CO1	Understand the basic principles and practices of physical Education and sports.
CO2	To develop the Physical Activities and sports practices for Healthy Living.
CO3	To develop sportsmanship among students to conduct, organize and officiate Physical Education and sports events at Colleges and community level.
CO4	To provide experiential learning insports & games
CO5	Understand to organise the sports & games

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1						2		2	3			
CO2						2		2	3			1
CO3						2		2	3			
CO4						2		2	3			1
CO5						2		2	3			

VI. Assessment Details (CIE)

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure section -8***

VII. Learning Resources

VII(a): Reference Books:

Sl. No.	Title of the Book	Name of the author	Name of the publisher	Edition and Year
1.	Health , Exercise and Fitness	Muller, J P	Delhi,Sports	2000
2.	Play Field Manual	Anaika	Friends Publication Delhi	2005
3	Track and field Marking and Athletics Officiating Manual	M J Vishwanath	Silver Star Shimoga	2002
4.	Complete conditioning for Volleyball	Steve Oldenburg	Human Kinetics	2015
5	IAAF Manual			

VII(b). Web links and Video Lectures (e-Resources):

- https://www.caluniv.ac.in/cbcs-ug/ug-files/UG-Physical-Edu.pdf
- https://books.google.co.in/books/about/Athlete_s_Guide_to_Career_Planning.html?id=lUp5QgAACAAJ&redir_esc=y
- https://www.youtube.com/watch?v=dczxtSt1Kjk
- https://youtube.com/watch?v=TXGejZBgNeo

VIII. Activity Based Learning

Participation, Quiz, Presentation, Assignments &Models .

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Semester:	**V**	**Course Type:**	**NCMC**		
Course Title: Yoga					
Course Code:	**23YOGN02**		**Credits :**		**0**
Teaching Hours / Week(L:T:P:O)			**0:0:0:2**	**Total Hours:**	**25 Hrs**
CIE Marks:	**50**		**Total Marks:**		**50**

I. Course Objectives:

This course will enable students to:

- To enable the student to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To integrate moral values.
- To attain higher level of consciousness.
- Enable students to do regular practice

II. Teaching-Learning Process(General Instructions):

- **Demonstration**
- **PPT**
- **Expert Discourse**

III.COURSE CONTENT

Module-1:Ashtanga Yoga by Patanjali Maharshi — **5 Hrs**

- Importance of Ashtanga Yoga,
- focusing on Asana, Pranayama, and Pratyahara.

Pre-requisites: Understanding of Ashtanga Yoga basics from Semester IV.

RBT Levels:L1, L2

Module-2: Detailed Asana Study — **5 Hrs**

- Asana analysis: meaning, technique, precautions, and benefits.

Pre-requisites: Completion of Module 1.

RBT Levels: L1,L2

Module-3: Asana Practice — **5 Hrs**

- **Sitting:** Ardha Ushtrasana, Vakrasana, Yogamudra in Padmasana.
- **Standing:** Urdhva Hastothanasana, Hastapadasana, ParivrittaTrikonasana, Utkatasana.
- **Prone:** Padangushtha Dhanurasana, Poorna Bhujangasana/Rajakapotasana.
- **Supine:** Sarvangasana, Chakrasana, Navasana/Noukasana, Pavanamuktasana.

Pre-requisites: Completion of Module 2.

RBT Levels: L1,L2, L3

Module-4: Pranayama Practice	**5 Hrs**

- Revision: 60 strokes/min, 3 rounds.
- Pranayama types: Ujjayi, Sheetali, Sheektari.

Pre-requisites: Completion of Module 3.

RBT Levels: L1,L2, L3

Module-5: Practical Integration	**5 Hrs**

- Completion of Modules 1-4.

Pre-requisites: Practicals

RBT Levels: L1,L2, L3

IV.COURSE OUTCOMES

CO1	Demonstrate a basic understanding of yoga philosophy, including the eight limbs of yoga (Ashtanga Yoga).
CO2	Develop an understanding of how yoga can improve posture and body awareness..
CO3	Apply breathwork techniques (pranayama) to manage stress and anxiety.

V. CO-PO-PSO MAPPING(mark H=3;M=2;L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3
CO1	-	-	-	-	-	1	2	3	2	1	2	3	-	-	3
CO2	-	-	-	-	-	1	2	3	2	1	2	3	-	-	3
CO3	-	-	-	-	-	1	2	3	2	1	2	3	-	-	3

VI. Assessment Details (CIE)

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure -8***

VII. Learning Resources

VII (a). Reference Books :

1. **Yoga pravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr.M L Gharote & Dr. SK Ganguly**
4. **Yoga Instructor Course handbook published by SVYASA University, Bengaluru**
5. **Yoga for Children –step by step–by Yamini Muthanna**

VII(b):Web links and Video Lectures(e-Resources):

1. **https://youtu.be/KB-TYlgd1wE**
2. **https://youtu.be/aa-TG0Wg1Ls**

VIII: ActivityBasedLearning/PracticalBasedLearning/Experientiallearning:

Seminar,Assignments,Quiz,casestudies,self-studyactivities,groupdiscussions

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Semester:	V	Course Type:	NCMC
Course Title: NSS-National Service Scheme			
Course Code:	23NSSN03	Credits:	0
Teaching Hours/Week (L: T: P: O)	0:0:0:2	Total Hours:	25 Hrs
CIE Marks:	50	Total Marks:	50

I. Course Objectives:

National Service Scheme (NSS) will enable the students to:

- Identify the needs and problems of the community and involve the minproblem–solving.
- Develop among them a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course out comes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted, so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in society and provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning activities and documenting student's progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

III. COURSE CONTENT

Module-1:Environment Enrichment Programmes	5 Hrs

1. Plantation of trees and their preservation.
2. Creation of NSS gardens and Cleaning of village ponds and wells.
3. Awareness of Gobar Gas Plants and disposal of garbage & composting.

Module-2: Environment Conservation Programmes	5 Hrs

1. Prevention of soil erosion and work for soil conservation.
2. Watershed management and wasteland development.
3. Creation of consciousness about the preservation of cultural heritage among the community.

Module-3: Women's awareness Programmes	**5 Hrs**
1. Programmes of educating people and making them aware of women's rights, both constitutional and legal. 2. Creating consciousness among women that they too contributed to economic and social well-being of the community.	
Module-4: Hazardous materials Awareness Programmes	**5 Hrs**
1. Plastic Awareness and Cleaning programmes. 2. Rally programmes. 3. Community service Programmes.	
Module-5: General NSS Programmes	**5 Hrs**
1. Orientation Programmes. 2. Free computer training program for Govt. School Students. 3. Debate, Essay Writing, Pick and Speech and Cross Word Competitions, etc., conducting on occasions of State and National importance.	

IV. COURSE OUTCOMES

CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and propose practical solutions for the same for sustainable development.
CO4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1						2		1	1			
CO2						1		1	1			1
CO3						2		1	1			
CO4						2		1	1			1

VI. Formative Assessment Details (CIE)

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure section -8***

VII Learning Resources

VII (a). Reference Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

VIII. Activity Based Learning

Participation, Execution of Activities, Presentation, Assignments & Models.

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Semester:	**V**	**Course Type:**	**NCMC**		
Course Title: NCC-National Cadet Corps					
Course Code:	**23NCCN04**	**Credits:**			**0**
Teaching Hours/Week (L: T: P: O)		**0:0:0:2**	**Total Hours:**		**25 Hrs**
CIE Marks:	**50**		**Total Marks:**		**50**

I. Course Objectives:

- To develop qualities of Character, Courage, Comradeship, Discipline, Leadership, Secular Outlook, Spirit of Adventure and Sportsmanship, besides the ideals of Selfless Service among the youth to make them useful citizens.
- Emphasize on practical training with examples from India's freedom struggle and wars fought by India, post-independence, supplement relevant subjects to generate secular and patriotic fervor.
- To create human resources of organized, trained and motivated youth, provide leadership in all walks of life including the Armed Forces and always be available for the service of the Nation.
- The prime objective of NCC course is to build a strong youth force that aims at 'Nation Building'.

II. Teaching-Learning Process (General Instructions):

1. In addition to the traditional lecture method, with the aim to nurture core values, develop self-confidence, enhance awareness, leadership qualities and give exposure to basic military skills and knowledge.
2. Institutional training is imparted by regular NCC parades in college before/after teaching hours.
3. Grading assignments and quizzes and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.

III. COURSE CONTENT

Module-1:Personality Development - I	5 Hrs
Carrier Counselling, SSB procedure and Interview Skills **Textbook:1Chapter:4**	
RBT Levels:L2	
Module-2:Drill with Arms	5 Hrs
Words of command, Open Drill, Closed Drills, Getting on Parade with Rifle and Dressing at the Order, Ground and Take up Arms, Saluting, Saluting at the Shoulder at the Halt and on the March. **Textbook:1 Chapter:3 (a), Section: 1-9**	
RBT Levels: L1, L2	
Module-3:Ceremonial Drill	5 Hrs
Gard Mounting, Guard of honour, Salutes, Salami Shastra and General Salute **Textbook:2Unit:1, Section: 1-7, Unit: 2, Section: 1-3, Unit: 3, Section: 1-2, 8-10.**	
RBT Levels:L1, L2	

Module-4: Disaster Management	5 Hrs
Civil Defence Organisation & its Duties, Types of Emergencies /Natural Disasters, Disaster Management during Flood/Cyclone/Earth Quake, Setting up Relief Camp during Disaster Management. **Textbook:1 Chapter:2, Section: 1-4**	
RBT Levels: L2, L3	
Module-5:Fire Services	5 Hrs
Fire Fighting, Essential Services and their Maintenance, Fire Protection, Fire Fighting Equipments, Role of NCC during Natural Hazards **Textbook:1 Chapter:2, Section: 1-4**	
RBT Levels: L2, L3	

IV. COURSE OUTCOMES

CO1	Understand qualities Character, Comradeship, Discipline, Ethics and Ideals of Selfless Service in developing individual as a Leader.
CO2	Understand the essence of implementing drills with arms as the foundation for physical and mental fitness.
CO3	Acquire an insight into lifestyle of armed forces and Conventional Signs, Field Craft and Battle Craft involved in using them in defence forces.
CO4	Understand individual responsibility in Disaster Management and equipped themselves to provide solutions.
CO5	Develop awareness on issues related to conservation of Environment, Social and Community development.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1								3	3	2		1
CO2									3	2		1
CO3	3	2	1		1	1			2	2		1
CO4	3	1	1			1	1		2	2		1
CO5	3	1	1			1	1		2	2		1

VI. Formative Assessment Details (CIE)

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure -8***

VII. Learning Resources

VII (a). Textbooks:

1. Cadet's Handbook-Common subject for all wings, NCC Directorate, Bhubaneswar.
2. National Cadet Corps, Head Quarters DG NCC, Delhi.
3. NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations, R Gupta, Ramesh Publishing House, 2020.

VII (b). Web links (e-Resources):

1. https://indiancc.mygov.in/

VIII . Activity Based Learning

Drills, Assignments, Quiz, Presentation.

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Semester:	V	**Course Type:**	NCMC		
Course Title: Indian Knowledge System					
Course Code:	**23IKSN05**	**Credits:**		0	
Teaching Hours/Week (L: T: P: O)		0:0:0:2	**Total Hours:**	25 Hrs	
CIE Marks:	50		**Total Marks:**	50	

I. Course Objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

II. Teaching-Learning Process (General Instructions):

1. In addition to the traditional lecture method, innovative teaching methods shall be adopted.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Grading assignments and quizzes and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.

III. COURSE CONTENT

Module-1: Co-ordinate Systems	**5 Hrs**
Celestial Sphere and Co-ordinate Systems, Time in Indian Astronomy. **Textbook : 2, Chapter: 3 & 5**	
RBT Levels: L1, L2	
Module-2: Calendrical systems.	**5 Hrs**
Gregorian calendar, Solar calendar, Luni-solar calendar **Textbook : 2, Chapter: 7**	
RBT Levels: L1, L2	
Module-3 : Mean Positions of Sun, Moon, Planets	**5 Hrs**
Ahargana and Mean Longitudes of the Sun, Moon and Planets. **Textbook :2 Chapter: 8 & 9**	
RBT Levels: L1, L2	

Module-4 : True Positions of Sun, Moon	**5 Hrs**
Epicyclic theory, Equation of Centre **Textbook :2 Chapter: 10.**	
RBT Levels:L1, L2	
Module-5 :Lunar Eclipse	**5 Hrs**
Cause of Lunar eclipse, Angular diameter of shadow cone. **Textbook :2 Chapter: 13**	
RBT Levels:L1, L2	

IV. COURSE OUTCOMES

CO1	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2	Appreciate the need and importance of protecting traditional knowledge.
CO3	Recognize the relevance of Traditional knowledge in different domains.
CO4	Establish the significance of Indian Knowledge systems in the contemporary world.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	
CO1	2							3				1	
CO2						2							
CO3			2	2									
CO4						3	2						

VI. **Formative Assessment Details (CIE)**

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure -8***

VII .Learning Resources

VII (a). Textbooks:

Sl. No.	**Title of the Book**	**Name of the author**	**Name of the publisher**	**Edition and Year**
1	Indian Mathematics and Astronomy	Dr.Balachandra Rao,	Jnanadeep	revised 3rd Edn 2014
2	Indian Astronomy : Concepts and Procedures	Dr.Balachandra Rao,	M P Birla Institute of Management	2014

VII (b) : Reference Book:				
3	Eclipses in Indian Astronomy	Dr.Balachandra Rao, Dr.Padmaja Venugopal	Gandhi Centre	2008
4	Transits and Occultations in Indian Astronomy	Dr.Balachandra Rao, Dr.Padmaja Venugopal	Bhavan's Gandhi Centre of Science and Human Values	2009
5	Hindu Mathematics and Astronomy	Datta B B and Singh A N	Asia Publishing House	1962
VII (c). Web links and Video Lectures (e-Resources):				
1. https://www.bvbgandhicentre.org/bookstore/sku/indian-mathematic 2. https://www.bvbgandhicentre.org/bookstore/sku/eclipses 3. https://www.bvbgandhicentre.org/bookstore/sku/transit 4. https://www.youtube.com/results?search_query 5. https://www.youtube.com/results?search_query				
VIII. Activity Based Learning				
Assignments, Quiz, Presentation.				

6th Semester Syllabus

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Autonomous Scheme of Teaching & Examinations (ST&E) (Tentative) UG - BE 3rd Year ECE

SCHEME: 2023 SEM:VI Revision date: 22/04/2025

S. #	Course Type	Course type Series	Course Code	Course Title	Teaching Dept.	QP setting dept	Credits	Teaching Hrs/Week				Examinations				
								L	T	P	O		SEE (Dur. & Marks)			
								Lecture	Tutorial	Practical	PBL/ABL / SL/etc.	CIE Marks	Dur.	Th.	Lab	Tot.
1	PCC	4	23ECT601	VLSI Design & Testing	ECE	ECE	**3**	3	0	0	@	50	03	50	-	100
2	IPCC	7	23ECI602	Microwave & Antennas	ECE	ECE	**4**	3	0	2	@	50	03	50	-	100
3	PCCL	4	23ECL603	VLSI Design & Testing Lab	ECE	ECE	**1**	0	0	2		50	03	-	50	100
4	PEC	2	23ECP62y	Professional Elective Course - 2	ECE	ECE	**3**	3	0	0		50	03	50	-	100
5	OEC	1	23ECO61y	Open Elective Course - 1	Any dept.	Any dept.	**3**	3	0	0		50	03	50	-	100
6	ETC	4	23ECE64y	Emerging Technology Course - 4	ECE	ECE	**3**	3	0	0	@	50	03	50	-	100
7	AEC	6	23RMAE61	Research Methodology & IPR	ECE	ECE	**3**	3	0	0	@	50	03	50	-	100
8	PRJ	1	23ECPRJ1	Major Project - Phase I	ECE	ECE	**2**	0	0	4	@	50	03	-	50	100
9	HSMC	7	23SCRH08	Social Connect & Responsibility	Any dept	Any dept	**1**	1	0	0	@	50	-	-	-	50
10	NCMC	4	23PASN01	Physical Education - Sports and Athletics	PED	PED	**PP / NP**	-	-	-	2	50	-	-	-	50
			23YOGN02	Yoga	PED	PED										
			23NSSN03	NSS - National Service Scheme	NSS	NSS										
			23NCCN04	NCC - National Cadet Corps	NCC	NCC										
			23IKSN05	Indian Knowledge System	HSS	HSS										
Total							**23**	**19**	**0**	**8**	**2**	**500**		**300**	**100**	**900**

PCC: Professional Course; IPCC: Integrated Professional Core Course; PCCL: Professional Core Course Laboratory; PEC: Professional Elective Course; OEC: Open Elective Course;
HSMC: Humanities, Social Sciences & Management Course; AEC: Ability Enhancement Course; NCMC: Non Credit Mandatory Course; PRJ: Project work.
{@ - Compulsory one activity during the semester};
{I.E.-Industry Experts};
PBL: project Based learning; ABL: Activity Based Learning; SL: Self-Learning

Open Elective Courses (OEC):
1) Open Electives listed here are to offer for other department students.
2) Students shall select open elective courses offered from other departments, separate consolidated list of courses offered from various departments will be published time to time.

ETC (Emerging Technology Course):
For ETC (L:T:P:O) can be planned by the depts considering practicality & possibility of conduction, same shall be indicated along with course title in the list, if altered than above. If planned altering the prescription, the same shall be approved at the department BOS & authorities. Atleast one activity is mandatory during the delivery of the course. The guidelines is applicable to all the semesters III to VI semesters (ETC-1 to ETC-4).

NCMC (Non Credit Mandatory Course) for course type series-4: Refer to guidelines in III SEM.

Professional Elective Course – 2 (23ECP62y)		**Open Elective Course - 1 (23ECO61y)**		**Emerging Technology Course - 4 (23ECE64y)**	
Course Code	**Course Title**	**Course Code**	**Course Title**	**Course Code**	**Course Title**
23ECP621	Satellite Communication	23ECO611	Electronic Communication Systems	23ECE641	Robotics and Its Applications
23ECP622	DSP Algorithm and Architecture	23ECO612	Basic VLSI Design	23ECE642	Natural Language Processing
23ECP623	Hardware Software Co-Design	23ECO613	Consumer Electronics	23ECE643	Principles of Machine Learning
23ECP624	Digital Image Processing	23ECO614	Digital System Design using Verilog	23ECE644	Nano Technology for Engineers

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	PCC		
Course Title: VLSI Design & Testing					
Course Code:	**23ECT601**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03 hrs

I. Course Objectives:

- Impart knowledge of MOS transistor theory and CMOS technology
- Emphasizes on basic theory of digital circuits, design principles and techniques for digital design blocks implemented in CMOS technology.
- Understand switching characteristics of digital circuits along with delay and power estimation.
- Infer the operation of Semiconductor memory circuits.
- Explore the knowledge of VLSI fault modelling and Testing

II. Teaching-Learning Process :

- Chalk and talk.
- Power point presentation.
- Hands-On Simulations using software tools (Cadence, Synopsys, Mentor Graphics) for circuit design and testing.
- Project Based Learning.

III. COURSE CONTENT

Module-1: MOS Transistor Theory — 8Hrs

Introduction: A Brief History, MOS Transistors, CMOS Logic: Inverter, NAND gate, CMOS Logic gate, NOR gate, Compound gates, pass transistors and transmission gates, tristate, multiplexer, Sequential circuits.
MOS Transistor Theory: Introduction, Long-channel I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics
Textbook 1: Chapter 1: sections 1.1 to 1.4
Chapter 2: sections 2.1, 2.2, 2.4 and 2.5.

Pre-requisites: Basic operation of FET, Basic gates.

RBT Levels: L1, L2

Module-2: CMOS Process Technology & Delay — 8Hrs

CMOS Process Technology: Silicon Semiconductor Technology, CMOS Technologies, Layout Design Rules.
Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths
Textbook 1: Chapter 3: sections: 3.1,3.2,3.3**, Chapter 4: sections**: 4.1, 4.2, 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.6, 4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.5.1, 4.5.2, 4.5.3, 4.5.4

Pre-requisites: Basic operation of FET

RBT Levels: L1, L2, L3

Module-3: Semiconductor Memories.	8Hrs
Semiconductor Memories: Introduction, Dynamic Random-Access Memory (DRAM) and Static Random-Access Memory (SRAM), Non-volatile Memory, Flash Memory. **Textbook 3: Chapter 10: sections**:10.1 to 10.5.	
Pre-requisites : Basic knowledge of Memory.	
RBT Levels: L1, L2, L3	
Module-4: CMOS Circuit and Logic Design.	8Hrs
CMOS Circuit and Logic Design: Introduction, CMOS Logic structures, CMOS Complementary logic, Pseudo n-MOS logic, Dynamic CMOS logic, Clocked CMOS Logic, Pass transistor Logic, CMOS Domino logic, Cascade Voltage Switch logic, Input output Pads. **Textbook 2: Chapter 5: sections** :5.1,5.4.1,5.4.3,5.4.4, 5.4.5, 5.4.6, 5.4.7,5.4.9, 5.6.3,5.6.4.	
Pre-requisites: Basic operation of FET	
RBT Levels: L1, L2, L3	
Module-5: Sequential MOS Logic Circuits & CMOS Testing	8Hrs
Sequential MOS Logic Circuits: Introduction, Behaviour of Bistable Elements (Excluding Mathematical analysis) SR Latch Circuit, Clocked Latch and Flip-Flop Circuits: Clocked SR Latch, Clocked JK Latch. **CMOS Testing:** Need for testing, Fault models, Observability, Controllability, Fault coverage, ATPG, Design for Testability, Ad-Hoc Testing. **Textbook 3: Chapter 8: sections:** 8.1, 8.2, 8.3, 8.4. **Textbook 2: Chapter 7: sections:** 7.1, 7.2.1, 7.2.2,7.2.3, 7.2.4, 7.2.5, 7.3.1, 7.3.2.	
Self learning: Scan Design, Built In Self Test(BIST)	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Acquire knowledge of MOS transistor theory, CMOS fabrication flow and technology scaling.
CO2	Construct the basic gates using the stick and layout diagram with the knowledge of physical design Aspects.
CO3	Interpret memory elements along with timing considerations
CO4	Design and realize combinational digital circuits in CMOS logic
CO5	Analyse the Sequential MOS Logic Circuits and its Testing.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2	1										2	1	1	
CO2	2	2	1										2	1	1	
CO3	3	3	2	2	2								2	1	1	
CO4	3	3	2	2	2								2	1	1	
CO5	3	3	2	2	2								2	1	1	

VI. Assessment Details (CIE & SEE)

General Rules:

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to - Annexure, SL #1
Rubrics: Refer to - Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	CMOS VLSI Design: A Circuits and Systems	Neil H E Weste, and David Money Harris	4th Edition,	Pearson Education.
2	Principles of CMOS VLSI Design: A System perspective.	Neil H E Weste and Kamran Eshraghain.	2nd Edition	Pearson Education.
3	CMOS Digital Integrated Circuits: Analysis and Design	Sung Mo Kang & Yosuf Leblebici	3rd Edition	Tata McGraw-Hill.

VII(b): Reference Books:

1	Digital Circuit Testing and Testability	Lala Parag K,	1997	New York Academic Press
2	Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits	M. Bushnell and V. D. Agrawal,	2005	Kluwer Academic Publishers

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=oL8SKNxEaHs&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM
- https://www.youtube.com/watch?v=lRpt1fCHd8Y&list=PLCmoXVuSEVHlEJi3SwdyJ4EICffuyqpjk
- https://www.youtube.com/watch?v=yLqLD8Y4-Qc

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Mini projects, Seminar, Assignments, Quiz.

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Department of Electronics & Communication Engineering

Semester:	**VI**	**Course Type:**	**IPCC**		
Course Title: Microwave & Antennas					
Course Code:	**23ECI602**			**Credits:**	**04**
Teaching Hours/Week (L:T:P:O)			**3:0:2:@**	**Total Hours:**	**40 Hr. Theory + 8 Lab Hr.**
CIE Marks:	**50**	**SEE Marks:**	**50**	**Total Marks:**	**100**
SEE Type:	**Theory**			**Exam Hours:**	**03**

I. Course Objectives:

This course will enable students to:
1. Describe the microwave properties and its transmission media.
2. 2. Describe the microwave devices for several applications.
3. Understand the basic concepts of antenna theory.
4. Identify antenna types for specific applications.

II. Teaching-Learning Process :

1. Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize & analyse information rather than simply recall it.
2. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
3. Use videos for demonstration of the fundamental principles to students for better understanding of concepts.
4. Demonstrate microwave devices and Antennas in the lab environment where students can study them in real time.

III. COURSE CONTENT

III(a). Theory PART

Module-1: Microwave Sources & Microwave transmission lines — 08 Hrs

Microwave Sources: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modes of Oscillations, Mode Curve (Qualitative Analysis only).
Microwave transmission lines: Microwave frequencies, Microwave devices, Microwave systems. Transmission line equations and solutions, Reflection Coefficient and Transmission Coefficient. Standing wave and standing wave ratio. Smith chart -Determination of K, VSWR
Text 1: Chapter 9: section: 9.1, 9.2.1-a,b,d and Text 2:Chapter 0: section: 0.1, 0.2, 0.3,Chapter 3: section: 3.1, 3.2, 3.3, 3.5

Pre-requisites: Frequency spectrum**,** Waveguide concepts
Self Learning: Gunn diode and its analysis, Single and double stub matching

RBT Levels : L1, L2, L3

Module-2: Microwave Network Theory & passive devices	08 Hrs
Microwave Network Theory: Introduction, S matrix representation of multi-port networks , Properties of S-Parameters. **Microwave passive devices**: Coaxial cables, connectors and Adapters, Directional coupler-Wave guide (only qualitative analysis), power divider, ring resonator, Attenuators-Precision Variable Attenuator, waveguide Tees- E-Plane & H-plane Tees , Magic Tee. Text 1: chapter 6: section:6.1, 6.3, 6.3.1, 6.4.1, 6.4.2, 6.4.18, 6.4.19, 7.10.4, 6.4.14, 6.4.16	
Pre-requisites: Two port networks **Self Learning:** Phase shifters-Dielectric Phase Shifters & Precision Dielectric Rotary Phase Shifter, circulator	
RBT Levels:L1, L2, L3	
Module-3: Strip Lines & Antenna Basics	08 Hrs
Strip Lines: Microstrip lines- Characteristic Impedance of Microstrip Lines, Losses in microstrip Lines, Parallel Strip lines **Antenna Basics**: Introduction, Radiation Patterns, Radiation Power Density, Radiation Intensity, Beam Area, Beam efficiency, Directivity, Gain, Antenna Efficiency, Antenna Aperture, Effective height, Bandwidth, Radio communication Link, Antenna Field Zones Text 2:chapter 11: section: 11.0,11.1 a,b &11.2 a,b and Text 3: chapter 2: section: 2.1-2.7, 2.9-2.11, 2.13.	
Pre-requisites: Maxwells equations, spherical coordinate system analysis **Self Learning:** Parallel strip lines, coplanar strip lines, Polarization of an antenna, Antenna Temparature	
RBT Levels:L1, L2, L3	
Module-4: Arrays & Electric Dipole	08 Hrs
Arrays: Power theorem, Arrays of Two isotropic point sources(with equal amplitude and phase, equal amplitude but opposite phase) , Pattern multiplication, Linear arrays of n Isotropic sources of equal amplitude and Spacing-Broadside and end fire array. **Electric Dipole**: Introduction, Short Electric dipole, Fields of a short dipole. Radiation resistance of a short dipole. Thin linear antenna field analysis & Radiation resistance. Text 3:chapter 5: section:5.1-5.6, 5.9, 5.13, chapter 6: section: 6.1-6.5, chapter 7: section: 7.2,7.4	
Pre-requisites: Maxwells equations, spherical coordinate system analysis **Self Learning:** Arrays of Two isotropic point sources with same amplitude and quadrature in phase, end fire array with increased directivity.	
RBT Levels: L1, L2, L3	
Module-5: Antenna Types	08 Hrs
Antenna Types: Small loop antenna- far fields, Radiation resistance of small loop antenna, Rectangular Horn Antenna, Helical Antenna- geometry, design considerations, Yagi Uda array, Parabolic Reflector, Microstrip patch antenna. Text 3:chapter 7: section 7.2, 7.4, 7.6, 7.7, 7.8, 7.19, 7.20chapter 8: section 8.3, 8.4, 8.5, 8.8, 9.5)	
Pre-requisites: Babinet's principle, Coordinate system **Self Learning:** Broadband antennas, Log periodic antenna, Lens antenna.	
RBT Levels:L1, L2, L3	

III(b). PRACTICAL PART

Use Microwave test bench and RF source to conduct experiment.

Use suitable simulation software (HFSS/CST/MATLAB) to demonstrate the operation

Sl. No.	List of Experiments
01	Measurement of frequency, guided wavelength, power, VSWR, Reflection coefficient and attenuation in a microwave test bench
02	Measure unknown impedance using Smith chart through Microwave test bench setup.
03	Measure Isolation, coupling coefficients and Input VSWR's and S parameters of Magic Tee
04	Measure S- parameters and Input VSWR of E-plane and H plane waveguide Tee.
05	Measure Coupling and Isolation characteristics of microstrip directional coupler.
06	Determine the power division of microstrip power divider.
07	Determination of resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
08	Obtain the radiation pattern of a Yagi-Uda Antenna array and calculate its directivity and gain.
09	Calculate the Gain, directivity, radiation pattern and aperture of a Dipole Antenna.
10	Design and test Microstrip Patch Antenna and study the different antenna parameters for using Simulation Software.

Instructions for conduction of practical part:

- Use software tools like MATLAB or other simulation software for Antenna design and analysis.
- Learn to design, implement, and analyze Antennas and microwave components.

IV. COURSE OUTCOMES

CO1	Analyze the various microwave sources and parameters related to microwave transmission lines.
CO2	Describe the behaviour of various microwave devices using scattering parameters for different applications.
CO3	Apply the knowledge of electromagnetic theory to understand the basics of antenna parameters, arrays and dipoles.
CO4	Discuss various antenna configurations according to the application.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	-	3	1	-	-	-	-	-	-		-			
CO2	2	3	2	3	1	-	-	-	-	-	-	-	2			
CO3	3	2	-	3	1	-	-	-	-	-	-	-	-			
CO4	2	3	2	3	1	-	-	-	-	-	-	-	2			

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #2
Rubrics: Refer to Annexure, SL #2

Semester End Examination (SEE): Refer to - Annexure, SL #2
Rubrics: Refer to - Annexure, SL #2

VII. Learning Resources

VII(a): Textbooks: (Insert or delete rows as per requirement)

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
01	**Microwave Engineering**	Annapurna Das, Sisir K Das	2nd, 2010.	TMH, Publication
02	**Microwave Devices and circuits**	Samuel Y Liao	3rd ,2000	Pearson Education
03	**Antennas and Wave Propagation**	John D. Krauss, Ronald J Marhefka, Ahmad S Khan	4th, 2013	McGraw Hill Education,

VII(b): Reference Books: (Insert or delete rows as per requirement)

01	**Microwave Engineering**	David M Pozar	3rd, 2008	John Wiley India Pvt. Ltd
02	**Microwave Engineering**	Sushrut Das	2nd, 2015	Oxford Higher Education
03	**Antennas and Wave Propagation**	Harish and Sachidananda	1st , 2007	Oxford University Press

VII(c): Web links and Video Lectures (e-Resources):

- ✓ https://www.tutorialspoint.com/antenna_theory/antenna_theory_horn.html
- ✓ http://www.antenna-theory.com/antennas/smallLoop.php
- ✓ https://onlinecourses.nptel.ac.in/noc24_ee150/preview
- ✓ https://onlinecourses.nptel.ac.in/noc20_ee20/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Quizzes, Seminars

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	PCCL		
Course Title: VLSI Design & Testing Lab					
Course Code:	**23ECL603**			**Credits:**	1
Teaching Hours/Week (L: T:P:O)			0:0:2:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Laboratory			**Exam Hours:**	3hrs

I. Course Objectives:

This laboratory course enables students to

- Design, model, simulate and verify digital circuits.
- Design layouts and perform physical verification of CMOS digital circuits.
- Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist.
- Perform RTL-GDSII flow and understand the stages in ASIC.

II. Experiments

ASIC Digital Design

Perform ASIC digital design for the following components. For each design, perform the steps outlined below using Cadence tool.

- Implement the digital design using Verilog.
- Verify the Functionality using Test-bench
- Synthesize the design by setting proper constraints and obtain the netlist.
- From the report generated identify Critical path, Maximum delay, Total number of cells, Power requirement and Total area required for the following experiments.

1.	4-Bit Adder.
2.	4-Bit Booth Multiplier.
3.	32-Bit ALU Supporting 4-Logical and 4-Arithmetic operations, using case and if statement for ALU Behavioural Modelling.
4.	Latch and Flip-Flop (D, SR, JK).
5.	Four-bit Synchronous MOD-N counter with Asynchronous reset
6.	4-to-2 Priority Encoder
7.	8-to-1 Multiplexer (MUX)

ASIC Analog Design	
8.	a) Construct the schematic of CMOS inverter with load capacitance of 0.1pF and set the widths of Inverter with Wn = Wp, Wn = 2Wp, Wn = Wp/2 and length at selected technology. Carry out the following: i. Set the input signal to a pulse with rise time, fall time of 1ns and pulse width of 10ns and the time period of 20ns and plot the input voltage and output voltage of designed inverter. ii. From the simulation result compute tp_{HL}, tp_{LH} and td for all three geometrical settings of width. iii. Tabulate the results of delay and find the best geometry for minimum delay for CMOS inverter. b) Draw layout of inverter with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with prelayout simulations. Record the observations.
9.	a) Construct the schematic of 2-input CMOS NAND gate having similar delay as that of CMOS inverter computed in experiment above. Verify the functionality of NAND gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Increase the drive strength to 2X and 4X and tabulate the results. b) Draw the layout of NAND with Wp/Wn = 40/20, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with prelayout simulations. Record the observations.
10.	a) Construct schematic of Common Source Amplifier with PMOS Current Mirror Load and find its transient response and AC response? Measure the Unit Gain Bandwidth (UGB), amplification factor by varying transistor geometries, study the impact of variation in width to UGB. b) Draw Layout of common source amplifier, use optimum layout methods. Verify for DRC & LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations
11.	a) Construct schematics of two-stage operational amplifier and measure the following: i. UGB ii. dB Bandwidth iii. Gain Margin and phase margin with and without coupling capacitance iv. Use the op-amp in the inverting and non-inverting configuration and verify its functionality. v. Study the UGB, 3dB bandwidth, gain and power requirement in op-amp by varying the stage wise transistor geometries and record the observations. b) Draw layout of two-stage operational amplifier with minimum transistor width set to 300 (in 180/90/45 nm technology), choose appropriate transistor geometries as per the results obtained in part a. Use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.
12.	For the synthesized netlist Perform the physical design steps for **D Flip-Flop** and **JK Flip-Flop .** For each design carry out the following: • Floor planning • Placement and Routing • Record the parameters such as no. of metal layers used for routing, flip method for placement of standard cells • Physical Verification and record the DRC and LVS reports • Generate GDSII

III. COURSE OUTCOMES	
CO1	Design and simulate combinational and sequential digital circuits using Verilog HDL.
CO2	Perform the synthesis of digital circuits using EDA tool.
CO3	Develop the ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level netlist.
CO4	Design and simulate basic CMOS circuits like inverter, common source amplifier, differential Amplifier.
CO5	Perform RTL_GDSII flow and understand the stages in ASIC design.

IV. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3	2	2	3								3	3	1	
CO2	3	2	2	2	3								3	3	1	
CO3	3	3	2	2	3								3	3	1	
CO4	3	3	2	2	3								3	3	1	
CO5	3	3	2	2	3								3	3	1	

V. Assessment Details (CIE & SEE)

General Rules:

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #4

Semester End Examination (SEE): Refer to - Annexure, SL #4 Rubrics: Refer to - Annexure, SL #4

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	PEC		
Course Title: Satellite Communication					
Course Code:	**23ECP621**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

This course will enable students to:

1. Understand the basic principle of satellite orbits and trajectories.
2. Study of electronic systems associated with a satellite and the earth station.
3. Understand the various technologies associated with satellite communication.
4. Focus on a communication satellite and the national satellite system.
5. Study of satellite applications focusing on various domains services such as remote sensing, weather forecasting and navigation.

II. Teaching-Learning Process :

- Chalk and talk.
- Power point presentation.
- Videos

III. COURSE CONTENT

Module-1: Satellite Orbits and Trajectories. — 8 Hrs

Satellite Orbits and Trajectories: Definition, Basic Principles, Orbital parameters, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance, Eclipses, Look angles: Azimuth angle, Elevation angle.

Textbook :1 Chapter : 2 & 3 Sections: 2.1 to 2.5, 3.3 to 3.7

Pre-requisites: Knowledge of sine and cosine functions, Fundamentals of signals and systems, Basic communication system components.
Self-Learning: Properties of the Fourier Transform, Dirac Delta Function.

RBT Levels: L1, L2, L3

Module-2: Satellite Subsystem — 8 Hrs

Satellite subsystem: Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Payload. Earth Station: Types of earth station, Architecture, Design considerations, Testing, Earth station Hardware, Satellite tracking.

Textbook :1 Chapter : 4 Sections:4.1, 4.5 to 4.8

Pre-requisites: Knowledge of sine and cosine functions, Fundamentals of signals and systems, Basic communication system components.
Self-Learning: FM Broadcasting System.

RBT Levels: L1, L2, L3	
Module-3: Multiple Access Techniques	8 Hrs
Multiple Access Techniques: Introduction, FDMA (No derivation), SCPC Systems, MCPC Systems, TDMA, CDMA, SDMA. Satellite Link Design Fundamentals: Transmission Equation, Satellite Link Parameters, Propagation considerations Textbook :1 Chapter : 6 Sections: 6.1 to 6.14	
Pre-requisites: Fundamentals of signals and systems, Discrete mathematics, calculus**.** **Self-Learning:** Digital Multiplexing.	
RBT Levels: L1, L2, L3	
Module-4: Communication Satellites	8 Hrs
Communication Satellites: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, Regional satellite Systems, National Satellite Systems. Textbook :1 Chapter : 9 Sections: 9.1 to 9.8	
Pre-requisites: Knowledge on Signal representation, Modulation and Demodulation. Self-Learning: Signalling schemes-RZ, NRZ, Bipolar, Manchister.	
RBT Levels: L1, L2, L3	
Module-5: Remote Sensing Satellites	8 Hrs
Remote Sensing Satellites: Classification of remote sensing systems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications. Weather Forecasting Satellites: Fundamentals, Images, Orbits, Payloads, Applications. Navigation Satellites: Development of Satellite Navigation Systems, GPS system, Applications. Textbook :1 Chapter : 10 Sections: 10.1 to 10.3	
Pre-requisites: Knowledge on Signal representation, Modulation and Demodulation. **Self-Learning:** BER Comparison of Signalling Schemes over AWGN channels**.**	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Describe the satellite orbits and its trajectories with the definitions of parameters associated with it.
CO2	Describe the electronic hardware systems associated with the satellite subsystem and earth station
CO3	Describe the communication satellites with the focus on national satellite system.
CO4	Compute the satellite link parameters under various propagation conditions with the illustration of multiple access techniques
CO5	Describe the satellites used for applications in remote sensing, weather forecasting and navigation

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	3										1			
CO2	3	2	3										1			
CO3	3	2	3										2			
CO4	3	2	3										2			
CO5	3	2	3										2			

VI. Assessment Details (CIE & SEE)				
General Rules: Refer to Annexure, SL #1				
Continuous Internal Evaluation (CIE):): Refer to Annexure, SL #1 **Rubrics: Refer to Annexure, SL #1**				
Semester End Examination (SEE): Refer to Annexure, SL #1 **Rubrics: Refer to Annexure, SL #1**				
VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Satellite Communications	Anil K. Maini	2015	4th Edition, Wiley, India Pvt. Ltd,
VII(b): Reference Books:				
1	Satellite Communications	Dennis Roddy	2006	Mc Graw Hill
2	Satellite Communications	Timothy Pratt, Charles Bostian, J Ereemy Allnutt	2017	Wiley India Pvt Ltd
VII(c): Web links and Video Lectures (e-Resources):				
Mention the links of the online resources, video materials, etc. https://www.youtube.com/watch?v=p-oMLP99tXc https://archive.nptel.ac.in/courses/117/105/117105131/				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Execution using Multimedia software				

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Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	PEC		
Course Title: DSP Algorithm and Architecture					
Course Code:	**23ECP622**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

Course objectives: This course will enable the students to

- Understand the concepts of digital signal processing techniques.
- Understand the computational building blocks of DSP processors and its speed issues.
- Understand the various addressing modes, peripherals, interrupts and pipelining structure of theTMS320C54xx processor.
- Understand DSP algorithms and applications with their implementation using TMS320C54xx processor.

II. Teaching-Learning Process :

1. Chalk and talk.
2. Power point presentation.
3. Hands-On Simulations using software tools.
4. Project Based Learning.

III. COURSE CONTENT

III(a).Theory PART

Module-1: Introduction to Digital Signal Processing	**08 Hrs**

Introduction, A Digital Signal – Processing system, Major features of programmable Digital signal processors, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-Invariant Systems, Digital Filters, Decimation and Interpolation.

Text 1 :Chapter 1 Section 1.3, Chapter 2-Section 2.1 to 2.8

Pre-requisites: Basic understanding of signals & systems and foundational mathematics, including calculus, linear algebra, and Fourier analysis.

RBT Levels: L1, L2, L3

Module-2: Architectures for Programmable Digital Signal Processing Devices	**08 Hrs**

Introduction, Basic Architectural Features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External Interfacing.

Text 1 :Chapter 4- Section 4.1 to 4.9

Pre-requisites: Basic knowledge of digital logic design, computer architecture, and microprocessor fundamentals	
RBT Levels:L1, L2, L3	
Module-3: Programmable Digital Signal Processors	**08 Hrs**
Introduction, Commercial Digital Signal-processing Devices, Data Addressing Modes of TMS32OC54XX, Memory Space of TMS32OC54xx Processors, Program Control. Detail Study of TMS320C54X, Instructions and Programming, On – Chip Peripherals, Interrupts of TMS32OC54XX Processors, Pipeline Operation of TMS32OC54xx Processor. **Text 1 : Chapter 5 - Section 5.1 to 5.10**	
Pre-requisites: Foundational understanding of microprocessor architecture, assembly language programming, and memory management. **Self-learning:** TMS32OC76XX Processors architecture and programming	
RBT Levels:L1, L2, L3	
Module-4: Implementation of Basic DSP Algorithms	**08 Hrs**
Introduction, The Q – notation, FIR Filters, IIR Filters, Interpolation and Decimation Filters (one example in each case). Implementation of FFT Algorithms: Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit – Reversed Index. Generation & Implementation on the TMS32OC54xx. **Text 1:Chapter 7- Section 7.1 to 7.6 Chapter 8- Section 8.1 to 8.6**	
Pre-requisites: Digital signal processing fundamentals, including filter design (FIR, IIR), interpolation, decimation, and the Q-notation for fixed-point arithmetic. Familiarity with FFT algorithms, scaling issues, and bit-reversal indexing. **Self-learning:** Filter designing and FFT algorithms	
RBT Levels:L1, L2, L3	
Module-5: FPGA based DSP systems	**08 Hrs**
Evolution of FPGA based DSP system design, Introduction to FPGA, Design flow for an FPGA based system design, CAD tools for FPGA based system design, Soft-core processors, FPGA based DSP system design. FPGA's in Telecommunication applications- Coordinate rotation Digital Computer (CORDIC) algorithms and its applications, Case study of an FPGA based Digital receiver. **Text 2 : Chapter 17- Section17.3 to 17.9Chapter 18- Section18.3 to 18.4**	
Pre-requisites: understanding FPGA architecture and telecommunication principles will help with system design and applications. **Self-learning:** Verilog coding, synthesis and implementation.	
RBT Levels:L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Comprehend the knowledge & concepts of digital signal processing techniques.
CO2	Apply knowledge of various types of addressing modes, interrupts, peripherals and pipelining structure of TMS320C54xx processor.
CO3	Develop assembly language programs to implement FIR, IIR filters and FFT algorithms.
CO4	Build the Applications on Programmable DSP devices.
CO5	Apply the knowledge of DSP computational building blocks to achieve speed in DSP architecture or processor.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	1	1									1			
CO2	3	2	1	1									1			
CO3	3	3	1	1									2			
CO4	3	3	2	1	2								2			
CO5	3	3	3	1	2								2			

VI. Assessment Details (CIE & SEE)

General Rules:Refer to – Academic regulations

Continuous Internal Evaluation (CIE):Refer to Annexure, SL #1

Semester End Examination (SEE):Refer to - Annexure, SL #1
Rubrics: Refer to - Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Digital Signal Processing	Avatar Singh and S Srinivasan	2004	Thomson Learning
2	Digital Signal Processors architecture, programming and applications	B Venkataramani and M Bhaskar,	2nd Edition, 2004	TMH

VII(b): Reference Books:

1	Digital Signal Processing: A practical approach	Ifeachor E C, Jervis B. W	2002	Pearson-Education, PHI,
2	Architectures for Digital Signal Processing	Peter Pirsch,	2007	John Wiley.

VII(c): Web links and Video Lectures (e-Resources):

https://www.ti.com/processors/digital-signal-processors/overview.html
https://www.youtube.com/playlist?list=PLv78DAx1VAVlOVRc3kX62AsZ-igfw5D2q

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Implement DSP algorithms using both software and hardware.
- Analyze case studies on DSP system design in real-time signal processing applications.

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	PEC		
Course Title: Hardware Software Co-Design					
Course Code:	**23ECP623**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

This course will enable students:

Outline the motivation, scope, and background of hardware software co-design.
Explain the co-design concepts, typical co-design processes and limitations of existing approaches.
Describe the general considerations, framework for co-design with examples and unique representation and basic modelling concepts.
Develop the hardware software system model and evaluate their performance on usage.
Explain the data types, model hardware component as classes and data decomposition.

II. Teaching-Learning Process :

- Chalk and talk method
- Power point presentation / keynotes
- Videos

III. COURSE CONTENT

III a.)Theory PART

Module-1: Introduction — 8 Hrs

Introduction Motivation hardware & software co-design, system design consideration, research scope & overviews Embedded systems, models of design representation, the virtual machine hierarchy, the performance modeling, Hardware Software development.

Textbook :1 Chapter -1,2 Sections: 1.1,1.2,1.3, 2.1,2.2,2.3,2.4,2.5

RBT Levels: L1, L2, L3

Module-2: Hardware/Software Co design Research — 8 Hrs

An Informal View of Codesign, Hardware/Software Trade-offs, Cross Fertilization, A Typical Codesign Process, Codesign Environments, Limitations of Existing Approaches, The ADEPT Modeling Environment

Textbook1: Chapter -3 Sections: 3.1,3.2,3.3,3.4 ,3.5, 3.6, 3.7

RBT Levels: L1, L2, L3

Module-3: Methodology for Co-Design — 8 Hrs

Co-Design methodology, Amount of unification, general consideration & basic philosophies, a framework for co-design, an example. Unified Representation for Hardware & Software Benefits of unified representation, modeling concepts, a unified representation.

Textbook 1: Chapter – 5,6, Sections : 5.1,5.2,5.3,5.4,5.5 6.1,6.2,6.3

RBT Levels: L1, L2, L3

Module-4: An Abstract of Hardware & Software	8 Hrs
Model Requirement & applications of the models, models of Hardware Software system, an abstract Hardware Software models, generality of the model. Performance Evaluation Application of the abstract Hardware & Software model, examples of performance evaluation. **Textbook 1: Chapter-7,8 Sections: 7.1,7.2,7.3,7.4,7.5,7.6, 8.1,8.2**	
RBT Levels: L1, L2, L3	
Module-5: Object-Oriented Techniques	8 Hrs
Motivations for Object-Oriented Techniques, Data Types, Modeling Hardware Components as Classes, Deriving Specialized Components, Data Decomposition, Processor Example, Type Genericity **Textbook 1: Chapter -9 Sections: 9.1,9.2,9.3,9.4,9.5,9.6,9.7,**	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Outline the motivation, scope, and background of hardware software co-design.
CO2	Explain the co-design concepts, typical co-design processes and limitations of existing approaches.
CO3	Describe the general considerations, framework for co-design with examples and unique representation and basic modelling concepts.
CO4	Develop the hardware software system model and evaluate their performance on usage.
CO5	Explain the data types, model hardware component as classes and data decomposition. Design specialized component.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	
CO1	3	2	2										2	2		
CO2	3	2	2										2	1		
CO3	3	2											2	1		
CO4	3	2														

VI. Assessment Details (CIE & SEE)

General Rules:
Refer to Academic Regulations

Continuous Internal Evaluation (CIE):
Refer to Annexure SL #1

Semester End Examination (SEE):
Refer to Annexure SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	The Co-design of Embedded Systems: A Unified Hardware Software Representation	Sanjaya Kumar, James H. Ayler	2002	Kluwer Academic Publisher

VII(b): Reference Books:				
1	Embedded System Design	Peter Mwrwedel	1994	Springer
2	Co-synthesis of Hardware and Software for Embedded Systems	R. Gupta	1995	Kluwer
3	Introduction to Real-time Software Design	S. Allworth	1984	Springer-Verlag,

VII(c): Web links and Video Lectures (e-Resources):

http://digimat.in/nptel/courses/video/106103182/L04.html
https://www.youtube.com/watch?v=qtUY27QJu64
https://archive.nptel.ac.in/courses/106/105/106105165/
https://archive.nptel.ac.in/courses/106/103/106103182/

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Quiz, Group Discussion

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)
Department of Electronics & Communication Engineering

Semester:	VI	**Course Type:**	PEC		
Course Title: Digital Image Processing					
Course Code:	**23ECP624**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

This course will enable students to:

- Understand the fundamentals of digital image processing.
- Understand the image transform used in digital image processing.
- Understand the image enhancement techniques in spatial domain used in digital image processing.
- Understand the Color Image Processing and frequency domain enhancement techniques in digital image processing.
- Understand the image restoration techniques and methods used in digital image processing.

II. Teaching-Learning Process :

1. Chalk and talk.
2. Power point presentation.
3. Videos
4. Project Based Learning.

III. COURSE CONTENT

Module-1 Digital Image Fundamentals — 8 Hrs

What is Digital Image Processing?, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition.
Text1: Chapter 1and Chapter 2: Sections 2.1to 2.2, 2.6.2

Pre-requisites: Image sensors
Self-Learning: Electromagnetic spectrum, one dimensional Sampling and quantitation

RBT Levels: L1, L2

Module-2 Image Enhancement in the Spatial Domain	8 Hrs
Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations. Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters Text1:Chapter2: Sections 2.3 to 2.62, Chapter3: Sections3.2 to3.6	
Pre-requisites: Probability theory **Self-Learning:** Mathematical tool used in DIP, Fuzzy techniques used in DIP	
RBT Levels: L1, L2	
Module-3: Enhancement in Frequency Domain	8 Hrs
Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-DDFT, Preliminary Concepts, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, Selective Filtering. Text1: Cbapter4: Sections 4.2, 4.5 to 4.10	
Pre-requisites: One dimensional Fourier transform. Concept of orthogonal and unitary matrix **Self-Learning**: Implementation of selective filters (band pass, band reject and notch filters)	
RBT Levels: L1, L2, L3	
Module-4: Restoration	8 Hrs
Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant degradations Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Text1: Chapter 5: Sections 5.2, to 5.9	
Pre-requisites: Probability density functions **Self-Learning:** Linear, Position-Invariant Degradations	
RBT Levels: L1, L2, L3	
Module-5: Morphological Image Processing	8 Hrs
Preliminaries, Erosion and Dilation, Opening and Closing. Color Fundamentals, Color Models, Pseudo colour Image Processing. Text1: Chapter 6: Sections 6.1 to 6.3 Chapter 9: Sections 9.1 to 9.3	
Pre-requisites: Basic logical operations performed over data points **Self-Learning:** Grey scale morphology	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES	
CO1	Describe the fundamentals of digital image processing.
CO2	Understand image formation and the role human visual system plays in perception of gray and color image data
CO3	Apply image processing techniques in both the spatial and frequency (Fourier) domains.
CO4	Conduct independent study and analysis of image Enhancement and restoration techniques.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/ PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	**3**	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-
CO4	**3**	2	1	-	-	-	-	-	-	-	-	-	2	-	-	-

VI. Assessment Details (CIE & SEE)

General Rules: Refer to Annexure, SL #1

Continuous Internal Evaluation (CIE):): Refer to Annexure, SL #1

Rubrics: Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to Annexure, SL #1

Rubrics: Refer to Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks :

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Digital Image Processing	Rafel C Gonzalez and Richard E. Woods	3rd Edition 2010	PHI

VII(b): Reference Books: (Insert or delete rows as per requirement)

1	Digital Image Processing	S.Jayaraman, S. Esakkirajan,T. Veerakumar	1st Edition 2014	Tata McGraw-Hill
2	Fundamentals of Digital Image Processing	A K. Jain	4th Edition 2004	Pearson

VII(c): Web links and Video Lectures (e-Resources):

NPTEL Video lectures: https://nptel.ac.in/courses/117105079
NPTEL Video lectures: https://nptel.ac.in/courses/108103174

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Group Discussion/Quiz
- Demonstration of Electromagnetic concepts.
- Case Study on Medical Imaging devices

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	OEC		
Course Title: Electronic Communication Systems					
Course Code:	**23ECO611**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

This course will enable students:

1. To explain the amplitude and frequency modulation techniques and perform time and frequency domain transformations.
2. To acquaint with the structural diagrams of radio transmitters and radio receivers, their advantages and disadvantages.
3. To give an introduction to the fundamentals of the wireless communications systems

II. Teaching-Learning Process :

- Chalk and talk method
- Power point presentation / keynotes
- Videos

III. COURSE CONTENT

III a.) Theory PART

Module-1: Introduction to Communication Systems — 8 Hrs

Introduction to Communication, Elements of a Communication System, Need for Modulation, Electromagnetic Spectrum and Typical Applications, Terminologies in Communication Systems, Some Communication Systems, Classification of Communication Systems External Noise, lnternal Noise

Textbook :1 Chapter **-1 &2 Sections: 1.1, 1.2,1.3, 1.4, 1.5,1.6,1.7, 2.2,2.3**

Pre-requisites: Basics of Communication

RBT Levels: L1, L2, L3

Module-2: Amplitude Modulation Techniques — 8 Hrs

Elements of Analog Communication, Theory of Amplitude Modulation Techniques, Generation of Amplitude Modulated Signals

Textbook1: Chapter - 3 Sections: 3.1, 3.2, 3.3

RBT Levels: L1, L2, L3

Module-3: Angle Modulation Techniques	**8 Hrs**
Theory of Angle Modulation Techniques, Practical Issues in Frequency Modulation, Generation of Frequency Modulation, **Textbook 1: Chapter - 4 Sections : 4.1, 4.2, 4.3**	
RBT Levels: L1, L2, L3	
Module-4: Radio Transmitters and Receivers	**8 Hrs**
Introduction lo Radio Communication, Radio Transmitters, Receiver Types, Superheterodyne Receiver, AM Receivers, Sensitivity, Detection and Automatic Gain Control (AGC), FM Receivers **Textbook 1: Chapter-7 Sections: 7.1,7.2,7.3,7.4,7.5,7.6, 7.7,7.8**	
RBT Levels: L1, L2, L3	
Module-5: Cellular Wireless Networks	**8 Hrs**
Introduction, Cellular Telephone System, Cellular Concept and Frequency Reuse, Wireless Network Topologies, First Generation(1G). Technology, Second Generation(2G). Technology, Global System for Mobile(GSM) Communications, General Packet Radio Services (GPRS), Third Generation (3G) Technology, CDMA Technology, From Universal Mobile Telecommunication Systems (UMTS) to Long – Term Evolution (LTE),From LTE to LTE- Advanced, 4G Communication Systems, Fourth Generation(4G). Technology, Wireless LAN(WLAN), Bluetooth **Textbook 2: Chapter -8 Sections: 8.1,8.2,8.3,8.4,8.5,8.6,8.7, 8.8, 8.9, 8.10, 8.12, 8.13, 8.14, 8.15, 8.16,8.17**	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Understand and identify the fundamental concepts and various components of analog communication systems.
CO2	Identify the schemes for amplitude and angle modulation and compare their performance.
CO3	Analyze the structure of radio transmitters and radio receivers, explain their advantages and disadvantages
CO4	Understand concepts of wireless and mobile communication and LTE technologies for mobile telephony.

V. CO-PO-PSO MAPPING (Mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	
CO1	3											2				
CO2	3	2										2				
CO3	3	1										2				
CO4	3											3				

VI. Assessment Details (CIE & SEE)

General Rules:
Refer to Academic Regulations

Continuous Internal Evaluation (CIE):
Refer to Annexure SL #1

Semester End Examination (SEE):
Refer to Annexure SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Electronic Communication Systems	George Kennedy, Bernard Davis, S R M Prasanna	6th Edition	McGraw Hill Education
2	Communication Systems	S L Kakani, Priyanka Punglia	2nd Edition	New Age International Publishers

VII(b): Reference Books:(Insert or delete rows as per requirement)

1	Communication System	Simon Haykins & Moher	5th Edition,2010	John Wiley, India Pvt. Ltd
2	Modern Digital and Analog Communication Systems	B P Lathi and Zhi Ding	4th edition, 2010	Oxford University Press ISBN: 97801980738002.
3	Principles of Communication Systems	H Taub & D L Schilling	2011	TMH

VII(c): Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=S8Jod9AtpN4
2. https://www.youtube.com/watch?v=PmuZnJfheK4
3. http://digimat.in/nptel/courses/video/106106167/L01.html

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	OEC		
Course Title: Basic VLSI Design					
Course Code:	**23ECO612**		**Credits:**		3
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3hrs

I. Course Objectives:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Impart knowledge on architectural choices and performance trade-offs involved in designing and realizing the circuits in CMOS technology
- Cultivate the concepts of subsystem design processes
- Demonstrate the concepts of CMOS testing

II. Teaching-Learning Process (General Instructions):

1. Chalk and talk.
2. Power point presentation.
3. Hands-On Simulations using software tools (Cadence, Synopsys, Mentor Graphics) for circuit design and testing.

III. COURSE CONTENT

III(a). Theory PART

Module-1: MOS transistor theory	8Hrs

Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, pwell processes, BiCMOS, Comparison of bipolar and CMOS, Drain to source current versus voltage characteristics, threshold voltage, transconductance.
Textbook 1: Chapter 1: sections: 1.1,1.7,1.8,1.8.1,1.8.2,1.10,1.10.1,2.1,2.1.1,2.1.2,2.2,2.3.

RBT Levels: L1, L2

Pre-requisites
Basic operation of FET.

Module-2: Basic Electrical Properties of MOS And BiCMOS Circuits	8Hrs

Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio: nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up. Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, super buffers, BiCMOS drivers.
Textbook 1: Chapter 2 & 4: sections: 2.6,2.8,2.9,2.10,2.1,2.3,2.3.1,4.1,4.3,4.6,4.7,4.7.1,4.8.2,4.8.3.

Pre-requisites
Basic operation of Inverter.

RBT Levels: L1, L2, L3

Module-3: MOS and BiCMOS Circuit Design Processes	8Hrs
MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style Design rules and layout & Scaling of MOS Circuits: λ - based design rules, scaling factors for device parameters **Textbook 1: Chapter 3 & 5: sections:**3.1,3.2,3.2.1,3.2.2,3.3,3.3.1,5.2.	
RBT Levels: L1, L2, L3	
Module-4: Subsystem Design and Layout-1	8Hrs
Subsystem Design and Layout-1: Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS Examples of structured design: Parity generator, Bus arbitration, multiplexers, logic function block, code converter. **Textbook 1: Chapter 6: sections:**6.2,6.2.1,6.3,6.3.1,6.3.2,6.3.3,6.4,6.4.1,6.4.2,6.4.3,6.4.4,6.4.5.	
Pre-requisites Basic knowledge of Logic gates.	
RBT Levels: L1, L2, L3	
Module-5: Memory, Registers and Aspects of system Timing and verification.	8 Hrs
Memory, Registers and Aspects of system Timing: System Timing Considerations, Some commonly used Storage/Memory elements. (TEXT1:9.1, 9.2). **Testing and Verification**: Introduction, Logic Verification, Logic Verification Principles, Manufacturing Test Principles, Design for testability. **Textbook 2: Chapter 15: sections:**15.1, 15.1.1, 15.3, 15.5, 15.6.	
Pre-requisites Basic knowledge of Memory.	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Demonstrate understanding of MOS transistor theory, CMOS fabrication flow and technology scaling.
CO2	Describe the general steps required for processing of CMOS integrated circuits.
CO3	Construct the basic gates using the stick and layout diagrams with the knowledge of physical design aspects
CO4	Demonstrate different logic styles such as complementary CMOS logic, pass-transistor Logic, dynamic logic
CO5	Interpret Memory elements along with timing considerations and Test generation for sequential circuits

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	1	1													
CO2	3	2	2													
CO3	3	2	2													
CO4	3	2	2													
CO5	3	2	2													

VI. Assessment Details (CIE & SEE)				
General Rules:				
General Rules: Refer to – Academic regulations				
Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1				
Semester End Examination (SEE): Refer to - Annexure, SL #1 Rubrics: Refer to - Annexure, SL #1				
VII. Learning Resources				
VII(a): Textbooks :				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Basic VLSI Design	Douglas A Pucknell, Kamran Eshraghian,	3rdEdition	Prentice Hall of India publication,
2	CMOS VLSI Design- A Circuits and Systems	Neil H E Weste, and David Money Harris	4th Edition,	Pearson Education.
VII(b): Reference Books:				
1	CMOS Digital Integrated Circuits: Analysis and Design	Sung Mo Kang & Yosuf Leblebici	Third Edition,	Tata McGraw-Hill.
VII(c): Web links and Video Lectures (e-Resources):				
• https://nptel.ac.in/courses/117101058 • https://nptel.ac.in/courses/117106093 • https://youtu.be/9SnR3M3CIm4 • https://nptel.ac.in/courses/108/107/108107129/				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Seminar, Assignments, Quiz.				

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	OEC		
Course Title: Consumer Electronics					
Course Code:	**23ECO613**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

- To understand the working principles and classifications of various microphones and loudspeakers, and their roles in audio systems.
- To explore the structure, recording, and playback processes of Audio Compact Disc systems, along with error correction techniques and digital-to-analog conversion.
- To analyse the fundamentals of colour television systems, including the transmission of colour signals, and to study recent advances in television technology.
- To gain knowledge of modern consumer electronic devices such as mobile phones, home appliances, and computers, focusing on their applications and technological advancements.

II. Teaching-Learning Process :

- Chalk and talk.
- Power point presentation.

III. COURSE CONTENT

III(a). Theory PART

Module-1: Microphones & Loudspeakers	8Hrs

Microphones: Introduction, Requirements, Quality of Microphones, Classification, Moving Coil Microphone, Ribbon Microphone, Condenser (or Capacitor) Microphone, Crystal Microphone, Carbon Microphone, Electret Microphone.
Loudspeakers: Introduction, Features of Loudspeaker, Moving Coil (Cone Type) Loudspeaker, Electrodynamic Loudspeaker, Horn Loudspeaker, Loudspeaker for High Fidelity Systems.
Textbook 1: Chapter 5: sections: 5.1 to 5.10 and 6.1 to 6.6

RBT Levels: L1, L2

Module-2: Audio Compact Disc Systems:	8Hrs

Audio Compact Disc Systems: Introduction, Comparison of CD and Tape, Optical Recording, Details of a Compact Disc, Details of Recording Process, Details of playback Process, Geometry of Audio Disc, Encoding Process and Error Correction, D/A Convertor, Handling of Compact Disc.
Textbook 1: Chapter 10: sections: 10.1 to 10.10

RBT Levels: L1, L2, L3	
Module-3: Colour Television	8Hrs
Colour Television: Introduction, Light Energy, Primary Colours, Tristimulus Values, Trichromatic Coefficients, Colour Triangle, Mixing of Colours, Grassman's Law, Colour Specifications, Bandwidth for Colour Signal Transmission. Chromaticity Diagram, Spectral and Non-Spectral Colours, Colour Circle, Visibility Curve, Digital Television (DTV) and High Definition Television (HDTV), Recent Advances in TV technology, LCD TV, LED TV, Plasma TV **Textbook 1: Chapter 14: sections:** 14.1 to 14.9, 14.13 to 14.16 and 14.26 to 14.27	
RBT Levels: L1, L2	
Module-4: Cable Television & Miscellaneous Devices	8Hrs
Cable Television: Introduction, Video Monitor, Closed Circuit Television (CCTV), Cable Television, Cable TV Using Internet. **Miscellaneous Devices:** Digital Watch, Calculator, An Electronic Guessing Game, Cordless Telephone. **Textbook 1: Chapter 15: sections:** 15.1 to 15.5 and 17.1 to 17.4.	
RBT Levels: L1, L2	
Module-5: Advancements in Consumer Electronics	8 Hrs
Mobile Telephone, Cellular Telephone, UPS, Inverter, Decorative Lighting, Remote Control for TV and VCR, Facsimile (FAX), Pager, Microwave Oven, LCD Timer with Alarm, Electronic Ignition System for Automobiles, Washing Machine, Organisation of Digital computer, Microprocessor, Note Book, Laptop, Tablet PC, Ultrabook, IPAD, Recent Advances in Consumer Electronics. **Textbook 2: Chapter 17: sections:** 17.6 to 17.7 and 17.13 to 17.27	
RBT Levels: L1, L2	

IV. COURSE OUTCOMES

CO1	Understand the functioning and classification of various types of microphones and loudspeakers
CO2	Demonstrate knowledge of the optical recording and playback processes in audio compact disc systems
CO3	Analyse the principles of colour television and modern display technologies
CO4	Evaluate the working of cable television systems and miscellaneous consumer devices
CO5	Explore advancements in consumer electronics, such as mobile phones, computing devices, and home appliances

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	2														
CO2	3	2	1													
CO3	3	2	1													
CO4	3	2	1													
CO5	3	2														

VI. Assessment Details (CIE & SEE)
General Rules:
General Rules: Refer to – Academic regulations
Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1
Semester End Examination (SEE): Refer to - Annexure, SL #1 Rubrics: Refer to - Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Consumer Electronics	B.R. Gupta, V. Singhal	6th edition	2013, ISBN 978-93-5014-407-7.

VII(b): Reference Books:

1	Consumer Electronics	R.P.Bali	2008	Pearson Education

VII(c): Web links and Video Lectures (e-Resources):

- Android Mobile Application Development: https://onlinecourses.swayam2.ac.in/nou24_ge66/preview
- Microelectronics: Devices to Circuits: https://onlinecourses.nptel.ac.in/noc24_ee139/preview

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, Assignments, Quiz.

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	OEC		
Course Title: Digital System Design using Verilog					
Course Code:	**23ECO614**			**Credits:**	3
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:0	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- Learn different Verilog HDL constructs.
- Familiarize the different levels of abstraction in Verilog.
- Understand Verilog Tasks and Functions.
- Understand Timing and Delay Simulation

II. Teaching-Learning Process :

1. Chalk and Board
2. Power point presentation
3. Mini projects
4. Videos and online material

III. COURSE CONTENT

Module-1: **Overview of Digital Design with Verilog HDL** — 8 Hrs

Evolution of Computer-Aided Digital Design (CAD), Emergence of HDLs, Typical Design flow, Importance of HDLs, Popularity of Verilog HDL, Trends in HDLs.

Hierarchical Modeling Concepts: Design Methodologies, Top-down and Bottom-up design methodology, Modules, Instances, Components of a Simulation, Design Block, Stimulus Block (Test Bench) with example.

Text 1: Chapter 1-Section 1.1 to 1.6, Chapter 2- Section 2.1 to 2.6

Pre-requisites: Number systems, C language

RBT Levels: L1, L2, L3

Module-2: Basic Concepts	8 Hrs
Lexical Conventions, Data Types, System Tasks, Compiler Directives. **Modules and Ports:** Modules, Ports, Connecting Ports, Hierarchical Names. **Text 1: chapter 3- Section 3.1 to 3.3, Chapter 4-Section-4.1 to 4.3**	
Pre-requisites: Verilog HDL **Self-Learning: Test bench designing**	
RBT Levels: L1, L2, L3	
Module-3: Gate-Level Modeling:	8 Hrs
Gate Types-Modeling using basic Verilog gate primitives, Description of AND/OR and BUF/NOT type gates. Gate Delays-Rise, Fall and Turn-Off Delays, Min, Max and Typical Delays. **Dataflow Modeling**: Continuous assignments, Delay Specification, Expressions, Operators, Operands, Operator Types, Examples **Text 1: chapter 5-Section- 5.1, 5.2, chapter 6-Section 6.1 to 6.5**	
Pre-requisites: Verilog HDL	
RBT Levels: L1, L2, L3	
Module-4: Behavioral Description	8 Hrs
Structured Procedures, Initial and Always statements, Procedural Assignments Blocking and Non-Blocking statements, Conditional statements, Multiway Branching, Loops, Sequential and Parallel blocks, Examples-4-to-1 Multiplexer, 4-bit Counter. **Text 1: chapter 7-Section- 7.1,7.2,7.4, 7.5, 7.6, 7.7, 7.9.1, 7.9.2**	
Pre-requisites: C programming	
RBT Levels: L1, L2, L3	
Module-5: Structural Description	8 Hrs
Highlights of Structural Descriptions, Organization of Structural Description, Binding **Tasks and Functions**: Differences between Tasks and Functions, Declaration and Invocation, Examples. **Text 2: Chapter 4- Section 4.1, 4.2, 4.3, Listings 4.1 to 4.13 only Verilog) , Text 1:Chapter 8-Section-8.1, 8.2, 8.2.1, 8.2.2, 8.3, 8.3.1, 8.3.2**.	
Pre-requisites: C programming	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Understand the evolution of Verilog HDL and design flow.
CO2	Describe the basic concepts of Verilog HDL programming.
CO3	Write Verilog programs in Gate, Dataflow, Behavioral, and structural modeling levels of Abstraction.
CO4	Write the programs more effectively using Verilog Tasks and Functions

V. CO-PO-PSO MAPPING (H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	3	3	3													
CO2	3	2	2													
CO3	3	2	2	2	2											
CO4	3	2	3	2	2											

VI. Assessment Details (CIE & SEE)

General Rules: Refer to Academic regulations

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to - Annexure, SL #1
Rubrics: Refer to Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1.	Verilog HDL: A Guide to Digital Design and Synthesis	Samir Palnitkar	Second edition.	Pearson education,
2.	HDL programming (VHDL and Verilog)	Nazeih M Botros	2008	John Wiley India Pvt. Ltd

VII(b): Reference Books:

1	"The Verilog Hardware Description Language",	Donald E. Thomas, Philip R. Moorby	Fifth edition	Springer Science+Business Media,LLC
2	"Advanced Digital Design with the Verilog HDL"	Michael D. Ciletti	Second edition.	Pearson (Prentice Hall),
3	"Design through Verilog HDL"	Padmanabhan, Tripura Sundari	2016	Wiley

VII(c): Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=vHLBO05TeyU&list=PLwdnzlV3ogoVlY7iVqr-FhWUQEX7JDdiP
- https://www.youtube.com/watch?v=twQ-KJzKZ6g
- https://www.youtube.com/watch?v=21luFDi1kS8
- https://www.youtube.com/watch?v=MzfT43ZRYDs

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Programming assignments / mini projects can be given to improve programming skills.

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Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	ETC		
Course Title: Robotics and Its Applications					
Course Code:	**23ECE641**		**Credits:**		03
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

This course will enable students to:

1.Understand and discuss the fundamental elementary concepts of Robotics.
2. Provide insight into different types of robots.
3. Explain intelligent module for robotic motion control.
4. Educate on various path planning techniques.
4. Illustrate the working of innovative robotic devices

II. Teaching-Learning Process :

- Chalk and talk method
- Power point presentation / keynotes
- Videos

III. COURSE CONTENT

Module-1: Introduction To Robotics — 8 Hrs

Introduction to Robotics and Automation, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, safety measures in robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots.
Text Book 1: Chapter 1-Section : 1.1-1.12

Pre-requisites: Knowledge of automation and control theory

RBT Levels: L1, L2, L3

Module-2: Power Sources and Sensors — 8 Hrs

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements. Sensor and Transducer- Sensors in robotics, Tactile Sensors, Proximity sensor and range sensors, Sensor based systems, Uses of Sensor in robotics.
Text Book 2: Chapter 2 -Section : 2.3-2.5
Text Book 2: Chapter 6-Section : 6.1-6.6

RBT Levels: L1, L2, L3

Module-3: Manipulators, Actuators and Grippers	8 Hrs
Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations. **Text Book 2: Chapter 3 -Section : 3.7** **Text Book 2: Chapter 4-Section : 4.1-4.3** **Text Book 2: Chapter 5-Section : 5.1-5.4**	
RBT Levels: L1, L2, L3	
Module-4: Artificial Intelligence in Robotics	8 Hrs
Introduction, goals of AI in research , AI techniques used in robots, LISP programming , AI and Robotics , LISP in factory **Text Book 2: Chapter 10 -Section : 10.1-10.6**	
RBT Levels: L1, L2, L3	
Module-5: Robotics Applications	8 Hrs
pick and place, palletizing and depalletizing, machining loading and unloading, welding & assembly, Medical, agricultural and space applications, unmanned vehicles: ground, Ariel and underwater applications, robotic for computer integrated manufacturing. Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots, Autonomous robots, and Swarm robots. **Text Book 13: Chapter 13 -Section : 13.1-13.3** **Text Book 14: Chapter 14-Section : 14.1-14.3**	
RBT Levels: L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Discuss the significance, social impact and future prospects of robotics and automation in various engineering applications.
CO2	Describe the components and anatomy of robotic system
CO3	Construct the suitable drives and end-effectors for a given robotics application
CO4	Apply robotics concept to automate the monotonous and hazardous tasks and categorize various types of robots based on the design and applications in real world scenarios

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	
CO1	3	2											1			
CO2	3	2											1			
CO3	3	2											1			
CO4	3	2									2		1			

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE):
Refer to - Annexure, SL #1

Semester End Examination (SEE):
Refer to - Annexure, SL #1

VI. Learning Resources

VI(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Robotics Technology and flexible automation	S.R. Deb	2009.	Tata McGraw-Hill Education
2	Industrial Robots - Technology, Programming and Applications	Mikell P. Groover et. al.,	2003	McGraw Hill,

VI(b): Reference Books:

1	Robotics Engineering – An Integrated Approach	Richard D Klafter, Thomas A Chmielewski, Michael Negin,	Eastern Economy Edition.2006	Prentice Hall of India Pvt. Ltd.,
2	Robotics: Control, Sensing, Vision and Intelligence	Fu K S, Gonzalez R C, Lee C.S.G	1987	McGraw Hill
3	A textbook on Industrial Robotics	Ganesh S Hegde	3rdedition, 2017	University science press

VI(c): Web links and Video Lectures (e-Resources):

1. https://roboticscasual.com/ros-tutorial-pick-and-place-task-with-the-moveit-c-interface/
2. https://roboticscasual.com/ros-tutorial-simulate-ur5-robot-in-gazebo-urdf-explained/
3. https://roboticscasual.com/the-best-degrees-to-work-in-robotics/
4. https://roboticscasual.com/robotics-tutorials/
5. https://www.ieee-ras.org/educational-resources-outreach/educational-material-in-robotics-andautomation
6. https://www.academia.edu/20361073/Web_Based_Control_and_Robotics_Education_pdf
7. https://github.com/Developer-Y/cs-video-courses
8. https://www.isa.org/
9. https://www.asme.org/engineering-topics/articles/bioengineering/top-6robotic- applications-inmedicine.

VII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Mini Projects can be given.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	VI	**Course Type:**	ETC		
Course Title: Natural Language Processing					
Course Code:	**23ECE642**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- To learn the fundamentals of natural language processing.
- To understand the various Parsing techniques NLP.
- Identify the various levels in processing of natural language.
- Analyze Natural language Generation and apply machine translation.
- Design an innovative application using NLP Components

II. Teaching-Learning Process :

- Chalk and talk method
- Power point presentation / keynotes
- Videos

III. COURSE CONTENT

III(a). Theory PART

Module-1: Overview and language modeling — 8Hrs

Overview and language modeling:

Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval.

Language Modeling: Various Grammar- based Language Models-Statistical Language Model.
Textbook1: Chapter 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7
Chapter 2:2.1, 2.2, 2.3

Pre-requisites

- Parts of speech.
- Context free grammar.

Self Learning

- Supervised learing
- Data preprocessing and exploration

RBT Levels: L1, L2, L3

Module-2: Word level analysis	8Hrs
Word level analysis: Word Level Analysis: Regular Expressions-Finite State Automata-Morphological Parsing-Spelling Error Detection and correction-Words and Word classes-Part-of Speech Tagging. **Textbook1:Chapter**3:3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7	
Pre-requisites • Parse tree. • Syntax,morphology and phonetics**..** **Self Learning** • linguistic concepts. • POS tagging	
RBT Levels: L1, L2, L3	
Module-3:Syntactic analysis and Extracting Relations from Text: From Word Sequences to Dependency Paths	8Hrs
Syntactic Analysis: Context-free Grammar Constituency- Parsing-Probabilistic Parsing. **Extracting Relations from Text: From Word Sequences to Dependency Paths:** Introduction, Subsequence Kernels for Relation Extraction, A Dependency-Path Kernel for Relation Extraction and Experimental Evaluation. **Textbook1:Chapter**4:4.1, 4.2, 4.3, 4.4, 4.5 **Textbook 2:Chapter** 3**:** 3.1 , 3.2, 3.3, 3.4, 3.5	
Pre-requisites • Kernels. • Knowledge representation **Self Learning** • Markov chain and graph theory.	
RBT Levels:L1, L2, L3	
Module-4: Information Retrieval And Lexical Resources	8Hrs
Information Retrieval And Lexical Resources: Information Retrieval: Design features of Information Retrieval Systems-Classical, Non classical, Alternative Models of Information Retrieval – valuation Lexical Resources: World Net-Frame NetStemmers-POS Tagger- Research Corpora. **Textbook:1** **Chapter 9 :9.1 , 9.2 , 9.3, 9.4, 9.5, 9.6, 9.7** **Chapter 12:12.1, 12.2, 12.3, 12.4, 12.5, 12.6, 12.7**	
Pre-requisites • Linear algebra • Probability and statistics. **Self Learning** • Indexing and query processing.	
RBT Levels:L1, L2, L3	

Module-5: Evaluating Self-Explanations in iSTART	8Hrs

Evaluating Self-Explanations in iSTART:

Word Matching, Latent Semantic Analysis, and Topic Models: Introduction, iSTART: Feedback Systems, iSTART: Evaluation of Feedback Systems,

Textual Signatures: Identifying Text-Types Using Latent Semantic Analysis to Measure the Cohesion of Text Structures:

Introduction, Cohesion, Coh-Metrix, Approaches to Analyzing Texts, Latent Semantic Analysis, Predictions, Results of Experiments.

A Case Study in Natural Language Based Web Search:

InFact System Overview, The GlobalSecurity.org Experience.

Textbook 2:Chapter6:6.1,6.2,6.3,6.4

Chapter 7:7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7, 7.8, 7.9, 7.10, 7.11

Chapter 5:5.1,5.2,5.3,5.4,5.5

Pre-requisites

- Parts of speech.
- Lingustic basics.

Self Learning

- large language models.

RBT Levels:L1, L2, L3

IV. COURSE OUTCOMES

CO1	Comprehend the fundamentals of language model
CO2	Understand the word and sematic analysis
CO3	Illustrate information retrieval techniques.
CO4	Describe the concepts Text mining and **syntactic analysis**

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2	2											2			
CO2	1	1	2										3			
CO3	1	1											2			
CO4	1	1	2										3			

VI. Assessment Details (CIE & SEE)

General Rules: Academic regulations.

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to - Annexure, SL #1
Rubrics: Refer to - Annexure, SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Natural Language Processing and Information Retrieval	Tanveer Siddiqui, U.S. Tiwary	Oxford University Press, 2008.	
2	Natural Language Processing and Text Mining. ,	Anne Kao and Stephen R. Poteet (Eds)	Springer-Verlag London Limited 2007.	

VII(b): Reference Books:

1	Speech and Language Processing: Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition"	Daniel Jurafsky and James H Martin,	2nd Edition, Prentice Hall, 2008.	
2	"Natural Language Understanding"	James Allen,	2nd edition, Benjamin/Cummi ngspublishing company, 1995.	
3	Information Storage and Retrieval systems	Gerald J. Kowalski and Mark.T. Maybury,	Kluwer academic Publishers, 2000.	

VII(c): Web links and Video Lectures (e-Resources):

'Natural Language Processing' Video Lectures from IIT Bombay by Prof. Pushpak Bhattacharyya - Computer Science and Engineering NPTEL Video Lectures
NPTEL :: Computer Science and Engineering - NOC:Natural Language Processing

VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

- Group Discussion/Quiz
- Assignments

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics & Communication Engineering

Semester:	VI	**Course Type:**	ETC		
Course Title: Principles of Machine Learning					
Course Code:	**23ECE643**			**Credits:**	3
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	3

I. Course Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.

II. Teaching-Learning Process (General Instructions):

- Chalk and talk.
- Use https://pythontutor.com/visualize.html#mode=edit in order to visualize the python code / Python Idle.
- Demonstrate and visualize basic algorithms.
- videos.

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction — 08 Hrs

Introduction, Human Learning, Types of Human Learning, what is machine learning, Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-the-Art Languages/Tools in Machine Learning, Issues in machine learning.
Textbook:1 Chapter:1 Sections: 1.1 to 1.9

Pre-requisites: Basic understanding of computer working

RBT Levels: L1 and L2

Module-2: Preparing to Model and Evaluation — 08 Hrs

Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing.
Introduction, selecting a Model, training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model. **Textbook:1 Chapter:2 Sections: 2.1 to 2.6, Chapter: 3 Sections: 3.1 to 3.6**

Pre-requisites: Knowledge of algorithms

RBT Levels: L1 and L2

Module-3: Feature Engineering and Bayesian Concept Learning	08 Hrs

Introduction, Feature transformation, feature subset selection.
Introduction, Why Bayesian Methods are Important, Bayes' Theorem, Bayes' Theorem and Concept Learning.

Textbook:1 Chapter:4 Sections: 4.1 to 4.3, Chapter:6 Sections: 6.1 to 6.4

Pre-requisites: Familiarity with probability distributions, statistical tests, and concepts like mean, variance, and standard deviation

RBT Levels: L1 and L2

Module-4: Supervised Learning	08 Hrs

Classification: Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms.
Regression: Introduction, Example of Regression, Common Regression Algorithms (Simple linear regression and Logistic regression).

Textbook:1 Chapter:7 Sections: 7.1 to 7.5, Chapter: 8 Sections: 8.1,8.2, 8.3.1 and 8.3.7

Pre-requisites: Familiarity with terms like supervised, overfitting, classification.

RBT Levels: L1, L2 and L3

Module-5: Unsupervised Learning	08 Hrs

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering, Finding Pattern using Association Rule.

Textbook:1 Chapter:9 Sections: 9.1 to 9.5

Pre-requisites: Familiarity with terms like unsupervised, clusters.

RBT Levels: L1, L2 and L3

IV. COURSE OUTCOMES

CO1	Explain the various machine learning algorithms and problems
CO2	Interpret the importance of data visualization and analytics solution
CO3	Apply structured thinking to unstructured problems
CO4	Describe the concepts of ML and various classification methods.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	
CO3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	
CO4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations.

Continuous Internal Evaluation (CIE): Refer to Annexure, SL #1

Semester End Examination (SEE): Refer to - Annexure, SL #1
Rubrics: Refer to - Annexure, SL #1

VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	**Machine Learning**	**Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das**	**2019**	**Pearson**
VII(b): Reference Books:				
1	**Marco Gori**	**Machine Learning: A Constraint-Based Approach**	**2017**	**Morgan Kaufmann**
2	**Ethem Alpaydin**	**Introduction to Machine Learning**	**2nd Ed, 2013**	**PHI Learning Pvt. Ltd**
VII(c): Web links and Video Lectures (e-Resources):				
https://onlinecourses.nptel.ac.in/noc23_cs18/preview https://www.coursera.org/courses?query=machine%20learning&productDifficultyLevel=Beginner https://www.udemy.com/topic/machine-learning/?srsltid=AfmBOoqgtD5Sky_V0d9FEay4ti6Xmso-CR_okMArGZ2QarvU3JhVs3_l				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Execution of Machine learning algorithms using python programming language				

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Department of Electronics and Communication Engineering

Semester:	VI	**Course Type:**	ETC		
Course Title: Nano Technology for Engineers					
Course Code:	**23ECE644**			**Credits:**	03
Teaching Hours/Week (L:T:P:O) {O – Other pedagogies, mention @}			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

Students will be able to

1. Gain knowledge of nano structure, properties, manufacturing, and applications of silicon and carbon materials.
2. Understand what nanotechnology is about and Fabrication methods in nanotechnology (top down & bottom up), characterization methods
3. Determine and Diagnosis the Principles of nanotechnology (optical, electrical, AFM, SEM, and TEM)
4. Analyse the Operation of self-Assembled Monolayer's , Semiconductor Quantum dots and Nano Sensor

II. Teaching-Learning Process :

- Chalk And Talk Method
- Power Point Presentation / Keynotes
- Videos

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction of Nanotechnology	8 Hrs

An Overview of Nanotechnology: Historical background – nature, scope and our Technologies and world we live in , Nano Beginning ,Experimental techniques and methods: For investigation and manipulating materials in the nano scale – electron microscope – scanning probe microscope – optical and other microscopes
Textbook 1: Chapter:1 sections: 1.1-1.3
Textbook:1 Chapter:2 sections : 2.1-2.5

Pre-requisites (Self Learning)

RBT Levels: L1 , L2

Module-2: Carbon Nano tubes:	8 Hrs
Carbon Nano tubes: Synthesis and purification – filling of nano tubes – mechanism of growth – electronics structure – transport properties – mechanical and physical properties – applications **Textbook:1 Chapter:4 sections : 4.1-4.10**	
Pre-requisites (Self Learning)	
RBT Levels: L1 , L2	
Module-3: self-Assembled Monolayer's and Semiconductor Quantum dots	8 Hrs
self-Assembled Monolayer's: Monolayer's on gold – growth process – phase transitions – patterning monolayer's – mixed Monolayer's – applications. Semiconductor Quantum dots: Synthesis – electronic structure of nano crystals – how quantum dots are studied – correlation of properties with size – uses **Textbook:1 Chapter:5 sections : 5.1-5.6** **Textbook:1 Chapter:7 sections : 7.1-7.6**	
Pre-requisites (Self Learning)	
RBT Levels:L1, L2, L3	
Module-4: Monolayer and Core Shell Nano Particles	8 Hrs
Monolayer – Protected Metal Nano particles: Method of preparation – characterization – functionalized metal nano particles – applications- super lattices. Core-Shell Nano particles: Types – characterization – properties – applications. Nano shells – Types – Characterization – Properties – Applications. **Textbook:1 Chapter:8 sections : 8.1-8.6** **Textbook:1 Chapter:9 sections : 9.1-9.5** **Textbook:1 Chapter:10 sections : 10.1-10.5**	
Pre-requisites (Self Learning)	
RBT Levels:L1, L2, L3	
Module-5: Introduction to Nano Sensor	8 Hrs
Introduction to Nano Sensor What is a Sensor, Nanosensors,Order from Chaos—Nanoscale Organization for Sensors Characterization—To Know What has been Put In, Perception—Nanosensors Based on Optical Properties ,Nanosensors Based on Quantum Size Effects, Electrochemical Sensors, Sensors Based on Physical Properties, Nanobiosensors—A Step towards Real-time Imaging and Understanding of Biological Events, Smart Dust—Sensors of the Future **Textbook:1 Chapter:12 sections : 12.1-12.11**	
Pre-requisites (Self Learning)	
RBT Levels:L1, L2, L3	

IV. COURSE OUTCOMES

CO1	Describe the basic Concepts of nano structure, properties, manufacturing, and applications of silicon and carbon materials.
CO2	Comprehend the concepts nanotechnology is about and Fabrication methods in nanotechnology (top down & bottom up), characterization methods
CO3	Apply the concepts of Nanotechnology to Diagnosis the Principles of nanotechnology (optical, electrical, AFM, SEM, and TEM)
CO4	Examine the function of self-Assembled Monolayer's , Semiconductor Quantum dots and Nano Sensor

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	POS1	POS2	POS3	POS4
CO1	3	3											3	2		
CO2	3	3	3										3	2		
CO3	3	2	3										2	3		
CO4	3	2	3										2	3		

VI. Assessment Details (CIE & SEE)

General Rules: Refer to Academic Regulations

Continuous Internal Evaluation (CIE): Refer to Annexure SL #1

Semester End Examination (SEE): Refer to Annexure SL #1

VII. Learning Resources

VII(a): Textbooks:

Sl. No.	Title of the Book	Name of the author	Edition and Year	Name of the publisher
1	Nano: The Essentials understanding Nano Science and Nano Technology	T Pradeep	2007	Tata McGraw-Hill Publishing Company Limited NEW DELHI

VII(b): Reference Books:

1	Nanotechnology	Richard Booker & Earl Boysen;	2005	Wiley (2005)
2	Introduction to Nano scale Science and Technology	Di Ventra, et al (Ed);	2004	Springer

VII(c): Web links and Video Lectures (e-Resources):

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VIII: Activity Based Learning / Practical Based Learning/Experiential learning:

Seminar, assignments, quiz

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Accredited by NAAC with 'A+'grade, Certified by ISO 9001 - 2015
Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	VI	**Course Type:**	AEC		
Course Title: Research Methodology & IPR					
Course Code:	**23RMAE61**			**Credits:**	03
Teaching Hours/Week (L:T:P:O)			3:0:0:@	**Total Hours:**	40
CIE Marks:	50	**SEE Marks:**	50	**Total Marks:**	100
SEE Type:	Theory			**Exam Hours:**	03

I. Course Objectives:

- To Understand the knowledge on basics of research and its types.
- To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
- To learn Ethics in Engineering Research.
- To Discuss the concepts of Intellectual Property Rights in engineering.

II. Teaching-Learning Process :

- Chalk and talk method
- Power point presentation / keynotes
- Videos

III. COURSE CONTENT

III(a). Theory PART

Module-1: Introduction — **08 Hrs**

Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.

Textbook 1 : Chapter1 : sections: 1.1,1.2,1.3,1.4
Textbook 1 : Chapter5 : sections: 5.1,5.2,5.3

Self Learning : Case Studies

RBT Levels: L2

Module-2: Literature Review and Technical Reading — **08 Hrs**

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

Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in,

Books Dissertations, Dedication or Acknowledgments.

Textbook1: Chapter2: sections: 2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,2.10
Textbook1: Chapter3: sections: 3.1,3.2,3.3,3.4

Self Learning : Case Studies

RBT Levels: L2

Module-3: Introduction To Intellectual Property	08Hrs

Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.

Patents: Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting.

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

Textbook2: Chapter1: sections:1.1,1.2,1.3,1.4,1.6
Textbook2: Chapter2: sections:2.1 (2.1.1 to 2.1.9)

Self Learning : Case Studies

RBT Levels: L2

Module-4: Copyrights and Related Rights	08 Hrs

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases.

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Textbook2: Chapter2: sections: 2.2 (except 2.2.6)
Textbook2: Chapter2: sections:2.3 (2.3.1 to 2.3.10, 2.3.14)

Learning : Case Studies

RBT Levels: L2

Module-5: Industrial Designs	**08 Hrs**

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

Textbook2: Chapter2: Sections : 2.4, 2.5 (2.5.1 – 2.5.13)

Self Learning : Case Studies

RBT Levels:L2

IV. COURSE OUTCOMES

CO1	Understand the importance of engineering research and its ethics.
CO2	Interpret the fundaments of Literature Review and Technical Reading.
CO3	Outline the fundamentals of patens laws and drafting procedure.
CO4	Illustrate the copyright laws and basic principles of design rights.

V. CO-PO-PSO MAPPING (mark H=3; M=2; L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3	S4
CO1	2							2		1		2				
CO2	2							3		3		2				
CO3				2				3	2	2		3				
CO4								3	2	2		3				

VI. Assessment Details (CIE & SEE)

General Rules: Refer to – Academic regulations

Continuous Internal Evaluation (CIE):
Refer to Annexure, SL #5
Rubrics: Refer to Annexure, SL #5

Semester End Examination (SEE):
Refer to - Annexure, SL #5
Rubrics: Refer to - Annexure, SL #5

VII. Learning Resources				
VII(a): Textbooks:				
Sl. No.	**Title of the Book**	**Name of the author**	**Edition and Year**	**Name of the publisher**
1	Engineering Research Methodology	Dipankar Deb, Rajeeb Dey, Valentina E. Balas	ISSN 1868- 4394 ISSN 1868-4408 (electronic)	Intelligent Systems Reference Library, ISBN 978-981-13- 2946-3 ISBN 978-981-13-2947-0 (eBook),
2	Intellectual Property A Primer for Academia	Prof. Rupinder Tewari Ms. Mamta Bhardwaj	2021	Publication Bureau, Panjab University Chandigarh-160014, India
VII(b): Reference Books:				
1	Research Methods for Engineers	David V. Thiel	978-1-107-03488-4	Cambridge University Press
2	Intellectual Property Rights	N.K.Acharya	ISBN: 978-93-81849-30-9	Asia Law House 6th Edition
VII(c): Web links and Video Lectures (e-Resources):				
https://www.youtube.com/watch?v=5fvpsqPWZac http://kcl.digimat.in/nptel/courses/video/109106137/L68.html http://kcl.digimat.in/nptel/courses/video/109106137/L72.html http://acl.digimat.in/nptel/courses/video/109106137/L04.html				
VIII: Activity Based Learning / Practical Based Learning/Experiential learning:				
Quizzes, Assignments, Seminars				

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	VI	**Course Type:**	HSMC		
Course Title: Social Connect Responsibility					
Course Code:	**23SCRH08**	**Credits:**			01
Teaching Hours/Week (L: T: P: O)		1:0:0:0	**Total Hours:**		15
CIE Marks:	50		**Total Marks:**		50

I. Course Objectives:

- This course aims to familiarize students with the dynamics of society and importance of conscious participation in the formation of an ideal society
- The course enables students to critically analyze the social processes of globalization, modernization and social change, and its impact on the socio-cultural system.
- The course aims to develop socially responsible engineers by engaging them in real-world social issues, analyzing their impact, proposing innovative solutions, and effectively documenting their findings.
- The course enables students to create a responsible connection with the society.
-

II. Teaching-Learning Process (General Instructions):

This course is designed to provide students with hands-on learning experiences that foster social awareness, critical thinking, and problem-solving skills. Teachers play a crucial role in guiding students through real-world issues and encouraging innovative, ethical solutions.

1. Foster an Experiential Learning Approach
   - Encourage field visits, case studies, and real-world problem analysis rather than relying solely on theoretical lectures.
   - Use problem-based learning (PBL) where students actively engage with a community issue and work towards solving it.
2. Facilitate Active Student Engagement
   - Conduct brainstorming sessions to help students identify and understand societal problems.
   - Promote group discussions and debates on contemporary social issues.
3. Encourage Innovative & Feasible Solutions
   - Help students explore technology-driven solutions using engineering principles.
   - Promote a multi-disciplinary approach, integrating environmental, social, and economic aspects.
4. Promote Community Interaction & Implementation
   - Guide students to collaborate with NGOs, local communities, or government agencies.
   - Ensure that students test their solutions in real-world settings and collect feedback.
   - Emphasize the importance of ethical considerations in community engagement.
5. Train Students in Documentation & Reporting
   - Teach students how to prepare structured reports on their findings, solutions, and implementation outcomes.
   - Encourage presentations, digital storytelling, and video documentation for effective communication.
   - Provide constructive feedback on student projects and ensure continuous improvement.

III. COURSE CONTENT

Module-1:Introduction to Social Connect Responsibility — 03Hrs

1. Identify the factors comprising the socio-cultural system and its impact on society
2. The concept of inter-relatedness of society and culture, socio-cultural dimensions, factors contributing to socio-cultural evolution.
3. Identifying problems in areas such as education, healthcare, environment, and infrastructure.

Module-2: Understanding Social Issues — **03 Hrs**

1. Understanding societal challenges in local and global contexts.
2. Role of engineers in addressing these issues.
3. Conducting preliminary field surveys and interviews

Module-3: Analyzing the Social Problem — **03 Hrs**

1. Understanding the economic, environmental, and societal impact of the problem
2. Ethical and moral considerations in problem-solving by Interaction with stakeholders (community members, NGOs, government bodies)
3. Root cause analysis using tools like SWOT, Fishbone Diagram, and Case Studies.

Module-4: Proposing Engineering Solutions — **03 Hrs**

1. Application of engineering knowledge to develop feasible solutions.
2. Use of technology for social good (IoT, AI, Renewable Energy, Smart Systems, etc.).
3. Sustainable and cost-effective approaches.
4. Feasibility analysis and implementation strategies.

Module-5: Documentation & Reporting — **03 Hrs**

1. Preparing a structured report with problem identification, analysis, proposed solutions, and implementation insights.
2. Creating presentations, videos, and other forms of project documentation.
3. Reflecting on personal learning and the social impact of the project.
4. Submission of a final report and group presentation.

IV.COURSE OUTCOMES

CO1	Students will be able to recognize and define real-world social issues, assessing their relevance and impact on communities.
CO2	Students will develop analytical skills to investigate the root causes of social problems and evaluate their economic, environmental, and ethical implications.
CO3	Students will apply engineering principles and innovative thinking to propose feasible, sustainable, and technology-driven solutions for identified social issues.
CO4	Students gain from stakeholder's interaction and develop presentation skills.

V.CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1			1			2	1	1	1			1
CO2			1			1	2	1	1			1
CO3			1			2	2	1	1			1
CO4			1			2	1	1	1			1

VI. Formative Assessment Details (CIE)
Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure section -8***
VII. Learning Resources
VII (a). Reference Books : 1. C. N. Shankar Rao (2006) Sociology of Indian Society, 2nd, S. Chand publication 2. Nandan Nilekani, Imagining India: The Idea of a Renewed Nation, Penguin Books, 2009. 3. Gurcharan Das, India Unbound: From Independence to the Global Information Age, Anchor Books, 2002. 4. Raghuram G. Rajan, I Do What I Do, Harper Business, 2017.
VIII. Activity Based Learning
1. **Community Survey:** Students visit local communities (rural/urban) to identify real social issues (sanitation, education, healthcare, infrastructure) 2. **Collaboration with NGOs & CSR Units:** Partner with organizations working on social impact projects. 3. **Sustainability Planning:** Students draft plans for scaling up their solutions in a sustainable manner. 4. **Video Documentation:** Create short films showcasing their social project progress and community feedback.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	VI	**Course Type:**	NCMC		
Course Title: Physical Education –Sports and Athletics.					
Course Code:	**23PASN01**			**Credits:**	00
Teaching Hours/Week (L: T: P: O)		0:0:0:2	**Total Hours:**		25 Hrs
CIE Marks:	50		**Total Marks:**		50

I. Course Objectives:

- To Improve the student's Physical and mental health.
- Understand the meaning, Importance and benefits of the fitness.
- To create awareness of fitness among the student's.

II. Teaching-Learning Process (General Instructions):

- Use lectures and demonstrations to introduce new concepts, techniques, and rules. this is especially important for explaining complex skills or strategies.
- Show correct techniques and movements for sports skills and exercises. allow students to observe and practice.
- Engage students through hands-on activities and drills. This includes practicing sports skills, participating in games, and performing fitness exercises.

III. COURSE CONTENT

Module-1 :Moral Values in Sports	5 Hrs
A. Moral Values in Sports and Games	
RBT Levels: L2 & L3	
Module-2 :Specific Games court Measurements	5 Hrs
A. Kho-Kho B. Table Tennis.	
RBT Levels:L1, L2 & L3	
Module-3: Track & Field	5 Hrs
A. Athletics - Track & Field Events	
RBT Levels: L2 & L3	
Module-4: Specific Games (Any one to be selected by the student)	5 Hrs
A. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. B. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. C. Athletics (Track / Field Events) – Any event as per availability of Ground.	
Module-5: Role of Organisation and administration	5 Hrs
A. Organization of Inter Branch Sports Events. B. Report presentation and Records Administers.	

IV. COURSE OUTCOMES

CO1	Understand the basic principles and practices of physical Education and sports.
CO2	To develop the Physical Activities and sports practices for Healthy Living.
CO3	To develop sportsmanship among students to conduct, organize and officiate Physical Education and sports events at Colleges and community level.
CO4	To provide experiential learning in sports & games
CO5	Understand to organise the sports & games

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1						2		2	3			
CO2						2		2	3			**1**
CO3						2		2	3			
CO4						2		2	3			**1**
CO5						2		2	3			

VI. Assessment Details (CIE)

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure section -8***

VII. Learning Resources

VII(a): Reference Books:

Sl. No.	Title of the Book	Name of the author	Name of the publisher	Edition and Year
1.	Health , Exercise and Fitness	Muller, J P	Delhi, Sports	2000
2.	Play Field Manual	Anaika	Friends Publication Delhi	2005
3	Track and field Marking and Athletics Officiating Manual	M J Vishwanath	Silver Star Shimoga	2002
4.	Complete conditioning for Volleyball	Steve Oldenburg	Human Kinetics	2015
5	IAAF Manual			

VII(b). Web links and Video Lectures (e-Resources):

- https://www.caluniv.ac.in/cbcs-ug/ug-files/UG-Physical-Edu.pdf
- https://books.google.co.in/books/about/Athlete_s_Guide_to_Career_Planning.html?id=lUp5QgAACAAJ&redir_esc=y
- https://www.youtube.com/watch?v=dczxtSt1Kjk
- https://youtube.com/watch?v=TXGejZBgNeo

VIII. Activity Based Learning

Participation, Quiz, Presentation, Assignments &Models .

Semester:	VI	**Course Type:**	NCMC		
Course Title: Yoga					
Course Code:	23YOGN02			**Credits:**	0
Teaching Hours/Week(L:T:P:O)		0:0:0:2		**Total Hours:**	25 Hrs
CIE Marks:	50	**Total Marks:**	50		

I. Course Objectives:

This course will enable students to:

- To enable the student to have good health.
- To practice mental hygiene.
- To possess emotional stability.
- To integrate moral values.
- To attain higher level of consciousness.
- Enable students to do regular practice

II. Teaching-Learning Process (General Instructions):

- **Demonstration**
- **PPT**
- **Expert Discourse**

III.COURSE CONTENT

Module-1: Higher Yogic States	**5 Hrs**

- Study of Dharana,
- Dhyana (Meditation), and Samadhi Samadhi

Pre-requisites: Completion of Semester V.

RBT Levels:L1, L2

Module-2: Advanced Asana Techniques	**5 Hrs**

- Detailed asana practice with a focus on technique,
- precautions, and benefits.

Pre-requisites: Understanding of advanced asanas from previous semesters.

RBT Levels: L1,L2

Module-3: Asana Practice	**5 Hrs**
○ **Sitting:** Bakasana, Hanumanasana, Ekapada Rajakapotasana, Yogamudra in Vajrasana. ○ **Standing:** Garudasana. ○ **Balancing:**Veerabhadrasana, Sheershasana. ○ **Supine:**Sarvangasana, SetubandhaSarvangasana, Shavasana (Relaxation posture).	
Pre-requisites: Completion of Module 2.	
RBT Levels: L1,L2, L3	
Module-4: Advanced Pranayama	**5 Hrs**
○ Kapalabhati practice: 80 strokes/min, 3 rounds. ○ Pranayama types: Bhastrika, Bhramari.	
Pre-requisites: Basic Pranayama practice from Semester V.	
RBT Levels: L1,L2, L3	
Module-5: Shatkriya Techniques	**5 Hrs**
○ Study of Shatkriyas: meaning, importance, technique, and benefits. ○ Techniques covered:Theory on: Jala Neti, Sutra Neti, Nauli (for men), Sheetkarma, and Kapalabhati practice.	
Pre-requisites: Completion of Modules 1-4.	
RBT Levels: L1,L2, L3	

IV.COURSE OUTCOMES

CO1	Achieve proficiency in advanced asanas and pranayama techniques, demonstrating a deep understanding of their practice and benefits
CO2	Integrate higher yogic practices such as Dharana, Dhyana, and Samadhi to deepen meditation and concentration skills.
CO3	Apply advanced Shatkriya techniques to purify the body and enhance overall yogic practice.

V.CO-PO-PSOMAPPING(mark H=3;M=2;L=1)

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12	S1	S2	S3
CO1	-	-	-	-	-	1	2	3	2	1	2	3	-	-	3
CO2	-	-	-	-	-	1	2	3	2	1	2	3	-	-	3
CO3	-	-	-	-	-	1	2	3	2	1	2	3	-	-	3

VI. Assessment Details (CIE)
Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure -8***
VII. Learning Resources
VII (a). Reference Books :
1. **Yoga pravesha in Kannada by Ajitkumar** 2. **Light on Yoga by BKS Iyengar** 3. **Teaching Methods for Yogic practices by Dr.M L Gharote & Dr. SK Ganguly** 4. **Yoga Instructor Course handbook published by SVYASA University, Bengaluru** 5. **Yoga for Children –step by step–by Yamini Muthanna**
VII(b): Web links and Video Lectures(e-Resources):
1. **https://youtu.be/KB-TYlgd1wE** 2. **https://youtu.be/aa-TG0Wg1Ls**
VIII: Activity Based Learning/Practical Based Learning/Experiential learning:
Seminar,Assignments,Quiz,casestudies,self-studyactivities,groupdiscussions

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Semester:	VI	**Course Type:**	NCMC		
Course Title: NSS-National Service Scheme					
Course Code:	**23NSSN03**	**Credits:**			0
Teaching Hours/Week (L: T: P: O)		0:0:0:2	**Total Hours:**		25 Hrs
CIE Marks:	50		**Total Marks:**		50

I. Course Objectives:

National Service Scheme (NSS) will enable the students to:

- Identify the needs and problems of the community and involve the minproblem–solving.
- Develop among them a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
- Develop competence required for group-living and sharing of responsibilities & gain skills
- in mobilizing community participation to acquire leadership qualities and democratic attitudes.

II. Teaching-Learning Process (General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course out comes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted, so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in society and provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning activities and documenting student's progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

III. COURSE CONTENT

Module-1: Health and Nutrition Programmes	5 Hrs

1. Working with people in nutrition programmes
2. Provision of safe and clean drinking water.
3. Health education and preliminary health care

Module-2: Family Welfare Programmes	5 Hrs

1. AIDS awareness and preliminary health care.
2. Free Health and Eye Check-up Camps.
3. Organizing Blood donation Camps and Yoga programs.

Module-3: Social Service Programmes	5 Hrs

1. Work in institutions meant for physically and mentally handicapped.
2. Work in orphanages, homes for the aged etc.
3. Prevention of slums through social education and community action

Module-4: Awareness Programmes	5 Hrs

1. Plastic Awareness and Cleaning programmes.
2. Rally programmes.
3. Community service Programmes.

Module-5: General NSS Programmes	5 Hrs

1. Orientation Programmes.
2. Free computer training program for Govt. School Students.
3. Debate, Essay Writing, Pick and Speech and Cross Word Competitions, etc., conducting on occasions of State and National importance.

IV. COURSE OUTCOMES

CO1	Understand the importance of his / her responsibilities towards health and family.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and propose practical solutions for the same for sustainable development.
CO4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general

V.CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1						2		1	1			
CO2						1		1	1			1
CO3						2		1	1			
CO4						2		1	1			1

VI. Formative Assessment Details (CIE)

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure section -8***

VIII. Learning Resources

VII (a). Reference Books :

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

IX. Activity Based Learning

Participation, Execution of Activities, Presentation, Assignments & Models.

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Recognized by UGC, New Delhi with 2(f) & 12 (B)

Semester:	VI	**Course Type:**	NCMC		
Course Title: NCC-National Cadet Corps					
Course Code:	**23NCCN04**	**Credits:**			0
Teaching Hours/Week (L: T: P: O)		0:0:0:2	**Total Hours:**		25 Hrs
CIE Marks:	50		**Total Marks:**		50

I. Course Objectives:

- To develop qualities of Character, Courage, Comradeship, Discipline, Leadership, Secular Outlook, Spirit of Adventure and Sportsmanship, besides the ideals of Selfless Service among the youth to make them useful citizens.
- Emphasize on practical training with examples from India's freedom struggle and wars fought by India, post-independence, supplement relevant subjects to generate secular and patriotic fervor.
- To create human resources of organized, trained and motivated youth, provide leadership in all walks of life including the Armed Forces and always be available for the service of the Nation.
- The prime objective of NCC course is to build a strong youth force that aims at 'Nation Building'.

II. Teaching-Learning Process (General Instructions):

1. In addition to the traditional lecture method, with the aim to nurture core values, develop self-confidence, enhance awareness, leadership qualities and give exposure to basic military skills and knowledge.
2. Institutional training is imparted by regular NCC parades in college before/after teaching hours.
3. Grading assignments and quizzes and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.

III. COURSE CONTENT

Module-1: Personality Development – II	5 Hrs
Public Speaking, Critical and creative thinking, Decision making and problem Solving **Textbook:1Chapter:5, Section: 1-11**	
RBT Levels:L2	
Module-2:Health & Hygiene	5 Hrs
Hygiene and Sanitation, First aid in common Medical Emergencies and treatment of wounds, Environmental awareness and Conservation **Textbook:1 Chapter:3 (a), Section: 1-9**	
RBT Levels: L1, L2	

Module-3: Armed Forces	5 Hrs
Basic organisation of Armed Forces, Organisation of Army, Command HQ, Badges and Ranks, Task and Role of Fighting Arms, Supporting Arms and Services, Modes of Entry to Army, Honors and Awards, **Textbook:2Unit:1, Section: 1-7, Unit: 2, Section: 1-3, Unit: 3, Section: 1-2, 8-10.**	
RBT Levels:L1, L2	
Module-4: Map Reading	5 Hrs
Definition of Map, Conventional Signs, Scale and grid systems, Topographical forms and technical terms, Cardinal points, Types of North. **Textbook:2Unit:1, Section: 1-7, Unit: 2, Section: 1-3, Unit: 3, Section: 1-2, 8-10.**	
RBT Levels: L2, L3	
Module-5: Social Service and Adventure activities	5 Hrs
Weaker Sections of our Society and their Needs, Social Service and its Need, Contribution of Youth towards Social Welfare. Introduction to adventure activities, Trekking, Cycle Expedition, Para sailing. **Textbook:1 Chapter:7, Section: 1-2,6; Chapter: 9, Section: 1-4**	
RBT Levels: L2, L3	

IV. COURSE OUTCOMES

CO1	Understand qualities Character, Comradeship, Discipline, Ethics and Ideals of Selfless Service in developing individual as a Leader.
CO2	Understand the essence of implementing drills with arms as the foundation for physical and mental fitness.
CO3	Acquire an insight into lifestyle of armed forces and Conventional Signs, Field Craft and Battle Craft involved in using them in defence forces.
CO4	Understand individual responsibility in Disaster Management and equipped themselves to provide solutions.
CO5	Develop awareness on issues related to conservation of Environment, Social and Community development.

V. CO-PO-PSO MAPPING

PO	1	2	3	4	5	6	7	8	9	10	11	12
CO1								3	3	2		1
CO2									3	2		1
CO3	3	2	1		1	1			2	2		1
CO4	3	1	1			1	1		2	2		1
CO5	3	1	1			1	1		2	2		1

VI. Formative Assessment Details (CIE)
Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure -8***
VII. Learning Resources
VII (a). Textbooks: 1. Cadet's Handbook-Common subject for all wings, NCC Directorate, Bhubaneswar. 2. National Cadet Corps, Head Quarters DG NCC, Delhi. 3. NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations, R Gupta, Ramesh Publishing House, 2020.
VII (b). Web links (e-Resources): **1.** https://indiancc.mygov.in/
VIII . Activity Based Learning
Drills, Assignments, Quiz, Presentation.

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Semester:	VI	**Course Type:**	NCMC		
Course Title: Indian Knowledge System					
Course Code:	**23IKSN05**		**Credits:**		0
Teaching Hours/Week (L: T: P: O)		0:0:0:2	**Total Hours:**		25 Hrs
CIE Marks:	50		**Total Marks:**		50

I. Course Objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

II. Teaching-Learning Process (General Instructions):

1. In addition to the traditional lecture method, innovative teaching methods shall be adopted.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Grading assignments and quizzes and documenting students' progress.
4. Encourage the students for group learning to improve their creative and analytical skills.

III. COURSE CONTENT

Module-1: Solar Eclipse	5 Hrs
How a solar eclipse is caused, Saros and Metonic cycles. **Textbook :2 Chapter: 14**	
RBT Levels: L1, L2	
Module-2: Transits	5 Hrs
Introduction, Venus Transit of June 8, 2004, Mercury Transit of November 8/9, 2006 **Textbook :2 Chapter: 15**	
RBT Levels: L1, L2	
Module-3: Lunar Occultation of Planets	5 Hrs
Introduction, Occultation of Venus **Textbook :2 Chapter: 17**	
RBT Levels: L1, L2	

Module-4: Indian Astronomical Tables.	5 Hrs
Introduction, Astronomical tables of Karnataka.	
Textbook :2 Chapter: 20	
RBT Levels: L1, L2	
Module-5: Vakya Tables	5 Hrs
Determination of Mesa Sankranti **Textbook :2 Chapter: 20**	
RBT Levels: L1, L2	

IV. COURSE OUTCOMES

CO1	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2	Appreciate the need and importance of protecting traditional knowledge.
CO3	Recognize the relevance of Traditional knowledge in different domains.
CO4	Establish the significance of Indian Knowledge systems in the contemporary world.

V. CO-PO-PSO MAPPING

PO/PSO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2							3				1
CO2						2						
CO3			2	2								
CO4						3	2					

VI. **Formative Assessment Details (CIE)**

Continuous Internal Evaluation (CIE)& Rubrics: ***Refer to Annexure -8***

VII .Learning Resources

VII (a). Textbooks:

Sl. No.	Title of the Book	Name of the author	Name of the publisher	Edition and Year
1	Indian Mathematics and Astronomy	Dr.Balachandra Rao,	Jnanadeep	revised 3rd Edn 2014
2	Indian Astronomy : Concepts and Procedures	Dr.Balachandra Rao,	M P Birla Institute of Management	2014

VII (b) : Reference Book:

3	Eclipses in Indian Astronomy	Dr.Balachandra Rao, Dr.Padmaja Venugopal	Gandhi Centre	2008
4	Transits and Occultations in Indian Astronomy	Dr.Balachandra Rao, Dr.Padmaja Venugopal	Bhavan's Gandhi Centre of Science and Human Values	2009
5	Hindu Mathematics and Astronomy	Datta B B and Singh A N	Asia Publishing House	1962

VII (c). Web links and Video Lectures (e-Resources):

1. https://www.bvbgandhicentre.org/bookstore/sku/indian-mathematic
2. https://www.bvbgandhicentre.org/bookstore/sku/eclipses
3. https://www.bvbgandhicentre.org/bookstore/sku/transit
4. https://www.youtube.com/results?search_query
5. https://www.youtube.com/results?search_query

VIII. Activity Based Learning

Assignments, Quiz, Presentation.

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ANNEXURE

CIE & SEE evaluation for Autonomous Scheme 2023 – UG

Note: Revised as per approvals of 4th Academic Council Meeting held on 05/02/2025

S. #	Course Type /Credits	Continuous Internal Evaluation (CIE)																					Semester End Examination (SEE)									Min. pass % (CIE + SEE)
		Total CIE marks	Min. Eligty.	I. Theory Component									II. Practical Component									Total CIE marks	Dur. In hrs.	Theory			Practical			Total SEE marks	
						A. Unit test			B. Formative Assessments			Tot. Theory marks (I)			C. Weekly Evaluation		D. Internal Test			E. Prj	Tot. marks (II)				Max. conducted marks	Max. considered marks	min. pass %	Max. conducted marks	Max. considered marks	min. pass %		
				Marks	Min. Eligty.	Nos.	Marks / Each	Tot.	Nos.	Marks / Each	Tot.		Marks	Min. Eligty.	Each week	Tot. marks	Nos.	Marks / Each	Total marks	Marks												
1	BSC/ESC/PCC/ETC /PEC/OEC (3 or 4 Credit courses)	50	40%	50	40%	2	50	50 (avg. of 2)	2	50	50 (avg. of 2)	50 (avg. of A & B)	--	--	--	--	--	--	--	--	--	50 (I)	03	100	50	35%	--	--	--	50	40%
2	IBSC/IESC/IPCC/ ETC (4 Credit courses)	50	40%	50	40%	2	50	50 (avg. of 2)	2	50	50 (avg. of 2)	50 (avg. of A & B)	50	40%	50	50 (Avg. of all)	1	50	50	50	50 (Avg. of C & [D or E])	50 (Avg. of I & II)	03	100	50	35%	--	--	--	50	40%
3	IESC - CAED (4 credit course)	50	40%	--	--	--	--		--	--		--	50	40%	50	50 (Avg. of all)	1	50	50	--	50 (Avg. of C & D)	50	03	--	--	--	100	50	35%	50	40%
4	PCCL (1 Credit courses)	50	40%	--	--	--	--		--	--		--	50	40%	50	50 (Avg. of all)	1	50	50	50	50 (Avg. of C & [D or E])	50 (II)	03	--	--	--	100	50	35%	50	40%
5	AEC- IDT, Skill Development courses (1 credit course)	50	40%	50	40%	1	50		1	50		50 (Avg. of 2)	--	--	--	--	--	--	--	--	--	50 (I)	02	50	50	35%	--	--	--	50	40%
6	HSMC- CIP, Env studies, SFH, UHV (1 credit course)	50	40%	50	40%	1	50		1	50		50 (Avg. of 2)	--	--	--	--	--	--	--	--	--	50 (I)	02	50	50	35%	--	--	--	50	40%
7	HSMC - English, Kannada (No credits)	50	40%	50	40%	1	50		1	50		50 (Avg. of 2)	--	--	--	--	--	--	--	--	--	50 (I)	--	--	--	--	--	--	--	--	40%
8	NCMC - Personality Development courses, PE, Yoga, NCC, NSS, IKS (No credits)	50	40%	50	40%	--	--		1	50		50	--	--	--	--	--	--	--	--	--	50 (I)	--	--	--	--	--	--	--	--	40%

 # Formative (Successive) Assessments: Assignments/quiz/ seminars/field survey and report presentation/course project/group discussions/etc. based on the faculty & dept. planning. **# Practical Conduction:** The conduction of each experiment/program per week should evaluate for 50 Marks and average of all shall be taken. **# In case of Integrated course,** minimum eligibility shall be attained as prescribed in both the theory and practical components.
 # Self Learning Courses (SLC) Courses, Internship, Mini project & Major Project: Rubrics & Methodology shall be defined seperately

Academic Dean 10/2/25

Principal 10.2.2025

Academic Director 10/2/25

ANNEXURE

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CIE and SEE guidelines for Autonomous Scheme 2023 –ಆ೬

Note: Revised as per approvals of 4th Academic Council Meeting held on 05/02/2025

Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)	Final Passing requirement
1. BSC/ESC/PCC/ ETC/PEC/OEC – Theory Course (03 & 04 Credit courses)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.		
Continuous Internal Evaluation: The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). CIE will be conducted by the department and it will have only 01 component (I): **I. Theory component:** Theory Component will consist of A. Internal Assessment Test (IAT). B. Formative Assessments (FA). **A. Internal Assessment Test:** i) There are 02 tests each of 50 marks conducted during 8th week & 15th week, respectively. ii) The question paper will have four questions (max of 3 sub questions) from the notified syllabus. Each question is set for 25 marks. iii) The student must answer 2 full questions (one from 1st & 2nd questions and another from 3rd & 4th question).	**Semester-End Examination:** The minimum passing mark for SEE is 35% of the maximum marks (18 out of 50 marks). Duration of 03 hours and total marks of 100. i) The question paper will have ten questions. Each question is set for 20 marks. ii) There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module. iii) The students have to answer 5 full questions, selecting one full question from each module. iv) Marks scored shall be proportionally reduced to 50 marks.	The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together.

Academic Dean 10/2/25

Principal 10.2.2025

Academic Director 10/2/25

iv) IAT QP shall be designed to attain the different levels of Bloom's taxonomy as per the outcomes defined for the course. **B. Formative assessments:** i) 02 formative assessments each of 50 marks shall be conducted by the course coordinator based on the dept. planning during random times. ii) One formative assessment shall be completed before 5th week and second shall be completed before 12th week. iii) The syllabus content for the formative assessment shall be defined by the course coordinator. iv) The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc. v) The assignment QP or Quiz QP shall indicate marks of each question and the relevant COs & RBT levels. vi) The rubrics required for the other type of formal assessments shall be defined by the departments along with mapping of relevant COs & POs and get it approved from academic dean. **The final CIE marks will be 50:** CIE = Avg. {Avg. of two tests + Avg. of two FA} **The documents of all the assessments shall be maintained meticulously.**		
2. IBSC/IESC/IPCC– Integrated with Theory & Practical (04 credit courses), ETC (if offered as integrated course)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.		
Continuous Internal Evaluation: The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). Minimum eligibility of 40% marks shall be attained separately in both the theory component and practical component. CIE will be conducted by the department and it will have 02 component: I. Theory Component. II. Practical Component. **I. Theory Component:** Theory component will consist of A. Internal Assessment Test (IAT). B. Formative assessments (FA).	The minimum passing mark for SEE is 35% of the maximum marks (18 out of 50 marks). **Semester-End Examination:** Only theory SEE for duration of 03 hours and total marks of 100. i) The question paper will have ten questions. Each question is set for 20 marks. ii) There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.	The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together.

A. Internal Assessment Test: i) There are 02 tests each of 50 marks conducted during 8th week & 15th week, respectively. ii) The question paper will have four questions (max of 3 sub questions) from the notified syllabus. Each question is set for 25 marks. iii) It is suggested to include questions on laboratory content in the Internal Assessment test Question papers. iv) The student must answer 2 full questions (one from 1st & 2nd questions and another from 3rd & 4th question). v) IAT QP shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course. **B. Formative assessments:** i) 02 formative assessments each of 50 marks shall be conducted by the course coordinator based on the dept. planning during random times. ii) One formative assessment shall be completed before 5th week and second shall be completed before 12th week. iii) The syllabus content for the formative assessment shall be defined by the course coordinator. iv) The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc. v) The assignment QP or Quiz QP shall indicate marks of each question and the relevant COs & RBT levels. vi) The rubrics required for the other type of formal assessments shall be defined by the departments along with mapping of relevant COs & POs and get it approved from academic dean. **II. Practical Component:** **C.** Conduction of each experiment/program should be evaluated for 50 marks and average of all the experiments/programs shall be taken. (rubrics will be published by the concerned committee) **D.** One laboratory Internal Assessment test will be conducted during the 14th week for 50 marks. (rubrics will be published by the concerned committee) **E.** If the course project / mini project is involved in the laboratory component. **The evaluation shall be completed by 14th week of the semester.** The rubrics required for the evaluation of the project shall be defined by the departments along with mapping of relevant COs & POs and get it approved from academic dean.	iii) The laboratory content must be included in framing the theory question papers. iv) The students have to answer 5 full questions, selecting one full question from each module. v) Marks scored shall be proportionally reduced to 50 marks. **No Practical SEE for Integrated Course.** **Note:** CAED Course shall not be considered here. It shall be considered as in sl. No. 3 in the next row	

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Note:

i) If component 'E' is involved in the course, either component 'D' or 'E' along with component 'C' shall be considered for average of item II.

ii) Otherwise, components 'C' & 'D' shall be considered for average of item II.

The final CIE marks will be 50:

CIE= Avg. {**I** [Avg. of two tests + Avg. of two FA] + **II** [Avg. of (C & (D or E))]}

The documents of all the assessments shall be maintained meticulously.

Note: CAED Course shall not be considered here, it shall be considered as in sl. no. 3 in the next row.

3. IESC: CAED Course (4 credits)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50).

i) CIE shall be conducted for max. marks of 100 and shall be scaled down to 50 marks

ii) CIE component should comprise of both Manual and computer drafting i.e. 50% manual and 50% computer drafting out of total 100 marks

iii) CIE component should comprise of Continuous evaluation of drawing work of students as and when the modules are covered based on below detailed weightage.

Module	Module Max. Marks	Evaluation Weightage in marks	
		Computer display and print out	Manual Sketching
Module 1	20	10	10
Module 2	20	10	10
Module 3	20	10	10
Module 4	20	10	10
Module 5	20	10	10
TOTAL	**100**	**50**	**50**

The minimum passing mark for SEE is 35% of the maximum marks (18 out of 50 marks).

Semester-End Examination:

SEE for duration of 03 hours and total marks of 100.

i) SEE shall be conducted and evaluated for maximum marks of 100 and shall be scaled down to 50 marks.

ii) Question paper shall be made available for each batch as per schedule.

iii) Evaluation shall be carried jointly by both the internal & external examiners.

iv) Scheme of Evaluation: To be defined by both the examiners jointly.

v) Maximum 3 questions shall be set as per the following pattern.

The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together.

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iv) At least one Test covering all the modules is to be conducted for 100 marks during 14th week and the same is to be scaled down to **25 Marks.**

v) Assignments = **10 Marks from each module. (50 marks scaled down to 25 Marks)**

vi) The final CIE 50 marks = Test (25 marks) + Assignment (25 marks).

From Module	Marks Allotted
Module 01 (Choice between Lines or Planes)	30
Module 02 (Compulsory question)	40
Module 03 or Module 04 or Module 05	30
TOTAL	**100**

Q. No.	Manual Sketching	Computer display and print out	TOTAL MARKS
1	15	15	30
2	20	20	40
3	15	15	30
TOT.	**50**	**50**	**100**

4. PCCL: Laboratory course (01 credit course)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

Continuous Internal Evaluation: The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50).

CIE will be conducted by the department and it will have only 01 component:

I. Theory Component. (Not required for Laboratory course)

II. Practical Component.

II. Practical Component:

C. Conduction of each experiment/program should be evaluated for 50 marks and average of all the experiments/program shall be taken (rubrics will be published by the concerned committee).

D. One laboratory Internal Assessment test will be conducted for 50 marks (rubrics will be published by the concerned committee).

E. If the course project / mini project is involved in the laboratory component. **The evaluation shall be completed by 14th week of the semester.** The rubrics required for the evaluation of the project shall be defined by the departments along with mapping of relevant COs & POs and get it approved from academic dean.

The minimum passing mark for SEE is 35% of the maximum marks (18 out of 50 marks).

Semester-End Examination:

Only laboratory SEE will be conducted jointly by the internal examiner and external examiner appointed by COE as per the scheduled timetable for duration of 03 hours.

i) The examination shall be conducted for 100 marks and shall be reduced to 50 marks proportionately.

ii) All laboratory experiments/programs are to be included for practical examination.

iii) Breakup of marks (Rubrics) and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners (OR) based on the course

The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together.

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Note: **i)** If component 'E' is involved in the course either component 'D' or 'E' along with component 'C' shall be considered for average of item II. **ii)** Otherwise, components 'C' & 'D' shall be considered for average of item II. **The final CIE marks will be 50** = Avg. of (C & [D or E]) **The documents of all the assessments shall be maintained meticulously.**	requirement evaluation rubrics shall be decided jointly by examiners. iv) Students can pick one question (experiment/program) from the questions lot prepared by the internal /external examiners jointly. v) Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. vi) General rubrics suggested for SEE: writeup-20%, Conduction procedure and results-60%, Viva-voce 20% of maximum marks. vii) Change of experiment is allowed only once and shall be assessed only for 85% of the maximum marks.	

5. AEC: Ability Enhancement Courses (01 credit courses)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). **Continuous Internal Evaluation:** CIE will be conducted by the department and will have only 01 component: **I. Theory component.** Theory Component will consist of A. Internal Assessment Test (IAT). B. Formative Assessments (FA). **A. Internal Assessment Test:** i) 01 test of 50 marks conducted during 15th week. ii) The question paper will be of Multiple-Choice Questions (MCQ). iii) The student must answer all questions. iv) IAT QP shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.	The minimum passing mark for SEE is 35% of the maximum marks (18 out of 50 marks). **Semester-End Examination:** Theory SEE will be conducted by COE as per the scheduled timetable for duration of 02 hours and total marks of 50. i) Multiple choice Question paper. ii) The students have to answer all questions.	The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together.

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B. Formative assessments: i) 01 formative assessment of 50 marks shall be conducted by the Course coordinator based on the dept. planning during 12th week. ii) The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc. iii) The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. iv) The rubrics required for the other type of formal assessments shall be defined by the departments along with mapping of relevant COs & POs. **The final CIE marks will be 50:** CIE = Avg. of 02 events (01 IAT and 01 FA). **The documents of all the assessments shall be maintained meticulously.**		

6. HSMC: (01 credit course)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

Continuous Internal Evaluation: The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). CIE will be conducted by the department and will have only 01 component: **I. Theory component.** Theory Component will consist of A. Internal Assessment Test (IAT). B. Formative Assessments (FA). **A. Internal Assessment Test:** i) 01 test of 50 marks conducted during 15th week. ii) The question paper will be of Multiple-Choice Questions (MCQ). iii) The student must answer all questions. iv) IAT QP shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course **B. Formative assessments:** i) 01 formative assessment of 50 marks shall be conducted by the faculty based on the dept. planning during 12th week. ii) The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc.	The minimum passing mark for SEE is 35% of the maximum marks (18 out of 50 marks). **Semester-End Examination:** Theory SEE will be conducted by COE as per the scheduled timetable for duration of 02 hours and total marks of 50. i) Multiple choice Question paper. ii) The students have to answer all questions	The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together.

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iii) The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. iv) The rubrics required for the other type of formal assessments shall be defined by the departments along with mapping of relevant COs & POs. **The final CIE marks will be 50:** CIE = Avg. of 02 events (01 IAT and 01 FA). **The documents of all the assessments shall be maintained meticulously.**		
7. HSMC: (0 credit courses)		
The weightage is only for Continuous Internal Evaluation (CIE).		
Continuous Internal Evaluation: The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). CIE will be conducted by the department and it will have only 01 component: **I. Theory component.** Theory Component will consist of A. Internal Assessment Test (IAT). B. Formative assessments (FA). **A. Internal Assessment Test:** i) 01 test of 50 marks conducted during 15th week. ii) The QP will be of Multiple-Choice Questions (MCQ). iii) The student must answer all questions. iv) IAT QP shall be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course **B. Formative assessments:** i) 01 formative assessment of 50 marks shall be conducted by the faculty based on the dept. planning during 12th week. ii) The formative assessments include Assignments/seminars/case study/field survey/ report presentation/course project/etc. iii) The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. iv) The rubrics required for the other type of formal assessments shall be defined by the departments along with mapping of relevant COs & POs. **The final CIE marks will be 50:** CIE = Avg. of 02 events (01 IAT and 01 FA). **The documents of all the assessments shall be maintained meticulously.**	No Semester End Examination.	The student is declared as a pass in the course if he/she secures a minimum of 40% (20 marks out of 50) in the CIE.

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8. NCMC: (0 credit course)		
The weightage is only for Continuous Internal Evaluation (CIE).		
Continuous Internal Evaluation: The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). CIE will be conducted by the department and it will have only 01 component: **I. Theory component.** Theory Component will consist of only 01 assessment A. Internal Assessment Test (not required for NCMC course). B. Formative Assessment (FA). **B. Formative assessments:** i) 01 formative assessment of 50 marks shall be conducted by the faculty based on the dept. planning during random times during 12th week. ii) The formative assessments include Quiz/Assignments/seminars/case study/field survey/ report presentation/course project/etc. iii) The assignment QP shall indicate marks of each question and the relevant COs & RBT levels. iv) The rubrics required for the other type of formal assessments shall be defined by the departments along with mapping of relevant COs & POs. **The final CIE marks will be 50.** **The documents of all the assessments shall be maintained meticulously.**	No Semester End Examination.	The student is declared as a pass in the course if he/she secures a minimum of 40% (20 marks out of 50) in the CIE.

Academic Dean
Dr. Babu N V

Principal
Dr. K V Mahendra Prashanth

Academic Director
Dr. Puttaraju

Academic Dean

Principal 10.2.2025

Academic Director

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ATAL Ranking:
Band Performer

Band of 151 to 300 in
Innovation Category

Academic Year 2025-2026

2023-2027 Batch

Department Vision

Empowering Electronics and Communication engineers to meet the advancements in technological and societal needs.

Department Mission

M1: To facilitate students in acquiring proficiency & providing eminence in Technical education.

M2: To imbibe value based education that contributes to the human values, ethics and societal relevance.

M3: To foster culture of innovation, industry and research in developing intellectual professionals and entrepreneurs.