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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

V Semester
Scheme & Syllabus of B.E. Programme
Electronics & Communication Engineering
(2024 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy

AICTE | NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300 | NBA | NAAC A+ | QS I-GAUGE GOLD | INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

AICTE Approved, Accredited by NBA(CSE, ISE, ECE, ME, CV, AE) and NAAC with 'A+' grade, QS – I Gauge Gold Rated

SCHEME OF TEACHING AND EXAMINATION – B.E. – Branch Name: ECE

(Applicable for students admitted from the Academic Year 2024-25 and onwards)

5th Semester

Electronics and Communication Engineering

Sl. No.	Course Code	Course Title	Course Type	TD/ PSB	Teaching Hours / Week			Examination				
					L	T	P	SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	Credits
1	BEC501	Electromagnetic Field Theory	PCC	ECE	3	0	0	3	50	50	100	3
2	BEC502	Digital Signal Processing	IPCC	ECE	3	0	2	3	50	50	100	4
3	BEC503	Digital Communication	PCC	ECE	3	2	0	3	50	50	100	4
4	BECL504	Digital Communication Lab	PCCL	ECE	0	0	2	3	50	50	100	1
5	BEC525x	Professional Elective Course – I	PEC	ECE	3	0	0	3	50	50	100	3
6	BEC536	Mini Project	PROJ	ECE	0	0	2	3	50	50	100	2
7	BRM507	Research Methodology and IPR	AEC	ECE	2	2	0	3	50	50	100	3
8	BCE508	Competency Enhancement Course-3	NCMC	CDCAC	0	2	0	-	100	-	100	0
9	BNS509	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	-	100	-	100	0
	BPE509	Physical Education (PE) (Sports and Athletics)		Physical Education Director								
	BYO509	Yoga		Yoga Teacher								
	BMU509	Music		Music Teacher								
									550	350	900	20

ASC: Applied Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

Professional Elective Course – I

Course Code	Course Name	Course Code	Course Name
BEC525A	Introduction to ML	BEC525C	System Verilog
BEC525B	Advanced Python Programming	BEC525D	Advanced Satellite Communication

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2024-25 may please be referred.

National Service Scheme /Physical Education/Yoga/Music: All students have to register for any one of the courses namely National Service Scheme, Physical Education, Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3rd semester. Activities shall be carried out between 3rd semester to the 6th semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Music activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Semester: V					
Electromagnetic Field Theory					
Course Code	**:**	BEC501	**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Fundamentals of Mathematics
Knowledge on Fundamental Concepts	Vector Calculus, Differential Calculus
Knowledge on Connected Tools(If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
CLO2	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.
CLO3	Understand the physical significance of Biot-Savart's, Ampere's Law and Stokes' theorem for different current distributions.
CLO4	Infer the effects of magnetic forces, materials and inductance
CLO5	Acquire knowledge of Poynting theorem and its application of power flow

Module – 1	**08 Hrs**
Introduction: Vectors, Revision of Vector Calculus **Coulomb's Law, Electric Field Intensity and Flux density**: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **Text Book1: Ch.1:1.1,1.2,Ch.2: 2.1-2.5,Ch.3:3.1**	
Module – 2	**08 Hrs**
Gauss's Law and Divergence: 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, Numerical Problems Energy expended or work done in moving a point charge in an Electric field. **Text Book1: Ch.3:3.2-3.7,Ch.4:4.1,4.2**	
Module – 3	**08 Hrs**
Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Examples of the solution of Laplace's equation, Numerical problems on Laplace's equation. **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density. **Text Book1:Ch.7: 7.1-7.3 ,Ch.8:8.1-8.5**	
Module – 4	**08 Hrs**
Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, the magnetic circuit, problems **Text Book1:Ch.9: 9.1-9.3,9.6-9.8**	

Module – 5	08 Hrs
Faraday's law of Electromagnetic Induction: Integral form and Point form, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **Uniform Plane Wave**: Wave propagation in free space, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Poynting's Theorem and wave power, Numerical problems. **Text Book1:Ch.10:10.1-10.4,Ch.12: 12.1,12.3,12.4**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret various operations of vector calculus and basic laws of electromagnetism.
CO2	Apply electric and magnetic fields for simple configurations under static conditions.
CO3	Analyze time varying electric and magnetic fields.
CO4	Evaluate maxwell's equations for time varying fields, EM waves in free space and power associated with EM waves.
CO5	Develop students in self-learning through multimedia resources and by working on projects related to electromagnetic fields.

Text Books	
1	Engineering Electromagnetics, W.H. Hayt and J.A. Buck,9th Edition, 2020, Tata McGraw- Hill, ISBN- 978-9353169725

Reference Books	
1	Elements of Electromagnetics, Matthew N.O, Sadiku, 7th Edition, 2018, and Oxford University press, ISBN-13:978-0190698614.
2	Electromagnetic Waves and Radiating systems, E. C. Jordan and K.G. Balman, 2nd Edition, 2015, Pearson Education, ISBN-13:978-9332551770.
3	Electromagnetics, Joseph A Edminister, Schaum Outline Series, 2nd Edition, 2017, McGraw Hill, ISBN-13: 978-0070681958.
4	Fundamentals of Electromagnetics for Engineering, N. Narayana Rao, 1st Edition, 2008, Pearson Education, ISBN-13:978-8131724156.

Web links and Video Lectures (e – Resources)	
1	NPTEL Video lectures : https://youtu.be/pGdr9WLto4A
2	NPTEL Video lectures: https://youtu.be/xn2IpxI991M

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	3	2			1			1	2	2
CO2	3	3		2	2			1			1	1	2
CO3	3	3		2	2			1			1	2	1
CO4	3	3		2	2			1			1	2	2
CO5	2	2	2	1	2	1	1	2	1		1	2	1

Semester: V						
Digital Signal Processing						
Course Code	**:**	BEC502		**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs+12 PS		**SEE**	**:**	50 Marks
Course Type	**:**	IPCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Signals and Systems
Knowledge on Fundamental Concepts	Matrix Basics, Fourier Transform
Knowledge on Connected Tools (If any)	Scilab, Python

Course Learning Objectives: This course will enable the students to	
CLO1	To provide background and fundamental material for the analysis and processing of digital signals
CLO2	To understand the fast computation of DFT and appreciate the FFT processing.
CLO3	To study the designs and structures of digital (IIR and FIR) filters and analyze, synthesize and implement for a given specifications
CLO4	To gain knowledge of DSP Processors.
CLO5	Understand the concepts of Multirate DSP

Module – 1	**8 Hrs**
Discrete Fourier Transforms: Introduction to Signal processing (Basic Signals, Operations, Linear Convolution), Twiddle Factors, Matrix method of DFT and IDFT computation, Properties of DFT (Only statement and numerical), Circular convolution using graphical method and DFT. **Fast Fourier Transforms (FFT) –** Introduction , Radix-2 Decimation-in-Time FFT Algorithms, Inverse FFT (N=4) **Text Book 1: Ch.8-8.5,8.6,8.7 , Ch.9-9.3**	
Module – 2	**8 Hrs**
IIR Digital Filters (Low pass and High pass): Introduction to IIR Digital Filters, Analog filter approximations – Butterworth, Design of IIR Digital Filters from Analog Filters, Bilinear Transformation Method. **FIR Digital Filters:** Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters. **Text Book 1:Ch.7-7.0,7.1,7.2,7.3**	
Module – 3	**8 Hrs**
Realization of Digital Filters: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms. **Text Book 1: Ch.6-6.3,6.5**	
Module – 4	**8 Hrs**
Introduction to DSP processors: DSP Processor Architecture, DSP hardware units (Multiplier and Accumulator, Shifters, Address Generators, Fixed-Point and Floating-Point Formats, IEEE Floating-Point Formats, Fixed-Point Digital Signal Processors, Floating-Point Processors.	

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors. **Text Book 2 :Ch.9-9.1,9.2,9.3,9.4,9.5**
Module – 5 **8 Hrs**
Multirate DSP: Multirate Digital Signal Processing Basics, Sampling Rate Increase by an Integer Factor, Changing Sampling Rate by a Non-Integer Factor L/M, Multistage Decimation, Polyphase Filter Structure and Implementation, Oversampling of Analog-to-Digital Conversion, Application Example: CD Player **Text Book 2 :Ch.12-12.1, 12.2.12.3,12.4**

SL. NO	NAME OF THE EXPERIMENT
PART-A:	
1	Verification of Sampling theorem.
2	Linear convolution of two given sequences,(Verification Commutative, distributive and associative property)
3	Auto and cross correlation of two sequences and verification of their properties
4	Solving a Difference Equation (First Order)
5	Computation of N point DFT of a given sequence and to plot magnitude and phase spectrum (using built-in routine).
6	Verification of DFT properties (Linearity and Parseval's theorem)
7.	Circular Convolution using DFT.
8	Design and implementation of FIR filter to meet given specifications (using different window techniques).
9	Up-sampling and Down-sampling a sinusoidal signal by a factor of 2
PART – B : Experiments to be done using DSP kit	
10	Linear convolution of two sequences.
11	Circular convolution of two sequences.
12	N-point DFT of a given sequence.

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze digital signals using various transforms such as DFT and FFT to identify their frequency domain characteristics.
CO2	Design digital filters and implement using various filter structures that meet given frequency specifications using suitable techniques and tools
CO3	Relate between the architectural features of general-purpose processors and DSP processors for signal processing tasks.
CO4	Infer the Concept of Multirate DSP and its applications
CO5	Apply modern digital signal processing algorithms to solve real-world problems .

Text Books	
1	Discrete Time Signal Processing, A. V. Oppenheim and R.W. Schaffer, Third Edition, 2009, Prentice-Hall Signal Processing Series, ISBN: 978-1-292-02572-8
2	Digital Signal Processing Fundamentals and Applications, Li Tan, 2007, Academic Press/Elsevier, ISBN: 9788131215197.
Reference Books	
1	Digital Signal Processing, S. Salivahanan, A. Vallavaraj and C. Gnanapriya, Fourth Edition -, 3 July 2019,TMH,ISBN-13: 978-9353167424
2	Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis,2nd Edition, 2009,Pearson Education, ,ISBN: 0201596199
3	Digital Signal Processing, Principles, Algorithms, and Applications,John G. Proakis, Dimitris G. Manolakis, 2007,Pearson Education/PHI,ISBN: 9788131710005

Web links and Video Lectures (e – Resources)	
1	https://dss-kiel.de/index.php/teaching/lectures/lecture-advanced-digital-signal-processing
2	https://ekeeda.com/degree-courses/electrical-engineering/advanced-digital-signal-processing

CO-PO MATRIX

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	2	-	1	-	-	-	-	-	-	3	1
CO2	3	2	2	2	3	1	-	-	-	-	-	2	1
CO3	3	2	2	2	2	1	-	-	-	-	-	2	1
CO4	3	2	2	1	1	1	-	-	1	1	1	2	1
CO5	2	2	2	3	2	1	1	1	1	1	1	1	2

Semester: V						
Digital Communication						
Course Code	**:**	BEC503		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Principles of Communication System
Knowledge on Fundamental Concepts	Base band and Band Pass transmission, Modulation and Demodulation process, Coding and Decoding.
Knowledge on Connected Tools (If any)	MATLAB/SCILAB

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the concept of signal processing of digital data and signal conversion to symbols at the transmitter and receiver.
CLO2	Compute performance metrics and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
CLO3	Gain foundational knowledge of wideband signal transmission techniques and the operational concepts behind spread spectrum systems.
CLO4	Explore the core concepts of data communication theory, including entropy, redundancy, and the design of efficient data representation (source coding) and error-resilient transmission methods (channel coding).
CLO5	Describe the concepts and compare different source and channel coding techniques applied in digital communication systems.

Module – 1	**08 Hrs**
Bandpass Signals to Equivalent Low pass: Hilbert Transform, Pre-envelopes, Complex envelopes of Band-pass Signals, Canonical Representation of Bandpass signals. **Signaling over AWGN Channels**: Introduction, Geometric representation of signals, Gram- Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver. **Text Book 1: Ch 2: 2.8, 2.9, 2.10, 2.11 Ch 7: 7.1, 7.2, 7.3, 7.4**	
Module – 2	**08 Hrs**
Digital Modulation Techniques: 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. BFSK using No coherent Detection, Differential Phase Shift Keying. **Text Book 1: Ch 7: 7.6, 7.7, 7.8, 7.12, 7.13**	

Module – 3	**08 Hrs**
Introduction to Information theory: Measurement of Information, Entropy and information rate, Source Coding Theorem (only Definition), Huffman's coding algorithm, Channel capacity of binary Symmetric channels. **Text Book 1: Ch 5: 5.1, 5.2, 5.3, 5.4, 5.7**	
Module – 4	**08 Hrs**
Error control coding: Introduction, Linear Block codes – rate, encoding procedure. Error detecting and correcting capability. Syndrome calculation for error detection. Convolutional encoder representation, impulse response, transform domain representation, tree, trellis and state representation. **Text Book 1: Ch 10: 10.1, 10.4, 10.6**	
Module – 5	**08 Hrs**
Principles of Spread Spectrum: Spread Spectrum Communication Systems: Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95. **Text Book 2: Ch 11: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2.**	

Course Outcomes: After completing the course, the students will be able to

CO1	Analyze bandpass signals and their equivalent low pass forms.
CO2	Implement and optimize modulation techniques over AWGN channels and analyze error probabilities.
CO3	Apply information theory concepts to measure and improve communication efficiency and channel coding techniques for error detection and correction.
CO4	Comprehend the fundamental concepts and operating principles of spread spectrum communication techniques.
CO5	Simulate digital communication system using software tools and analyze the system performance.

Text Books	
1	Digital Communication Systems, Simon Haykin, John Wiley & sons, 2014, ISBN 978-81- 265-4231-4.
2	Fundamentals of Communication Systems, John G Proakis and Masoud Salehi, 2014, Pearson Education, ISBN 978-8-131-70573-5.

Reference Books	
1	"Modern Digital and Analog Communication Systems" by B.P Lathi, Zhi Ding, 4th Edition, Oxford University press, ISBN: 9780198073802, 2017
2	"Digital and analog communication systems" by K Sam Shanmugam, Wiley India Pvt. Ltd, 2017, ISBN: 978- 81-265-3680-1.
3	"Information Theory and Coding" by K.N Hari Bhat, D. Ganesh Rao, Cengage Learning India Pvt Ltd, 2017, ISBN: 93-866-5092-4.

Web links and Video Lectures (e – Resources)	
1	Principles of Communication Systems Part II, https://onlinecourses.nptel.ac.in/noc19_ee47/preview

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3									1	3	
CO2	3	3	2	1							1	3	2
CO3	3	3	2	1							1	3	
CO4	3	1				1						3	
CO5	3	3	3	3	3			3	2		3	3	2

Semester: V						
Digital Communication Lab						
Course Code	**:**	BECL504		**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	50Marks
Total Hours	**:**	12 PS		**SEE**	**:**	50Marks
Course Type	**:**	PCCL		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Communication systems, Signals and Systems.
Knowledge on Fundamental Concepts	Basics of Communication system, Concepts of Modulation and Demodulation Techniques and digital representation of signals.
Knowledge on Connected Tools (If any)	MATLAB/SCI Lab

Course Learning Objectives: This course will enable the students to	
CLO1	Understand and demonstrate basic digital modulation and demodulation techniques.
CLO2	Gain knowledge of the signal processing techniques for efficient representation and analysis of signals.
CLO3	Understand the concept of digital modulation scheme and interpret the signal representations using constellation diagrams.
CLO4	Implementation of source coding techniques for efficient data representation.
CLO5	Implementation of channel coding techniques for error detection and correction in digital communication.

List of Experiments	
PART A (Experiments to be conducted using hardware components)	
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.
PART B (Experiments to be conducted using software tool e.g. MATLAB/SCI Lab etc)	
5.	Gram-Schmidt Orthogonalization: To find orthogonal basis vectors for the given set of vectors and plot the orthonormal vectors.
6.	Simulation of binary baseband signals using a rectangular pulse and estimate the BER for AWGN channel using matched filter receiver.
7.	Perform the QPSK Modulation and demodulation. Display the signal and its constellation.
8.	Generate 16-QAM Modulation and obtain the QAM constellation.
9.	Encoding and Decoding of Huffman code.
10.	Encoding and Decoding of binary data using a Hamming code.
11.	For a given data, use CRC-CCITT polynomial to obtain the CRC code. Verify for the cases, a) Without error b) With error
12.	Encoding and Decoding of Convolution code.

	Course Outcomes: After completing the course, the students will be able to
CO1	Demonstrate the generation and demodulation of digital modulation schemes.
CO2	Apply signal processing techniques (such as Gram-Schmidt orthogonalization) for efficient representation and simulate the binary baseband signal.
CO3	Analyze the performance of digital modulation schemes and interpret results using constellation diagram representation for different modulation orders.
CO4	Design and implement source coding techniques.
CO5	Design and implement channel coding techniques.

Text Books	
1	Simon Haykin, "Digital Communication Systems", John Wiley & sons, 2014, ISBN 978-81- 265-4231-4.
2	K.N Hari Bhat, D. Ganesh Rao, "Information Theory and Coding", Cengage Learning India Pvt Ltd, 2017, ISBN: 93-866-5092-4,.

Reference Books	
1	Herbert Taub, Donald L Schilling, Goutam Saha, Principles of Communication Systems, 2013, Mc Graw Hill Education, ISBN: 978-1-25-902985-1
2	B. P Lathi, Zhi Ding, Modern Digital and Analog Communication Systems,4th Edition, 2017, Oxford University Press, ISBJ:978-0-19-947628-2.

CO – PO MAPPING

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2	3	2	2			2		2		3	3
CO2	3	2	1	1	3			2		2		3	3
CO3	3	2	1	1	3			1		2		3	3
CO4	3	2	3	2	2			1		2		3	3
CO5	3	2	3	2	2			1		2		3	3

Semester: V						
Introduction to Machine Learning						
Course Code	**:**	BEC525A		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Mathematics (Statistics, Probability, Linear Algebra, Calculus)
Knowledge on Fundamental Concepts	Programming skills (Especially Python)
Knowledge on Connected Tools (If any)	Spider, ANACONDA, Google Colab etc…

Course Learning Objectives: This course will enable the students to	
CLO1	Introduce the fundamental concepts, priciples and techniques of machine learning.
CLO2	Understand various types of machine learning and the challenges faced in real world applications.
CLO3	Familiarize the machine learning algorithms such as regression, decision trees, Bayesian models, clustering, and neural networks.
CLO4	Explore advanced concepts like reinforcement learning and provide practical insight into its applications.
CLO5	Enable students to model and evaluate machine learning solutions for different types of problems.

Module – 1	**08 Hrs**
Introduction: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Applications. **Understanding Data – 1:** Introduction, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization. **Textbook 1: Ch.1: 1.1-1.7, Ch.2: 2.1-2.5**	
Module – 2	**08 Hrs**
Understanding Data – 2: Bivariate Data and Multivariate Data, Multivariate Statistics, Essential Mathematics for Multivariate Data, Feature Engineering and Dimensionality Reduction Techniques. **Basic Learning Theory:** Design of Learning System, Introduction to Concept of Learning, Modelling in Machine Learning. **Textbook 1: Ch.2: 2.6-2.8, 2.10, Ch. 3: 3.3, 3.4, 3.6**	
Module – 3	**08 Hrs**
Similarity-based Learning: Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR). **Regression Analysis:** Introduction to Regression, Introduction to Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression. **Decision Tree Learning:** Introduction to Decision Tree Learning Model, Decision Tree Induction Algorithms. **Textbook 1: Ch.4: 4.2-4.5, Ch.5: 5.1-5.3, 5.5-5.7, Ch.6: 6.1, 6.2**	
Module – 4	**08 Hrs**
Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model, Naïve Bayes Algorithm for Continuous Attributes. **Artificial Neural Networks:** Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Networks, Popular Applications of Artificial Neural	

Networks, Advantages and Disadvantages of ANN, Challenges of ANN. **Textbook 1: Ch.8: 8.1-8.4, Ch.10: 10.1-10.5, 10.9-10.11**

Module – 5	**08 Hrs**
Clustering Algorithms: Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Grid-based Approach. **Reinforcement Learning:** Overview of Reinforcement Learning, Scope of Reinforcement Learning, Reinforcement Learning as Machine Learning, Components of Reinforcement Learning, Markov Decision Process, Multi-Arm Bandit Problem and Reinforcement Problem Types, Model-based Learning, Model Free Methods, Q-Learning, SARSA Learning**.** **Textbook 1: Ch.13: 13.1-13.6, Ch.14: 14.1-14.10**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret fundamental machine learning concepts, types and data analysis framework.
CO2	Apply mathematical concepts for feature engineering and perform dimensionality reduction to enhance model performance.
CO3	Develop similarity-based learning models and regression models for solving classification and prediction tasks.
CO4	Build probabilistic learning models and design neural network models using perceptron and multilayer architectures.
CO5	Utilize clustering algorithms to identify patterns in data and implement reinforcement learning techniques.

Text Books	
1	S Sridhar, M Vijayalakshmi, “Machine Learning”, OXFORD University Press, 2021, First Edition.

Reference Books	
1	Murty, M. N., and V. S. Ananthanarayana. Machine Learning: Theory and Practice, Universities Press, 2024.
2	T. M. Mitchell, “Machine Learning”, McGraw Hill, 1997.
3	Burkov, Andriy. “The hundred-page machine learning book”, Vol. 1. Quebec City, QC, Canada: Andriy Burkov, 2019.

Web links and Video Lectures (e – Resources)	
1	Introduction to Machine Learning: https://onlinecourses.nptel.ac.in/noc22_cs29/preview
2	Machine Learning Tutorials: https://www.geeksforgeeks.org/machine-learning/

CO – PO MAPPING

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2											
CO2	3	3		2	3			2	2			2	3
CO3	3	3	3	2	3			2	2			2	3
CO4	3	3	3	2	3			2	2			2	3
CO5	2	3	2	3	3			2	2		2	2	3

Semester: V						
Advanced Python Programming						
Course Code	**:**	BEC525B		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Introduction to Python Programming
Knowledge on Fundamental Concepts	Data Types, Control Structures, Functions, File I/O, Object-Oriented Programming in Python
Knowledge on Connected Tools (If any)	Spyder

Course Learning Objectives: This course will enable the students to	
CLO1	Understand data handling and preprocessing techniques using Pandas for various file formats.
CLO2	Study data transformation and string processing techniques for structured datasets.
CLO3	Explore classification tasks using scikit-learn and TensorFlow for handwritten digit recognition.
CLO4	Gain textual data using NLP techniques and sentiment analysis with NLTK.
CLO5	Understand basic image processing techniques and edge detection using OpenCV in Python.

Module – 1	**08 Hrs**
Pandas: Reading and Writing Data: I/O API Tools, CSV and Textual Files, Reading Data in CSV or Text Files, Reading and Writing HTML Files, Reading Data from XML, Reading and Writing Data on Microsoft Excel Files, JSON Data, The Format HDF5, Pickle—Python Object Serialization. **Text Book 1: Ch 5**	
Module – 2	**08 Hrs**
Pandas in Depth: Data Manipulation: Data Preparation, Concatenating, Data Transformation, Discretization and Binning, Permutation. String Manipulation. **Text Book 1: Ch 6**	
Module – 3	**08 Hrs**
Recognizing Handwritten Digits : Handwriting Recognition, Recognizing Handwritten Digits with scikit-learn, The Digits Dataset, Learning and Predicting, Recognizing Handwritten Digits with TensorFlow, Learning and Predicting. **Text Book 1: Ch 12**	
Module – 4	**08 Hrs**
Textual Data Analysis with NLTK: Text Analysis Techniques, The Natural Language Toolkit (NLTK), Import the NLTK Library and the NLTK Downloader Tool, Search for a Word with NLTK, Analyze the Frequency of Words, Selection of Words from Text, Bigrams and Collocations, Use Text on the Network, Extract the Text from the HTML Pages, Use Text on the Network, Extract the Text from the HTML Pages. Sentimental Analysis. **Text Book 1: Ch 13**	

Module – 5	08 Hrs
Image Analysis and Computer Vision with OpenCV : Image Analysis and Computer Vision, OpenCV and Python, OpenCV and Deep Learning, Installing OpenCV, First Approaches to Image Processing and Analysis, Image Analysis, Edge Detection and Image Gradient Analysis. **Text Book 1: Ch 14**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze data from multiple sources (CSV, Excel, JSON, HDF5) using Pandas for efficient data handling.
CO2	Apply data transformation techniques such as binning, concatenation, and string manipulation using Pandas.
CO3	Implement classification models for handwritten digit recognition using scikit-learn and TensorFlow.
CO4	Interpret textual data using NLTK to perform frequency analysis, bigram extraction, and sentiment classification.
CO5	Apply basic image processing operations such as filtering, edge detection, and gradient analysis using OpenCV

Text Book	
1	Python Data Analytics, Fabio Nelli, 1st Edition, 2015, Apress Publishing, ISBN: 978-14-842-0959p2

Reference Books	
1	Python Data Science Handbook, Jake VanderPlas, First Edition, 2016, O'Reilly Media, ISBN: 978-14-919-1205-8
2	Mastering OpenCV with Python, Alberto Fernandez Villan, 2023, Packt Publishing, ISBN: 978-18-032-4349-5

Web links and Video Lectures (e – Resources)	
1	https://docs.opencv.org/4.x/d6/d00/tutorial_py_root.html
2	https://www.youtube.com/watch?v=vmEHCJofslg

CO – PO MAPPING

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	–	–	3	–	–	–	–	–	–	3	2
CO2	3	2	–	–	3	–	–	–	–	–	–	3	2
CO3	3	2	3	2	3	–	–	–	–	2	–	2	3
CO4	3	2	–	2	2	1	1	–	1	–	–	2	3
CO5	3	–	3	2	3	1	–	–	–	2	–	2	3

Semester: V						
System Verilog						
Course Code	**:**	BEC525C		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses:	Verilog HDL, Object Orient Programming
Knowledge on Fundamental Concepts	Digital Circuits, Procedural , Functional
Knowledge on Connected Tools (If any)	Xilinx, Cadence

Course Learning Objectives: This course will enable the students to	
CLO1	Understand methods and techniques to verify the functionality of digital electronic systems using System Verilog.
CLO2	Learn the System Verilog Language for Digital System Verification
CLO3	To develop the ability to create structured and modular testbenches for verifying digital designs
CLO4	Use Constrained Random Tests for Verification
CLO5	To understand and utilize the concepts of functional coverage

Module – 1	**08Hrs**
Introduction to System Verilog: System Verilog standards, Key System Verilog enhancements for hardware design. Advantages of System Verilog over Verilog **Data Types:** Verilog data types, System Verilog data types, 2 - State Data types, Bit, byte, shortint, int, longint. 4 - State data types. Logic, Enumerated data types, User Defined data types, Struct data types, Strings, Packages, Type Conversion: Dynamic casting, Static Casting, Memories: Arrays, Dynamic Arrays, Multidimensional Arrays, Packed Arrays, Associative Arrays, Queues, Array Methods. **Text2: 1.1.1, 1.1.2,1.2** **Text2: 3.3.1, 3.3.2, 3.3.3, 3.3.4, 4.1,4.2, 5.1, 5.7, 2.1, 3.9.1.3.9.2** **Text 1: 2.4, 2.5,2.6, 2.8**	
Module – 2	**08Hrs**
Connecting the Test Bench and Design: Separating the Test Bench and Design, The Interface Construct, Stimulus Timing, Interface Driving and Sampling, System Verilog Assertions. **Procedural Statements and Routines**: Procedural Statements, Tasks, Functions and Void Functions, Task and Function Overview, Routine Arguments, Returning from a Routine, Local Data Storage, Time Values. **Text 1: 5.2,5.3, 5.4,5.5, 5.9** **Text1: 3.2, 3.3, 3.4,3.5, 3.6, 3.7,3.8**	
Module – 3	**08 Hrs**
Randomization: Introduction, Randomization in System Verilog, Constraint Details, Solution Probabilities, Valid Constraints, InLine Constraints, Random Number Functions, Common Randomization Problems, Random Control, Random Number Generators. **Text1: 6.1,6.3,6.4, 6.5, 6.6, 6.7,6.8, 6.9,6.11, 6.14, 6.15**	
Module – 4	**08 Hrs**
Functional Coverage: Introduction, Coverage Types, Functional Coverage Strategies , Anatomy of a Cover Group, Triggering a Cover Group, Data Sampling, Cross Coverage, Coverage Options, Parameterized Cover Groups **Text1: 9.1,9.2, 9.3, 9.6, 9.7,9.8, 9.9,9.10**	

Module – 5	08 Hrs
Complete Design Model Using System Verilog- Case Study: System Verilog ATM Example, Data Abstraction, Interface Encapsulation, Design Top Level Squat, Receivers and Transmitters, Test Bench for ATM. **Text2: 11.1,11.2, 11.3, 11.4, 11.5, 11.6**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Infer the principles and methodologies used in verifying the functionality of digital systems.
CO2	Apply the System Verilog concepts to verify the complex digital circuits.
CO3	Develop and implement constrained random testbenches using System Verilog
CO4	Analyze verification quality using functional coverage metrics and implement covergroups
CO5	Analyze real-world verification scenarios and apply System Verilog methodologies

Text Books	
1	System Verilog for Verification – A guide to learning the Test bench language features, Chris Spear, Springer Publications Second Edition, 2010.
2.	System Verilog for Design- A guide to using system Verilog for Hardware design and modelling, Stuart Sutherland, Simon Davidmann, Peter Flake, Springer Publications Second Edition, 2006

Reference Books	
1	Writing Testbenches using SystemVerilog, Janick Bergeron Synopsys, Inc, Springer, ISBN-10: 0-387-29221-7.
2	SystemVerilog golden reference guide-A concise guide to System Verilog Doulos, IEEE Standard1800- 2009, Version 5.0,ISBN: 0-9547345-9-9, 2012.
3	Step-by-Step Functional Verification with System Verilog and OVM, SasanIman, Hansen Brown Publishing Company,ISBN-13: 978-0-9816-5621-2, 2008
4	Verification Methodology Manual, Janick Bergeron, Springer Verlag, 2014, ISBN-13 : 978-1461498131

Web links and Video Lectures (e – Resources)	
1	http://www.systemverilog.org/
2	http://www.asic-world.com/systemverilog/index.html
3	https://rfsoc.mit.edu/6S965/_static/F24/documentation/1800-2017.pdf

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	2	2	-	-	-	-	-	-	3	2
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3
CO3	2	3	3	3	3	-	-	-	2	-	-	3	3
CO4	2	3	2	3	3	-	-	-	-	-	-	2	3
CO5	2	3	3	3	3	-	-	-	2	2	-	2	3

Semester: V						
Advanced Satellite Communication						
Course Code	**:**	BEC525D		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Principles of Communication System
Knowledge on Fundamental Concepts	Modulation, Multiplexing and Multiple Access
Knowledge on Connected Tools (If any)	MATLAB

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the concept of Kepler's Laws, Newton's law, orbital parameters, launch vehicles and propulsion.
CLO2	Become familiar with the performance of Spacecraft Technology, Telemetry, Tracking and command-Transponders of the space segment.
CLO3	Compute the satellite link design with and without frequency reuse.
CLO4	Gain knowledge about the basic principles of various modulation and multiplexing techniques.
CLO5	Build a comprehensive knowledge about various satellite applications.

Module – 1	**08 Hrs**
SATELLITE ORBITS: Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geostationary and non-geostationary orbits – Look Angle Determination, Limits of visibility, eclipse-Sub-satellite point – Sun transit outage-Launching Procedures - launch vehicles and propulsion. **Text Book 1: Ch 2:2.1 to 2.8, Ch 3:3.1 to 3.8**	
Module – 2	**08 Hrs**
SPACE SEGMENT: Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem **Text Book 1: Ch 7:7.1 to 7.8**	
Module – 3	**08 Hrs**
SATELLITE LINK DESIGN FUNDAMENTALS: Transmission equation, Satellite link parameters, Frequency considerations, Propagation considerations, Noise considerations, Interference related problems, Antenna gain to noise temperature ratio. **Text Book 2: Ch 7:7.1 to 7.8**	
Module – 4	**08 Hrs**
MULTIPLEXING AND MULTIPLE ACCESS TECHNIQUES: FDM and TDM multiple access: Introduction, FDMA(No derivation),SCPC Systems, MCPC Systems, TDMA, TDMA frame structure and TDMA burst structure **Text Book 2: Ch 5:5.8, Ch 6:6.1 to 6.7**	

Module – 5	08 Hrs
COMMUNICATION SATELLITES: Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks **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 **Text Book 2: Ch 9:9.1 to 9.5, Ch 10:10.1,10.2**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental concepts of satellite communication, including orbital mechanics, satellite orbits, and their impact on system performance.
CO2	Interpret the performance of various Satellite sub-systems for given parameters.
CO3	Design satellite communication links and compute link budgets considering path losses, noise and system parameters.
CO4	Analyze various multiplexing and multiple access techniques used in satellite communication
CO5	Explore remote sensing and weather forecasting satellite technologies including their classifications, payloads, image processing to real-world applications.

Text Books	
1	Dennis Roddy, Satellite Communication, 4th Edition, 2006, McGraw Hill International,ISBN-13 978-007-125286-7
2	Dr Anil K Maini and Varsha Agarwal, Satellite Communications, 2019, John Wiley and sons,ISBN 978-81-265-2073-2

Reference Books	
1	Timothy Pratt, Charles Bostain and Jeremy Allnutt, "Satellite Communication", 2nd Edition, 2002,Wiley Publications, ISBN 81-265-0833-7
2	Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, "Satellite Communication Systems Engineering",2nd Edition, 2007, Prentice Hall/Pearson,. ISBN 978-81-317-0242-0

Web links and Video Lectures (e – Resources)	
1	https://pcefet.com/common/library/books/31/711_%5BLouis_J._Ippolito_Jr.%5D_Satellite_Communications_S(b-ok.org).pdf

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3											3	
CO2	3	3	2	1							1	3	2
CO3	3	3	2	1							1	3	
CO4	3											3	
CO5	3	3	3	3	3			3	2		2	3	2

Semester: V					
Research Methodology and IPR (Common to all Branches)					
Course Code	:	BRM507	**Credits**	:	3
Hours/Week (L: T:P)	:	2:2:0	**CIE**	:	50 Marks
Total Hours	:	40Hrs	**SEE**	:	50 Marks
Course Type	:	AEC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Engineering / Technical Communication
Knowledge on Fundamental Concepts	Fundamentals of engineering problem solving, technical report writing, information retrieval, analytical thinking, and professional ethics
Knowledge on Connected Tools (If any)	Familiarity with web search engines, digital libraries, scholarly databases (e.g., Google Scholar), reference management tools, and basic office productivity software

Course Learning Objectives: This course will enable the students to	
CLO1	Familiarize students with research methodologies, problem formulation, and research ethics.
CLO2	Equip students with techniques for literature search, review, and analysis using scholarly databases.
CLO3	Strengthen technical reading and interpretation skills for research documents, algorithms, and datasets.
CLO4	Introduce Intellectual Property Rights and innovation protection procedures.
CLO5	Enhance awareness of IP management, commercialization, and significant IPR case studies.

Module – 1	**08Hrs**
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**: **Ch. 1, Ch. 2**	
Module – 2	**08Hrs**
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. **Textbook 1**: **Ch. 3, Ch. 4**	
Module – 3	**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. 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. 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. Commercialization of a Patent. Need for a Patent Attorney/Agent. Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models**.** **Textbook 2: Ch. 2**
Module – 4 **08Hrs**
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. @#@26092024 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. Acts and Laws. Classification of Trademarks. 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. **Textbook 2: Ch. 3**
Module – 5 **08Hrs**
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. Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. IP Organizations in India. Schemes and Programmes. **Textbook 2**: **Ch. 4, Ch. 7**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply research methodologies and ethical practices to address engineering research problems.
CO2	Analyze technical literature and synthesize research findings using appropriate citation practices.
CO3	Interpret research articles, algorithms, datasets, and technical documents in computing domains.
CO4	Implement intellectual property rights procedures for protecting technological innovations
CO5	Evaluate intellectual property case studies and determine suitable protection strategies for research outcomes

Textbooks	
1	"Research Methodology: Methods and Techniques", C.R. Kothari and Gaurav Garg, 5th Edition, New Age International Publishers, 2024. ISBN: 9389802555
2	"Intellectual property rights under WTO", T Ramappa, 2nd revised edition, Asia Law House Publisher, 2016, ISBN: 9385556819

Reference Books	
1	"Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, SAGE Publications 2018, ISBN: 9781526457080
2	"Principles of Intellectual Property", Dr. N. S. Gopalakrishnan and T. G. Agitha, Eastern Book Company Publisher, 3rd edition, 2023. ISBN: 9788170121572

Web links and Video Lectures (e – Resources)	
1	https://online.vtu.ac.in/course/1-research-methodologies-and-ipr
2	https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr24_ed08

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	3		3			3				2
CO2	2	3		3	1		2		2		3
CO3	2	3		2	2				2		3
CO4	1	1	2			2	3			2	2
CO5	1	3	2	2		2	3		1	2	2

Semester: V						
Competency Enhancement Course-3						
Course Code	:	**BCE508**		**Credits**	:	0
Hours/Week(L:T:P)	:	2:0:0		**CIE**	:	**100 Marks**
Total Hours	:	40 Hrs		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Prerequisites:	
Courses	Fundamentals of C Programing
Knowledge on Fundamental Concepts	Programming fundamentals, including variables, data types, control structures (if, loops), and syntax
Knowledge on Connected Tools	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Understand and apply fundamental programming concepts using C
CLO2	Develop object-oriented programs in C++
CLO3	Write and debug multi-file programs in C and C++
CLO4	Design and manage databases using SQL in Oracle and MySQL
CLO5	Compare and analyze different database models (RDBMS vs NoSQL)

Module – 1	**8 Hrs**
C programming (A) Data Types, Operators and Expressions Input and output Operations Control Flow – Branching, Control Flow – Looping, Statements and Blocks, If Else, Switch, Nesting of If Else, GOTO statement, The while statement, The For statement, The Do statement, Jumps in loops **C programming (B)** Arrays, Strings, One-dimensional arrays, Initialization of one-dimensional arrays, Two-dimensional Arrays, Initializing Two-dimensional arrays, Multi-dimensional arrays, Dynamic arrays, Declaring and Initializing string variables, Reading Strings from Terminal, Writing Strings to screen, String handling functions, Operations on strings **C programming (C)** User-defined Functions, Structures, Basics of Functions, Functions Returning Non-integers, External Variables, Scope Rules, Header Files, Static Variables, Register Variables, Block Structure, Initialization, Recursion, Category of functions, Functions that return multiple values, Nesting functions, Multi-file programs, Structures and Functions, Arrays of Structures, Pointers to Structures, Self-referential structures **Textbook 1, Ch1-11**	
Module – 2	**8 Hrs**
C Programming (D) Unions, Pointers, Difference between Structures and Unions, Accessing the address of a variable, Declaring and Initializing pointer variables, Accessing a variable through its pointers, Chain of pointers, Pointer Expressions, Pointer Increments and Scale Factors, Pointers and character strings, Array of pointers, Pointers as function arguments, Functions returning pointers, Pointers to functions, Drawback of Pointers	

File Management in C The Preprocessor, Defining and Opening a File, Closing a File, Input / Output Operations on Files, Random Access to Files, Command Line Arguments. Macro Substitution, File Inclusion, Compiler Control Directives, ANSI Additions **Textbook 1- Ch2-16**	
Module-3	**8 Hrs**
C++ Object oriented Programming, Class and Objects, Dynamic Memory Management POP,OOPs in C++, Console Input / Output in C++, Comment lines in C++, Importance of function prototyping in C++, Function overloading, Inline functions and default arguments **Textbook 2 –Ch1-6**	
Module-4	**8 Hrs**
C++ Scope Resolution Operator, Structures, Defining function outside the class , Friend functions, Friend class, Array of class objects, Passing class objects to and returning class objects from functions, Nested classes, Namespaces, Dynamic memory allocation using new and deallocation, new handler function **Textbook 2- Ch7-11**	
Module-5	**8 Hrs**
Database Management System : Types of DBMS – Merits and Demerits Oracle and MySQL, SDLC, Architecture (Oracle 10g) - Instance, User Accounts, Client Applications IP, Port Number, SQL Introduction Tables, DDL and DML, Pluggable Databases – Oracle 19c, Architecture Undo and Redo, Operators Constraints Sequences Triggers, Functions – Conversion, String, Math, Aggregate Clauses, Joins, Views, Synonyms, Indexes Stored Procedures, Normalization, Triggers and stored procedures, NoSQL Db, normalisation – tables **Textbook 3 – Ch1-8**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate basic C programming skills in data types, control flow, arrays and strings to solve problems.
CO2	Apply advanced C features like functions, structures, pointers, unions and file handling for modular coding
CO3	Apply C++ OOP concepts, including classes, function overloading, friend functions and dynamic memory management.
CO4	Design and manage databases with Oracle/MySQL, write SQL queries, normalize data and use stored procedures.
CO5	Combine C/C++ programming with database operations to build applications for data storage and retrieval.

Text Books	
1	**Let Us C** by Yashavant Kanetkar (ISBN- 978-8183331630), 15th Edition, BPB Publications-2016
2	**Object-Oriented Programming with C++** by E. Balagurusamy (ISBN- 978-9389949186), 8th Edition, Tata McGraw-Hill - 2020
3	**Database System Concepts** by Abraham Silberschatz, Henry Korth, S. Sudarshan(ISBN- 978-9332901384),6th Edition, McGraw Hill Education- 2013

Reference Books	
1	**Programming in ANSI C,** by E. Balaguruswamy, (ISBN- 978-9339219666), 7th Edition, Tata McGraw-Hill - 2017
2	**C PROGRAMMING LANGUAGE** by Brian W. Kernighan / Dennis Ritchie(ISBN- 978-9332549449), 2nd Edition, Pearson Education India - 2015

Web links and Video Lectures (e – Resources)	
1	https://www.softprayog.in/programming/c-programming-tutorial-data-types-and-expressions
2	https://www.geeksforgeeks.org/array-of-strings-in-c/
3	https://www.programiz.com/c-programming/c-structures-pointers
4	https://www.w3schools.com/cpp/cpp_oop.asp
5	https://www.geeksforgeeks.org/dbms/

CO – PO MAPPING

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3			2						2
CO2	3	3			2						2
CO3	3	2			2						2
CO4	3	2	3		2						2
CO5	3	2	3	2	2						2

Semester: V						
NATIONAL SERVICE SCHEME						
Course Code	**:**	**BNS509**		**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	**100 Marks**
Total Hours	**:**	24		**SEE**	**:**	-
Course Type	**:**	NCMC		**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the community in general in which they work
CLO2	Identify the needs and problems of the community and involve them in problem –solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions t
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Activity– 1	**06Hrs**
Developing Sustainable Water management system for rural areas and implementation approaches.	
Activity – 2	**06 Hrs**
Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	
Activity – 3	**06 Hrs**
Spreading public awareness under rural outreach programs.(Minimum 3 programs).	
Activity – 4	**06 Hrs**
Social connect and responsibilities.	

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution

Sl.	**Topic**	**Group Size**	**Location**	**Activity Execution**	**Reporting**	**Evaluation of the Topic**
1.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

2.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Group selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Spreading public awareness under rural outreach programs. (minimum5 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities for 5th Semester)

Sl. No.	Practice Session Description
1.	Lecture session by NSS Officer
2.	Selection of topic, Commencement of activity and its progress
3.	Execution of Activity
4.	Case study based Assessment, Individual performance
5.	Sector wise study and its consolidation
6.	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In the 5th semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.

- At the end of the 5th semester, consolidated report of all activities compiled report should be submitted as per the instructions.

Course Outcomes: After completing the course, the students will be able to	
CO1	Exploit the importance of his / her responsibilities towards society.
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field of societal problems.
CO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Assessment Details for CIE (100 Marks)

Weightage	**CIE- 100 Marks**
Selection of Topic, Commencement of activity and its progress	**40 Marks**
Case study based Assessment	**20 Marks**
Sector wise study and its consolidation	**20 Marks**
Video based seminar for 10 minutes by each student at the end of semester with Report	**20 Marks**
Total Marks for the course in the semester	**100 Marks**

Suggested Learning Resources:

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.

CO-PO Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1						3					3		
CO2						3					3		
CO3						3					3		
CO4						3					3		
CO5						2	3	3			3		

Semester: V						
Physical Education						
Course Code	**:**	BPE509		**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:1		**CIE**	**:**	**100 Marks**
Total Hours	**:**	24		**SEE**	**:**	**-**
Course Type	**:**	NCMC		**SEE Duration**	**:**	**-**

Course Learning Objectives: This course will enable the students to	
CLO1	Impart foundational knowledge on the importance of physical fitness, food, and nutrition for a healthy lifestyle and personal well-being.
CLO2	Develop awareness and proficiency in general fitness components such as agility, flexibility, and cardiovascular endurance through standardized physical fitness tests.
CLO3	Enhance motor skills and techniques in a selected sport (Badminton, Basketball, or Athletics) through structured practice and application of fundamental game-specific skills.

Module – 1	**4 Hrs**
Orientation A. Fitness B. Food & Nutrition	
Module – 2	**4 Hrs**
General Fitness & Components of Fitness A. Agility – Shuttle Run B. Flexibility – Sit and Reach C. Cardiovascular Endurance – Harvard step Test	
Module-3	**16 Hours**
Specific games (Any one to be selected by the student) A. Badminton (Fore hand low/high service, back hand service, smash, drop) B. Basketball (Dribbling, passing, shooting etc.) C. Athletics (Field events – Throws)	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamentals of fitness, food and nutrition and their role in a healthy lifestyle.
CO2	Demonstrate understanding of general fitness components such as agility, flexibility and cardiovascular endurance through standard fitness tests
CO3	Apply basic techniques, rules and strategies in the chosen sport (Badminton, Basketball, or Athletics)
CO4	Develop sport-specific skills to enhance performance in both practice and competitive situations
CO5	Exhibit teamwork, discipline and sportsmanship during training and game play

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2				3					
CO2	3	3				3			2		
CO3	2	3				3	2	3	3		
CO4	2	3				3	2	3	3		
CO5	2	2					3	3	3		

Semester: IV						
Yoga						
Course Code	:	BYO509		**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2		**CIE**	:	100 Marks
Total Hours	:	12 Hrs		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Describe patanjali's ashtanga yoga and its role in holistic well-being.
CLO2	Perform the suryanamaskar sequence with correct breathing and posture.
CLO3	Identify different types of asanas with their techniques and benefits.
CLO4	Utilize the knowledge of kapalabhati with proper technique and safety measures.
CLO5	Apply pranayama techniques to enhance physical and mental health.

Module - 1	**02 Hrs**
Patanjali's Ashtanga Yoga: Introduction, its need and importance, Eight limbs of Yoga – overview, **Yama:** Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha **Niyama:** Shoucha, Santosha, Tapa, Svaadhyaya, Eshvarapranidhana **Text Book 1: Ch. 1 (Part 1)**	
Module - 2	**02 Hrs**
Surya Namaskar: Concept and significance of Surya Namaskar, 12-step Surya Namaskar sequence, Practice - 4 rounds of Surya Namaskar, Breathing coordination and posture alignment. **Text Book 1: Ch. 2 (Part 2)**	
Module - 3	**03 Hrs**
Asanas: Meaning of Asana, Need and importance of practicing Asanas, Classification of Asanas, Sitting Asanas - Sukhasana, Paschimottanasana, Standing Asanas - Ardhakati Chakrasana, Parshva Chakrasana, Prone Line Asana - Dhanurasana, Supine Line Asanas - Halasana, Karna Peedasana, For each Asana - Meaning by name, Technique of performing, Precautionary measures, Benefits **Text Book 1: Ch. 2 (Part 2)**	
Module - 4	**02 Hrs**
Kriyas: Introduction to Shatkarmas (Cleansing practices), Meaning and importance of Kapalabhati, Technique of Kapalabhati (40 strokes/min, 3 rounds), Precautionary measures and benefits. **Text Book 1: Ch. 3 (Part 3)**	
Module - 5	**03 Hrs**
Pranayama: Meaning, need, and importance of Pranayama, Types of Pranayama and their benefits, For each type - Meaning by name, Technique, Precautionary measures, Benefits, Types included – Suryanuloma-Viloma, Chandranuloma–Viloma, Suryabhedana, Chandra Bhedana, Nadishodhana **Text Book 1: Ch. 3 (Part 3)**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize patanjali's ashtanga Yoga and its significance in promoting daily well-being.
CO2	Demonstrate surya namaskar with correct sequence, breathing and posture alignment.
CO3	Classify various types of asanas with their benefits and precautions.
CO4	Utilize the knowledge to practice kapalabhati with correct technique, breathing rhythm and safety guidelines.
CO5	Apply pranayama to improve overall physical fitness and mental wellness.

Text Book	
1	"The Illustrates Light on Yoga" by BKS Iyengar, HarperCollins Publishers, ISBN-81:7223-606-9

Reference Books	
1	Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245
2	Yoga Instructor Course hand book published by SVYASA University, Bengaluru
3	Yogapravesha in Kannada by Ajitkumar
4	Yoga for Children –step by step – by Yamini Muthanna

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/playlist?list=PLzF4lOyPf_Z9yQ_Gphjh1wZ5fEhMg6hmP
2	https://www.youtube.com/playlist?list=PLOzRYVm0a65cCcY4qKX5MIyJxBt7hJgQY
3	https://youtu.be/KB-TYlgd1wE
4	https://youtu.be/aa-TG0Wg1Ls

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						2			2		
CO2						2	2	3	2		2
CO3						2	2	3	2		2
CO4						2	2	3	2		2
CO5						2	2	3	2		2

Semester: V					
Music					
Course Code	**:**	BMU509	**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	**100 Marks**
Total Hours	**:**	26	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Objectives: This course will enable the students to	
1	Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
2	Recognize and describe various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system.
3	Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
4	Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.
5	Demonstrate basic vocal proficiency through the practice of Sarale Varase exercises, notations for Suladi Sapta Tala in Mayamalavagowla raga and performance of selected compositions such as Geethe, Jathi Swara and Krithi.

Module -I	**03 Hrs**
Preamble Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition. Origin of the Indian Music: Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela **Textbook1, V-1 Ch. 1-4**	
Module – II	**03 Hrs**
Compositions Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. **Textbook2 – Ch. 4-7**	
Module –III	**03 Hrs**
Composers Biography and contributions of Purandaradasa, Thyagaraja, Mysoro asudevacharya, Kanakadasa **Textbook3 – Ch. 2-5**	
Module –IV	**03 Hrs**
Music Instruments Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments. **Textbook1,V-4 – Ch. 2-6**	

Module –V	14 Hrs
Abhyasa Gana Singing the swara exercises (Sarale Varase Only), Botatio writing for sarale varase and sulafi sapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathi swara, oe krithi in a mela raga **Textbook1, V-1&2**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Outline the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala.
CO2	Identify and interpret basic Carnatic compositions using standard notation.
CO3	Summarize the contributions of composers.
CO4	Classify Indian musical instruments and describe their construction and use.
CO5	Demonstrate basic Carnatic vocal skills through selected exercises and compositions.

Text Books	
1	South Indian Music – Vol. I to VI, Prof. P. Sambamoorthy, The Indian Music Publishing House, Chennai.
2	A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, CBH Publications
3	Karnataka Sangeetha Charitre, Dr. V. S. Sampathkumaracharya, Kannada University, Hampi.

Reference Books	
1	Music of India, B. Chaitanya Deva, Munshiram Manoharlal Publishers
2	Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, Asian Educational Services

CO – PO MAPPING

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3		1		1		1	1	1		1
CO2	3		3	1	2	1	2	1	1		1
CO3	1				1	1	1		1		
CO4	2		2		3	1	1	1	1		1
CO5	3			1	2	1	1	1	1		1

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Department Vision

Transforming Individuals into Competent Electronics and Communication Engineers for Technological and Societal Advancements.

Department Mission

- Strengthening Fundamental Knowledge for Academic and Professional Excellence.
- Empowering innovation through Research in Emerging Technologies.
- Fostering Industry-Institute Collaboration for Technical & Entrepreneurial Progress.
- Equipping Students with Technical Skills and Ethical Values to cater Societal Needs.
- Nurturing Supportive Environment for Lifelong Learning.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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