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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

III Semester
Scheme & Syllabus of B.E. Programme
Electronics & Communication Engineering
(2025 Scheme)

Core Values

Spiritual, **J**udicious, **C**ommitment, **I**ntegrity, **T**rustworthy

NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

NAAC A+

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

||jai shri gurudev||
Sri Adichunchanagiri Shikshana Trust (R.)
SJC INSTITUTE OF TECHNOLOGY
(An Autonomus Institute Under VTU Belagavi & Approved by AICTE, New Delhi)
Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF (151-300), QS-I Gauge GOLD Rated
Estd.:1986
Post Box #20, B.B. Road, Chikkaballapur - 562 101, Karnataka

B.E. in Electronics and Communication Engineering, Scheme of Teaching and Examinations 2025

Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS) (Effective from the academic year 2025-26)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching and Learning Scheme					Examination				Credits
					CI		LI	TW & SL	Total Hours	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	SL						
1	ASC	1BMATE301	Differential Equations, Fourier Analysis and Z-Transform	TD /PSB: Mathematics	42	28	0	50	120	3	50	50	100	4
2	IPCC	1BEC302	Digital System Design using Verilog	TD/PSB: ECE	42	0	28	50	120	3	50	50	100	4
3	IPCC	1BEC303	Introduction to Embedded System	TD/PSB: ECE	42	0	28	50	120	3	50	50	100	4
4	PCC	1BEC304	Analog Electronics and Linear Integrated Circuits	TD/PSB: ECE	42	0	0	48	90	3	50	50	100	3
5	PCC	1BEC305	Network Analysis	TD/PSB: ECE	42	0	0	48	90	3	50	50	100	3
6	PCCL	1BECL306	Analog Electronics and Linear Integrated Circuits Lab	TD/PSB: ECE	0	0	28	02	30	3	50	50	100	1
7	AEC	1BECL307X	Ability Enhancement Course Lab	TD/PSB: ECE	0	0	28	02	30	2	50	50	100	1
8	SDC	1BCP308	Community Project	Any Department/ Respective Engineering Dept.	0	0	0	30	30	2	50	50	100	1

9	NCMC	1BNS309	National Service Scheme	Campus	NSS coordinator	0	0	0	28	28	--	100	---	100	PP
		1BPE309	Physical Education		Physical Education Director										
		1BYO309	Yoga		Yoga Teacher										
		1BMU309	Music		Music Teacher										
		1BNC309	National Cadet Corps - I		NCC coordinator										
10	NCMC	1BCE310	Competency Enhancement Course-1	CDCAC		14	0	0	14	28	--	100	---	100	PP
11	NCMC	1BMATDIP311	Additional Mathematics – I	TD/PSB -Maths Dept.		14	0	0	14	28	3	100	---	100	PP
Total												**700**	**400**	**1100**	**21**

Ability Enhancement Course (Laboratory) 1BECL307X			
1BECL307A	**Problem Solving Using C**	**1BECL307C**	**Data Structure Lab**
1BECL307B	**Python for Electronics**	**1BECL307D**	**Basics of Robotics and Automation Lab**

Semester: III					
Differential Equations, Fourier Analysis and Z-Transform. **Stream: ECE**					
Course Code	**:**	1BMATE301	**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:28:0:50	**CIE**	**:**	50 Marks
Total Hours	**:**	120	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Calculus, Laplace Transform and Numerical Techniques.
Knowledge on Fundamental Concepts	Basic Differentiation, Integration, vector calculus.
Knowledge on Connected Tools (If any)	Basic computer knowledge

Course Learning Objectives: This course will enable the students to	
CLO1	**Develop** the knowledge of solving differential equations of higher order and their applications in Electronics & Communication engineering.
CLO2	**Define** periodic function and construct Fourier series to represent the signal, use in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series and Fourier transforms.
CLO3	**Demonstrate** understanding of Z-transforms, their properties, inverse Z-transforms, and regions of convergence for discrete-time systems. Interpret and solve difference equations using Z-transform
CLO4	**Define** and compute the Z-transform of discrete-time signals and sequences. Compute inverse Z-transforms. Use partial fraction method to find inverse Z-transforms.
CLO5	**Determine** limits, continuity, differentiability, analyticity, and harmonic properties of complex functions using the Cauchy–Riemann equations.

Module – 1	**10 Hrs.**
Ordinary Differential Equations of Higher Order: Higher-order linear ODEs with constant coefficients - Inverse differential operator, problems types (Exponential, trigonometric and polynomial). Linear differential equations with variable Coefficients-Cauchy's differential equations –Problems and Legendre's differential equations. **Text Book 1:** Chapter 13: 13.1,13.2,13.3,13.4,13.5, 13.8, 13.9	
Module – 2	**10 Hrs.**
Fourier series: Euler's formulae, Dirichlet's conditions for Fourier series expansion of periodic functions with period 2π and with arbitrary period $2l$, Half-range Fourier series. Harmonic analysis. **Text Book 1:** Chapter 10: 10.2, 10.3, 10.5, 10.6, 10.7, 10.11.	

Module – 3	**10 Hrs.**
Fourier Transforms: Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. **Text Book 1:** Chapter 22: 22.2, 22.3, 22.4, 22.5, 22.6.	
Module – 4	**10 Hrs.**
Z-transforms: Definition, Standard Z transforms, Linearity property, Damping Rule, Shifting rule, initial and final value theorems, Bivariate Z-transforms, region of convergence, Inverse Z-transforms by partial fractions method. Solution of difference equations. **Text Book 1:** Chapter 23: 23.1,23.3,23.4,23.5,23.6,23.7,23.9,23.10, 23.15,23.16	
Module – 5	**10 Hrs.**
Complex Variables - Differentiation: Introduction to functions of complex variable-concept of Limit &continuity-Differentiation, Cauchy-Riemann equations (Cartesian and polar form), analytic functions, harmonic functions, finding harmonic conjugate-construction of an analytic function by Milne Thomson method. **Text Book 1:** Chapter 20: 20.1, 20.2, 20.3, 20.4, 20.5, 20.6.	

Topics for Self-learning		
Module – 1	**Applications:**	RLC Circuits.
	Self-study:	Method of Variation of Parameters.
Module – 2	**Applications:**	Signal processing, spectrum analysis.
	Self-study:	Periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave.
Module – 3	**Applications:**	Signal filtering, circuit analysis.
	Self-study:	Convolution Theorem.
Module – 4	**Applications:**	Solving linear time-invariant (LTI) problems, problems of analyzing signals in DSP.
	Self-study:	Initial and final value theorems, proof and problems.
Module – 5	**Applications:**	Signal Analysis & Representation, Analytic Functions in Electromagnetic Fields.
	Self-study:	Complex line integrals.

Course Outcomes: After completing the course, the students will be able to	
CO1	**Solve** higher-order linear differential equations with constant and variable coefficients, including Cauchy's and Legendre's differential equations, arising in engineering applications.
CO2	**Apply** Fourier Series to represent periodic functions and signals and determine Fourier coefficients using Dirichlet's conditions.
CO3	**Analyze** signals using Fourier Transforms and evaluate frequency-domain representations for engineering applications such as signal processing and filtering.
CO4	**Compute** Z-transforms and inverse Z-transforms of discrete-time signals and solve difference equations using Z-transform techniques.

CO5	**Apply** concepts of complex differentiation to construct analytic functions and verify properties of analytic and harmonic functions using Cauchy–Riemann equations and Milne–Thomson method.

Text Books	
1	Higher Engineering Mathematics, B.S. Grewal,45th Edition (2024-25), Khanna Publishers, ISBN-13:978-8193328491

Reference Books	
1	Higher Engineering Mathematics, B. V. Ramana, 11th Ed., 2017, McGraw-Hill Education
2	Advanced Engineering Mathematics, E. Kreyszig, 11th Ed, 2025, John Wiley & Sons. ISBN-13:978-9373329949.
3	A Textbook of Engineering Mathematics, N.P Bali and Manish Goyal, 10th Ed, 2022, Laxmi Publications.

Web links and Video Lectures (e – Resources)	
1	http://nptel.ac.in/courses.php?disciplineID=111
2	http://www.class-central.com/subject/math(MOOCs)

CO – PO & PSO MAPPING

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

Semester: III					
Digital System Design using Verilog (Branch: ECE)					
Course Code	**:**	**1BEC302**	**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:0:28:50	**CIE**	**:**	50 Marks
Total Hours	**:**	120	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Electronics
Knowledge on Fundamental Concepts	Number Systems, Logic Gates, Boolean Algebra
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Analyze and simplify Boolean expressions using K-map techniques and Quine–McCluskey minimization methods.
CLO2	Design and evaluate combinational logic circuits for given functional requirements.
CLO3	Apply design methods and verify the operation of sequential logic circuits.
CLO4	Implement digital system designs using Verilog HDL dataflow and behavioral models.
CLO5	Construct and test a simple digital system using modern CAD tools.

Module – 1	**08 Hrs**
Principles of Combinational Logic: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-up to 4 variables, Quine McCluskey Minimization Technique. (Textbook1: Ch 3 :3.1-3.5)	
Module – 2	**08 Hrs**
Logic Design with MSI Components and Programmable Logic Devices: Parallel Adder, Carry Look Ahead Adder, Decimal Adder and Subtractors (Half and Full), Comparators, Code Conversion (Gray to Binary, Excess-3 to Binary and Vice versa),Decoders, Encoders, Multiplexers, Introduction to Programmable Logic Devices (PLDs). (Textbook2: Ch 5: 5.1-5.7)	
Module – 3	**08 Hrs**
Flip-Flops and its Applications: The Master-Slave Flip-flops (Pulse-Triggered flip-flops):SR flip flops, JK flip flops, Characteristic equations, Counters based on Shift Registers (Ring and Johnson), Design of Synchronous and Asynchronous Counters, Design of Mealy and Moore state models. (Textbook2: Ch 6: 6.4, 6.6 - 6.9)	

Module – 4	**08 Hrs**
Introduction to Verilog: Structure of Verilog module, Operators, Data Types, Styles of Description. **Verilog Data flow description**: Highlights of Data flow description, Structure of Data flow description. (Textbook 3: Ch 1: 1.3 to 1.6) (Textbook 3: Ch 2: 2.1 - 2.2)	
Module – 5	**08 Hrs**
Verilog Behavioral description: Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Multiplexers (2:1, 4:1, 8:1). (Textbook3: Ch 3:3.1 - 3.4) **Verilog Structural description**: Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder. (Textbook3: Section 4.1 to 4.2 of Text 3)	

Practical component	
Module – 1	a) Design and implement Sum-of-Products (SOP) and Product-of-Sums (POS) expressions using universal gates (NAND and NOR) verify their functionality using discrete components.
	b) Design and simulate Half Adder, Full Adder, Half Subtractor, and Full Subtractor circuits using Verilog dataflow modeling.
Module – 2	a) Develop a 4-bit Arithmetic Logic Unit (ALU) using Verilog behavioral modeling and verify its functionality. b) Write and simulate a Verilog program for a 3:8 Decoder using behavioral modeling.
	a) Design and implement a BCD to Seven Segment Display using Verilog and verify the output through simulation. b) Design and Implementation of 4-bit Magnitude Comparator using IC 7485 using discrete components.
Module – 3	a) Model and simulate the following Flip-Flops using Verilog behavioral description: JK Flip-Flop, SR Flip-Flop, T Flip-Flop, D Flip-Flop
	b) Design and implement Ring Counter and Johnson Counter using IC 7476 (JK Flip-Flops) and verify their operation by observing the output sequences using discrete components.
Module – 4	a) Design and implement a 4:1 Multiplexer using basic logic gates and verify its functionality using a truth table using discrete components.
	b) Design and implement an 8:3 Encoder using Verilog behavioral modeling.
Module – 5	a) Design and simulate a simple AI-inspired decision-making circuit using Verilog HDL for binary classification of sensor inputs (e.g., Safe/Alert or Object/No Object).
	b) Implement a threshold-based intelligent controller using Verilog HDL and verify its operation for smart home or industrial automation applications.

Topics for Self learning	
Module – 1	Boolean Function Minimization using Espresso Algorithm
	Applications of Karnaugh Maps in Digital Design
Module – 2	Field Programmable Gate Arrays (FPGAs) – Architecture and Applications
	Programmable Array Logic (PAL) and Generic Array Logic (GAL)
Module – 3	Universal Shift Registers and Their Applications
	Finite State Machine (FSM) Design for Traffic Light Controller
Module – 4	Verilog Modeling of Basic Logic Gates
	Verilog Testbench Development and Simulation Techniques
Module – 5	Design and Verification of Digital Systems using ModelSim/Vivado
	FPGA-based AI Inference and Hardware Acceleration for Embedded Systems.

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret Boolean function simplification using K-map and Quine–McCluskey minimization techniques.
CO2	Apply Boolean algebra and logic gate concepts to design combinational and sequential circuits.
CO3	Analyze and design combinational and sequential digital logic circuits for specified applications.
CO4	Design digital circuits using HDL by applying behavioral, dataflow, gate-level, and structural modeling concepts.
CO5	Develop and implement simple digital systems using modern EDA tools and hardware platforms.

Text Books	
1	Digital Logic Applications and Design by John M Yarbrough, Thomson Learning, 1st Edition, 2015 reprint, Cengage Learning Publisher, ISBN 978-8131500583.
2	Digital Principles and Design by Donald D Givone, 1st Edition, 2018 reprint, McGraw-Hill Publisher, ISBN 9780072525038.
3	HDL Programming VHDL and Verilog by Nazeih M Botros ,1st Edition 2015 reprint, Dreamtech Press, ISBN-108177226975.

Reference Books	
1	Fundamentals of logic design, by Charles H Roth Jr.,7th Edition,2022 reprint, Cengage Learning Publisher, ISBN 9789360535650.
2	Logic Design, by Sudhakar Samuel,1st Edition,2018 reprint, Pearson Education Publisher, ISBN 9788131732304.
3	Fundamentals of HDL, by Cyril PR,1st Edition 2019 reprint, Pearson Education Publisher, ISBN 9788131732472.

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/108105113
2	https://nptel.ac.in/courses/106105185
3	Digital System Design: https://onlinecourses.nptel.ac.in/noc21_ee39/preview
4	Digital Circuits and Logic Design: https://www.udemy.com/course/ultimate-2021-digital-circuits and-logic-design-course/?couponCode=LETSLEARNNOWPP
5	Digital System Design: https: //www.coursera.org/learn/digital-systems
6	Verilog HDL: https://www.youtube.com/watch?v=NCrlyaXMAn8&list=PLRsFfXmDi9IYCNlvNjrsD8bLMm_NE0UxBH
7	Floyd Digital Fundamentals 9e : Free Download, Borrow, and Streaming : Internet Archive

CO – PO & PSO MAPPING

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

Semester: III					
Introduction to Embedded Systems (Branch: ECE)					
Course Code	**:**	**1BEC303**	**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:0:28:50	**CIE**	**:**	50 Marks
Total Hours	**:**	120	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Electronics
Knowledge on Fundamental Concepts	Introduction to C Programming
Knowledge on Connected Tools (If any)	IDE on C

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the differences between Microprocessor and Microcontroller
CLO2	Analyze the basic architecture of 8051microcontroller
CLO3	Make use of Assembly Language and C Program to Analyze 8051 microcontroller
CLO4	Infer the operation and use of inbuilt Timers/Counters, Serial port and Interrupts of 8051
CLO5	Analyze the fundamentals of ARM embedded systems, RISC architecture, and ARM processor organization

Module – 1	**08 Hrs**
Microcontrollers and Embedded Processors: Microcontroller versus General-purpose Microprocessor, Microcontrollers for Embedded systems, Embedded applications, Criteria for choosing a microcontroller. **8051 Architecture**- Introduction, 8051 Microcontroller Hardware, Input/Output Pins, Ports and Circuits, External Memory. Text book 1: Ch.1: 1.1 Text book 2: Ch.1: Ch.3: 3.0-3.3	
Module – 2	**10 Hrs**
Instruction Set: 8051 Addressing Modes, Data Transfer Instructions, Arithmetic instructions, Logical Instructions, Jump & Call Instructions. Text book 2: Ch.5, Ch.6, Ch.7, Ch.8.0-8.3	
Module – 3	**08 Hrs**
Basics of Timers & Counters, Data types & Time delay in the 8051 using C, Programming 8051 Timers, Mode 1 & Mode 2 Programming, Counter Programming (Assembly Language only). Text book 2: Ch.3: 3.4 Text book 1: Ch.7: 7.1, Ch.9: 9.1,9.2 Basics of Serial Communication, 8051 Connection to RS232, 8051 Serial Port Programming in Assembly, Serial Port Programming in C. Text book 2: Ch.3: 3.5 Text book 1: Ch.10: 10.1-10.3,10.5	

Module – 4	**08 Hrs**
Interrupt Programming: Basics of Interrupts, 8051 Interrupts, Programming Timer Interrupts, Programming Serial Communication Interrupts, Interrupt Priority in 8051(Assembly Language only) Text book 2: Ch.3: 3.6 Text book 1: Ch.11: 11.1,11.2,11.4,11.5	
Module – 5	**08 Hrs**
ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware – AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications. **ARM Processor Fundamentals:** ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions. Text book 3: Chapter 1, 2	

Practical component	
Module – 1	1. ALP to move a block of n bytes of data for the following. a. Internal RAM to Internal RAM b. External RAM to External RAM
	2. ALP To exchange N(05) bytes of Dataa a. Internal RAM to Internal RAM. b. Internal RAM to External RAM
Module – 2	3.Perform the following Operations by using ALP and consider the data is stored in RAM Location of 34h and 35h a. Addition b. Subtraction c. Multiplication d. Division
	4.ALP to Separate positive and negative in a given array.
Module – 3	5.ALP for Decimal Counter
	6.ALP for Hexadecimal Counter
Module – 4	7.Find the sum of first 10 Integer Numbers by using 8051 C program.
	8.Find Factorial of a given number by using 8051 C program.
Module – 5	9.8051 C Program to rotate stepper motor in Clock & Anti-Clockwise direction.
	10.8051 C program to Generate Sine & Square waveforms using DAC interface.

Topics for Self learning	
Module – 1	1. Applications of Embedded Systems in Smart Homes, Healthcare, Automotive, and Industrial Automation.
	2. Comparative study of modern microcontrollers (Arduino, ESP32, STM32, Raspberry Pi Pico) with the 8051 microcontroller.
Module – 2	3. Assembly language programming techniques for code optimization in 8051.
	4. Study of Keil µVision IDE and 8051 program simulation using Proteus.
Module – 3	5. Overview of serial communication protocols: UART, SPI, and I²C in embedded systems.
	6. AI-enabled embedded systems: Role of timers, sensors, and serial communication in real-time data acquisition.
Module – 4	7. Real-time applications of interrupts in embedded systems (robotics, traffic control, industrial automation).
	8. Interrupt handling techniques in ARM Cortex-M microcontrollers.
Module – 5	9. ARM Cortex-M processor families and their applications in IoT and embedded systems.
	10. Introduction to TinyML and Edge AI for embedded system applications.

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the architecture and functional concepts of the 8051 microcontroller for embedded system applications.
CO2	Examine the addressing modes and instruction set of the 8051 microcontroller for program execution.
CO3	Develop assembly language programs and C programs for 8051 timers and serial communication.
CO4	Construct interrupt-driven programs using timer and serial communication interrupts in the 8051 microcontroller.
CO5	Infer ARM architecture, embedded system components, and processor fundamentals

Text Books	
1	The 8051 Microcontroller and Embedded Systems – Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollind. Mckinlay, 2nd Edition Pearson, 2019, ISBN:978-81-317-1026-5.
2	The 8051 Microcontroller, Kenneth Ayala, 3rd edition, 2020, Cengage Learning, ISBN:13:978-81-315-0200-6
3	ARM System Developers Guide: Designing and Optimizing System Software, Andrew N Sloss, Dominic Symes and Chris Wright, 1st Edition, 2008, Morgan Kaufmann (Elsevier), ISBN-13: 978-1558608740

Reference Books	
1	The 8051 Microcontroller Based Embedded Systems, Manish K Patel, 2014, McGraw Hill, ISBN: 978-93-329-0125-4.
2	Microcontrollers: Architecture, Programming, Interfacing and System Design, Raj Kamal, 2nd Edition, 2013, Pearson Education, ISBN-13:978-8131759905..
3	Embedded System Design with ARM Cortex-M Microcontrollers, Cem Ünsalan, Hüseyin Deniz Gürhan, and Mehmet Erkin Yücel, 2022, Springer International Publishing, ISBN-13: 978-3030884836.

Web links and Video Lectures (e – Resources)	
1	https://youtu.be/pA6K5NgWTow?si=zQqqgXQq50dVL_-s
2	https://nptel.ac.in/courses/106105193
3	https://www.nxp.com/products/processors-and-microcontrollers/arm-processors:ARM-PROCESSORS

CO – PO & PSO MAPPING

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

Semester: III						
Analog Electronics and Linear Integrated Circuits (Branch: ECE)						
Course Code	**:**	**1BEC304**		**Credits**	**:**	3
Hours/Week (L:T:P:SL)	**:**	42:0:0:48		**CIE**	**:**	50 Marks
Total Hours	**:**	90		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Fundamentals of Electronics and Communication Engineering
Knowledge on Fundamental Concepts	Diodes, Transistors, OPAMPS
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Explain various BJT biasing, parameters and configurations
CLO2	Understand types of MOSFET biasing and demonstrate the use of MOSFET amplifiers
CLO3	Analyze Power amplifier circuits in different modes of operation
CLO4	Construct Feedback and Oscillator circuits using FET
CLO5	Analyze the different types of active filters and different modes of 555 Timer

Module – 1	**08 Hrs**
Transistor Biasing: Voltage Divider Bias (VDB), VDB Analysis, VDB Load line and Q point, Two supply Emitter Bias, Other types of Bias. **BJT AC Models:** Base Biased Amplifier, Emitter Biased Amplifier, Small Signal Operation, AC Beta, AC Resistance of the emitter diode, two transistor models, Analyzing an amplifier. H parameters, Relations between R and H parameters. Text book 1: Ch.8: 8.1-8.5, Ch.9: 9.1-9.8.	
Module – 2	**08 Hrs**
MOSFET: Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, drain to Gate feedback resistor. Small signal operation and modelling: The DC bias point, signal current in drain, voltage gain, and small signal equivalent circuit models, transconductance, The T equivalent circuit model. **MOSFET Amplifier configuration:** Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance, The Common Gate Amplifier, Source follower. Text book 2: Ch.4: 4.5.1-4.5.3, 4.6.1-4.6.3,4.6.5-4.6.7,4.7.1-4.7.6	
Module – 3	**08 Hrs**
Linear Op-amp Circuits: Summing Amplifier and D/A Converter, Comparator with and without references, Comparator with Hysteresis (Schmitt trigger) **Oscillators:** Theory of Sinusoidal Oscillation, The Wein-Bridge Oscillator, RC Phase Shift Oscillator, The Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator. **555 timer:** Monostable Operation, Astable Operation. **Precision Rectifiers:** Halfwave and Fullwave precision rectifiers Text book 1: Ch.20: 20.6, Ch.22: 22.1-22.3, Ch.23: 23.1-23.4,23.7-23.9 Text book 3: Ch.8: 8-12-2	
Module – 4	**08 Hrs**
Negative Feedback: Four Types of Negative Feedback, Advantages and Applications **Filters:** Active Filters, First order low pass Butterworth Filter, Second order low pass Butterworth Filter, First order high pass Butterworth Filter, Second order high pass Butterworth Filter, Band Pass Filters, Band Reject Filters, All Pass Filter. Text book 1: Ch.19: 19.1 Text book 3: Ch.7: 7.2-7.10	

Module – 5	08 Hrs
Power Amplifiers: Amplifier terms, Two load lines, Class A Operation, Class B operation, Class B push pull emitter follower, Class C Operation. **Introduction to power electronics:** Definition, Applications of PE, Types of power converters, VI characteristics of SCR, Two transistor analogy of SCR, Bidirectional Thyristors, IGBTs, phase control. Text book 1: Ch.12, Ch.15	

Topics for Self learning	
Module – 1	Comparison of CE, CB, and CC Amplifiers
	Thermal Runaway in BJTs and its Prevention
Module – 2	Comparison of MOSFET and BJT Amplifiers
	Enhancement MOSFET vs Depletion MOSFET
Module – 3	Comparison of Industrial OPAMPs packages
	Comparison of RC and LC Oscillators
Module – 4	Comparison of Active and Passive Filters
	Applications of All-Pass Filters
Module – 5	Comparison of Class A, Class B, Class AB, and Class C Amplifiers
	Comparison of SCR, TRIAC, DIAC, MOSFET, and IGBT

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize the configurations and characteristics of BJTs and MOSFETs for switching and amplifier applications.
CO2	Design amplifier and oscillator circuits using different transistor configurations for specified applications.
CO3	Construct feedback circuits and active filters using various feedback topologies and approximation techniques.
CO4	Interpret the characteristics and operation of power amplifiers and power electronic devices such as thyristors and IGBTs for power control applications.
CO5	Design various applications using electronic circuits and verify using EDA tools.

Text Books	
1	Electronic Principles, Albert Malvino, David J Bates, 7th Edition, 2017, Mc Graw Hill Education, ISBN: 978-0- 07-063424-4.
2	Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford,2015. ISBN:978-0-19-808913-1
3	Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, Pearson Education,2018. ISBN: 978-93-325-4991-3

Reference Books	
1	Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C.Halkias, McGraw-Hill, 2015.
2	Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=m4sjTt7rhow
2	https://www.youtube.com/watch?v=0RSl-QJ5-4A
3	https://www.youtube.com/watch?v=huDZjQcEBMg

CO – PO & PSO MAPPING

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

Semester: III					
Network Analysis **(Branch: ECE)**					
Course Code	**:**	1BEC305	**Credits**	**:**	3
Hours/Semester (L:T:P:SL)	**:**	42:0:0:48	**CIE**	**:**	50 Marks
Total Hours	**:**	90	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Fundamentals of Electrical Engineering,
Knowledge on Fundamental Concepts	Active and Passive components, ohms law, KVL and KCL
Knowledge on Connected Tools (If any)	--

Course Learning Objectives: This course will enable the students to	
CLO1	Develop the ability to use source transformation, source shifting, mesh, and nodal analysis to determine resistance/impedance, voltage, current, and power in electrical circuits.
CLO2	Gain the proficiency in applying Thevenin's, Norton's, Superposition, Millman's, and Maximum Power Transfer theorems to simplify and solve complex circuit problems.
CLO3	Understand and evaluate the dynamic response of electrical networks subjected to transient conditions, focusing on practical interpretation of circuit behavior
CLO4	Understand and apply two-port network parameters, their modeling, and inter-relationships, as well as to analyze resonance phenomena in electrical circuits.
CLO5	Apply Laplace-based approaches to step, ramp, and impulse inputs along with initial and final value theorems to deduce accurate time-domain responses of electrical circuits.

Module – 1	**08 Hrs**
Basic Concepts: Practical sources, Source transformations, Network reduction using Star–Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concept of super node and super mesh. Text book 1: Ch.3: 3.1,3.4-3.6	
Module – 2	**08 Hrs**
Network Theorems: Superposition, Milliman's theorems, Thevenin's and Norton's theorems, Maximum Power transfer theorem. Text book 1: Ch.9: 9.4,9.5	
Module – 3	**08 Hrs**
Two port network parameters: Definition of Z, Y, h and ABCD parameters, modelling with these parameters, and relationship between parameters sets. **Resonance**: Definition, Characteristics of Series and Parallel Resonance. Problems on series and parallel resonance. Text book 1: Ch.10: 10.6,10.7, Ch.11: 11.1,11.4	

Module – 4	**08 Hrs**
Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC Circuits. Text book 1: Ch.5: 5.1-5.3	
Module – 5	**08 Hrs**
Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis. Initial and Final value Theorem. Text book 1: Ch.7: 7.1,7.2,7.4,7.5,7.8, Ch.8: 8.1,8.2,8.5	

Topics for Self learning	
Module – 1	Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL)
	Applications of Star–Delta Transformation in Electrical Power Distribution Networks
Module – 2	Reciprocity theorem, Compensation theorem, Substitution theorem, Tellegen's theorem,
	Practical applications of Thevenin's and Norton's equivalents in electrical systems and importance of Maximum Power Transfer Theorem in Communication and Audio Systems
Module – 3	Transmission line basics, Hybrid-π model of transistor as a two-port network,
	Applications of resonance circuit in Filters, Tuned Circuits, and importance of Quality factor, bandwidth, Selectivity of resonant circuits,
Module – 4	Natural & forced responses of circuits, Damping in 2^{nd} order systems, Energy storage in inductors & capacitors.
	Protection of Electrical Circuits from Switching Transients and Surge Voltages.
Module – 5	Properties of Laplace transforms, Inverse Laplace transform using partial fractions
	Role of Initial Value and Final Value Theorems in System Stability and Circuit Analysis

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply basic electrical laws, network reduction techniques and network theorems to solve electrical networks.
CO2	Solve for various two-port network parameters and study the characteristics of series and parallel resonance circuits.
CO3	Analyze transient responses and calculate initial and final conditions in RL, RC, and RLC circuits under switching operations.
CO4	Apply Laplace Transform techniques to solve network problems and derive time-domain responses.
CO5	Demonstrate the behavior of electrical circuits using modern tools.

Text Books	
1	Network Analysis, M. E.Van Valkenburg, Revised Edition, 2019,Pearson India, ISBN:978-81-317-0158-4.

Reference Books	
1	Fundamentals of Electric Circuits, Charles K. Alexander and Matthew N. O. Sadiku, 7th Edition, 2020, McGraw Hill Education, ISBN: 978-1-260-22640-9.
2	Networks and Systems, D. Roy Choudhury, 2nd Edition (Reprint), 2020, New Age International, ISBN: 978-81-224-2767-7.
3	Engineering Circuit Analysis, William H. Hayt, Jack E. Kemmerly, Jamie Phillips, and Steven M. Durbin, 10th Edition, 2024, McGraw-Hill Education, ISBN: 978-1-266-26249-4.

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/108/106/108106070
2	https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html

CO – PO & PSO MAPPING

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

Semester: III					
Analog Electronics and Linear Integrated Circuits Lab (Branch: ECE)					
Course Code	**:**	1BECL306	**Credit**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02	**CIE**	**:**	50 Marks
Total Hours	**:**	30	**SEE**	**:**	50 Marks
Course Type	**:**	PCCL	**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Fundamentals of Electronics
Knowledge on Fundamental Concepts	Diodes, Transistors, OPAMPS,
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Gain knowledge of the working principles and applications of analog electronic components such as BJT, MOSFET, Op-Amps, and 555 timers.
CLO2	Explore the design and implementation of analog electronic circuits including amplifiers, oscillators, filters, converters, and multivibrators.
CLO3	Develop the ability to analyze and evaluate circuit performance using laboratory instruments and measurement techniques.
CLO4	Enhance practical skills in circuit construction, testing, troubleshooting, and hardware implementation.
CLO5	Explore the use of EDA and simulation tools for modeling, verification, and performance analysis of electronic circuits.

Experiments	
Sl. No.	**List of Experiments to execute in the Laboratory ….**
1.	Design and implement a voltage-divider bias BJT circuit to achieve a collector current of 2 mA and collector-emitter voltage of 6 V using a 12 V supply.
2.	Design and implement a common-source MOSFET amplifier with a voltage gain of 10 ± 10% and determine its frequency response over the range 100 Hz to 1 MHz.
3.	Design and set up an RC phase-shift oscillator using an op-amp to generate a sinusoidal output signal of frequency 1 kHz ± 5%.
4.	Design and implement second-order Butterworth active low-pass and high-pass filters using an op-amp with a cutoff frequency of 1 kHz and passband gain of 1.586.
5.	Design and construct an RC-coupled amplifier with a voltage gain of at least 50, and compare the gain and bandwidth with and without feedback.
6.	Design and implement the following op-amp circuits:(i)Comparator with a reference voltage of 2 V (ii).Inverting Schmitt Trigger with a hysteresis width of 1 V.
7.	Design op-amp based 4-bit R – 2R Digital to Analog Converter (i) using 4-bit binary input from toggle switches and (ii) by generating digital inputs using mod-16 counter.
8.	Design Monostable Multivibrator using 555 timer for a pulse width of 1 ms.
9.	Design Astable Multivibrator using 555 timer with frequency of 1kHz.
10.	Design and implement half-wave and full-wave precision rectifiers using op-amps for an input signal of 1 V peak amplitude at 1 kHz.
11.	Simulate the V-I Characteristics of Silicon Controlled Rectifier (SCR) and compute its latching and holding current.

12.	Design and simulate class C amplifier circuit for a given specification and also obtain the output characteristics.

Open Ended Experiments	
1	Design a MOSFET current mirror circuit to generate a constant current for different load resistance.
2	Design an instrumentation amplifier to meet given gain and bandwidth specifications and validate the design through simulation.

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the performance characteristics and stability of BJT and MOSFET amplifier circuits.
CO2	Design and implement oscillator circuits such as RC phase shift and crystal oscillators for specified frequencies.
CO3	Design Op-Amp based DAC, Precision rectifier for various analog electronics.
CO4	Develop sinusoidal and non-sinusoidal waveforms generation using 555 timer.
CO5	Simulate and validate electronic circuit performance using EDA tools and interpret results.

Text Books	
1	Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, 2021, Pearson Education. ISBN: 978-9353949037.
2	Electronic Principles, Albert Malvino, David J Bates, 7th Edition, 2017, Mc Graw Hill Education, ISBN: 978-0- 07-063424-4.
3	Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6thEdition, 2015, Oxford.ISBN:978-0-19-808913-1.

Reference Books	
1	Millman's Integrated Electronics: Analog and Digital Circuits and Systems, Ramamurthy, 3rd Edition, October 2025, MedTech,Science Press. ISBN: 978-9363636507
2	Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, January 2021, Pearson. ISBN 0132783746.

Web links and Video Lectures (e – Resources)	
1	https://www.electronics-tutorials.ws/amplifier/mosfet-amplifier.html
2	https://www.electronics-tutorials.ws/filter/filter_2.html
3	https://www.next.gr/tutorials/analog-circuit-analysis/monostable-multivibrator-tutorial?utm_source
4	https://youtu.be/2ErkCJczBKo?si=Ss86lSiqeL2oQcPw

CO – PO & PSO MAPPING

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

Semester: III					
Problem Solving Using C **(Branch: ECE)**					
Course Code	**:**	1BECL307A	**Credit**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02	**CIE**	**:**	50 Marks
Total Hours	**:**	30	**SEE**	**:**	50 Marks
Course Type	**:**	AEC	**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Introduction to C, Fundamentals of Programming
Knowledge on Fundamental Concepts	Basic understanding of algorithms, variables, data types, control structures and problem-solving concepts.
Knowledge on Connected Tools (If any)	Exposure to tools used for C programming, such as: Text editors (e.g., Notepad++, VS Code), Compilers (e.g., GCC), Basic command-line usage

Course Learning Objectives: This course will enable the students to	
CLO1	Understand and apply the core elements of C programming, including variables, data types, operators and decision-making constructs to solve basic computational problems.
CLO2	Develop the ability to decompose complex problems into smaller, manageable tasks by designing and implementing modular, reusable functions with proper parameter passing.
CLO3	Master the use of arrays, strings, structures, and unions to efficiently organize, store, and manipulate structured data in memory.
CLO4	Explore the concepts of memory addressing and dynamic memory allocation.
CLO5	Implement file-handling techniques to perform input/output operations, enabling the creation and management of permanent data storage for real-world applications.

Experiments	
Sl. No.	**List of Experiments to execute in the Laboratory ….**
1.	Develop a program to accept a sequence of signal values and calculate the mean, peak value and noise level.
2.	Implement a simple moving-average filter to process a noisy signal and display both the original and filtered results.
3.	Create a system to convert text to binary, transmit it with optional noise (bit flipping), and reconstruct the message at the receiver
4.	Simulate data acquisition (such as temperature or voltage), store the readings in a file, and analyze the average, minimum and maximum values.
5.	Implementation of a Simple Arithmetic Calculator in C Using Switch Case.

6.	Implement even and odd parity bits to detect errors during simulated digital communication transmission.
7.	Compute voltage, current, and resistance using Ohm's Law, including calculations for series and parallel resistor circuits.
8.	Develop a program for Student Grade Calculator Using C to Calculate Total Marks, Average, Percentage and Grade.
9.	Develop a menu-driven interface to control virtual devices such as lights and fans, with sensor-based or scheduled automation.
10.	Calculate the frequency, time period, and angular frequency of a signal based on user input, and plot the resulting sine waves

Open Ended Experiments	
1	Develop a C program to simulate a secure serial communication link between two devices. The system should allow the user to input a text message, encrypt it using a custom algorithm (such as a XOR-based cipher or a shifting cipher), and package it into a data frame.
2	Create a C program that simulates the monitoring of multiple industrial sensors(e.g., temperature, pressure, and humidity). The program should use an array of structures to store current sensor values and their safety thresholds.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply basic C programming concepts to solve simple engineering problems.
CO2	Develop C programs using control statements, functions, arrays, and file handling.
CO3	Implement C programs for engineering applications such as data processing, signal analysis, and automation.
CO4	Analyze and interpret program outputs to solve real-world engineering problems.
CO5	Design, test, and document C-based solutions for open-ended engineering applications.

Text Books	
1	The C Programming Language – Brian W. Kernighan & Dennis M. Ritchie, 2nd Edition (latest), Prentice Hall/Pearson.
2	Programming in ANSI C – E. Balagurusamy, 8th Edition (2023) / 9th Edition(latest updates), McGraw Hill Education.

Reference Books	
1	**C: The Complete Reference** – C The Complete Reference, Herbert Schildt, 4th Edition,McGraw Hill.
2	**Expert C Programming: Deep C Secrets** – Expert C Programming Deep C Secrets, Petervan der Linden, 1st Edition, Prentice Hall.
3	**C Programming: A Modern Approach** – C Programming A Modern Approach, K. N.King, 2nd Edition, W. W. Norton & Company.

Web links and Video Lectures (e – Resources)	
1	https://www.learn-c.org/
2	https://nptel.ac.in/courses/106106147
3	https://www.programiz.com/c-programming

CO – PO & PSO MAPPING

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

Semester: III					
Python for Electronics (Branch: ECE)					
Course Code	**:**	1BECL307B	**Credit**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02	**CIE**	**:**	50 Marks
Total Hours	**:**	30	**SEE**	**:**	50 Marks
Course Type	**:**	AEC	**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Introduction to Programming.
Knowledge on Fundamental Concepts	Basic knowledge of programming concepts Understanding of mathematical/logical problem solving.
Knowledge on Connected Tools (If any)	Familiarity with computer operations and basic tools (IDE, compiler/interpreter)

Course Learning Objectives: This course will enable the students to	
CLO1	Understand and apply fundamental Python programming concepts including data types, control structures, and functions.
CLO2	Develop problem-solving skills through implementation of real-world applications using Python.
CLO3	Analyze and process data using appropriate Python libraries and techniques.
CLO4	Design and implement modular, reusable, and efficient Python programs.
CLO5	Explore basic concepts of automation, simulation, and simple system modeling using Python.

Experiments	
Sl. No.	**List of Experiments to execute in the Laboratory ....**
1.	Develop a Python program to simulate basic signal processing by accepting a sequence of signal values (discrete samples) and performing operations such as calculating mean, peak value and noise level.
2.	Develop a Python-Based Application to Analyze the Charging and Discharging Characteristics of an RC Circuit Through Numerical Computation and Graphical Visualization.
3.	Develop a Python-Based Simulation to Study the Transient Current Response and Time Constant of an RL Circuit.
4.	Develop a Python-Based Simulation Model to Analyze the Dynamic Behavior and Waveforms of a Series RLC Circuit.
5.	Develop a Python-Based Calculator to Determine the Appropriate Current-Limiting Resistor for LED Biasing Applications.
6.	Develop a Python-Based Tool to Compute and Analyze the Output Voltage of a Voltage Divider Network for Different Input Conditions.
7.	Develop a Python program to compute electrical parameters such as voltage, current, and resistance using Ohm's Law. Extend it to handle series and parallel resistor calculations.
8.	Develop a Python-Based Application to Calculate the Capacitor Charging Time and Evaluate the Time Constant of an RC Circuit.
9.	Develop a Python-Based Battery Backup Time Estimator to Evaluate Battery Performance Under Various Load Currents.

10.	Develop a Python-Based Resistor Color Code Analyzer to Decode Color Bands and Determine the Resistance Value and Tolerance of Resistors.

Open Ended Experiments	
1	Develop a Python program to help users manage daily tasks and track productivity. The system should allow adding, updating, and completing tasks, along with tracking time spent. Extend the program with features like priority levels, reminders, data visualization, and performance insights.
2	Create a Python program that suggests items (such as movies, books, or courses) based on user preferences. The program should take user input, analyze patterns, and generate recommendations. Extend it with features like rating systems, history tracking, and basic machine learning techniques for improved suggestions.

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop Python programs using fundamental programming constructs, data structures, and libraries to solve basic engineering and mathematical problems.
CO2	Analyze and simulate electrical and electronic circuits using Python by implementing numerical methods, mathematical models, and graphical visualization techniques.
CO3	Apply Python programming to develop computational tools for solving practical engineering problems related to electronic circuits, signal processing, and system analysis.
CO4	Design and implement Python-based applications for data analysis, visualization, and engineering computations using appropriate libraries such as NumPy and Matplotlib.
CO5	Design innovative Python-based solutions for open-ended engineering problems by integrating problem-solving skills, algorithm development, and modern computational techniques.

Text Books	
1	Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, **3rd Edition**, No Starch Press, 2023.
2	Wesley J. Chun, Core Python Programming, 2nd Edition, Prentice Hall (Pearson Education), 2006.

Reference Books	
1	Wesley J. Chun, Core Python Programming, **2nd Edition**, Prentice Hall (Pearson Education), 2006.
2	Al Sweigart, Automate the Boring Stuff with Python, **2nd Edition**, No Starch Press, 2019.
3	Mark Lutz, Learning Python, **5th Edition**, O'Reilly Media, 2013.

Web links and Video Lectures (e – Resources)	
1	https://www.coursera.org/specializations/python
2	https://www.learnpython.org/

CO – PO & PSO MAPPING

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

Semester: III					
Data Structures Lab (Branch: ECE)					
Course Code	**:**	1BECL307C	**Credit**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02	**CIE**	**:**	50 Marks
Total Hours	**:**	30	**SEE**	**:**	50 Marks
Course Type	**:**	AEC	**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Basic Programming Language
Knowledge on Fundamental Concepts	Loops, Functions, Recursion, Basic mathematical logic.
Knowledge on Connected Tools (If any)	C

Course Learning Objectives: This course will enable the students to	
CLO1	Understand fundamental concepts of data structures, including classification
CLO2	Apply fundamental operations such as insertion, deletion, and traversal on arrays, stacks, queues, and linked lists
CLO3	Analyze simple algorithms in terms of time and space complexity.
CLO4	Implement basic data structures using a programming language.
CLO5	Select appropriate data structures to solve simple computational problems.

Experiments	
Sl. No.	**List of Experiments to execute in the Laboratory ....**
1.	Design, Develop and Implement a menu driven Program in C for the following Array operations a. Creating an Array of N Integer Elements b. Display of Array Elements with Suitable Headings c. Inserting an Element at a given valid Position (POS) d. Deleting an Element at a given valid Position (POS) e. Exit
2.	Design, Develop and Implement the **Bubble Sort** Algorithm Using One-Dimensional Arrays in C to Sort Data in Ascending OrderMerge Sort
3.	Design, Develop and Implement the **Merge Sort** Algorithm Using One-Dimensional Arrays in C to Sort Data in Ascending Order
4.	Design, Develop and Implement a menu driven Program in C for the following operations on **STACK** of Integers (Array Implementation of Stack with maximum size **MAX**) a. **PUSH** an Element on to Stack b. **POP** an Element from Stack c. Demonstrate how Stack can be used to check **Palindrome** d. Demonstrate **Overflow** and **Underflow** situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
5.	Design, Develop and Implement a C Program to Sort Array Elements in Ascending Order Using the Insertion Sort Algorithm

6.	Design, Develop and Implement a Program in C for the following Stack Applications a. Evaluation of **Suffix** expression with single digit operands and operators: +, -, *, /, %, ^ b. Solving Tower of **Hanoi** problem with n disks
7.	Design, Develop and Implement a menu driven Program in C for the following operations on **Circular QUEUE** of Characters a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
8.	Design, Develop and Implement a menu driven Program in C for the following operations on **Singly Linked List (SLL)** a. Create a SLL. b. Insert at Beginning c. Insert at Last d. Insert at any random location e. Delete from Beginning f. Delete from Last g. Delete node after specified location h. Search for an element i. Show and Exit
9.	Design, Develop and Implement a menu driven Program in C for the following operations on **Doubly Linked List (DLL)** a. Create a **DLL**. b. Print all the elements in DLL in forward traversal order c. Print all elements in DLL in reverse traversal order d. Exit
10.	Design, Develop and Implement a menu driven Program in C for the following operations on **Binary Search Tree (BST)** of Integers a. Create a BST of N Integers: 8, 10, 3, 1, 6, 14, 7 b. Traverse the BST in Inorder c. Traverse the BST in Preorder d. Traverse the BST in and Post Order

Open Ended Experiments	
1	Design, Develop and Implement a C Program to Compare the Performance of Multiple Sorting Algorithms for Different Input Sizes
2	Design, Develop and Implement a Menu-Driven Student Record Management System Using Arrays and Functions in C

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply array operations and sorting techniques to organize and manipulate data efficiently using C programming.
CO2	Implement stack and queue data structures and their applications to solve computational problems.
CO3	Design and implement linked list data structures to perform dynamic memory allocation and data manipulation operations.
CO4	Develop tree-based data structures and perform traversal operations for efficient data organization and retrieval.
CO5	Analyze, compare, and develop data structure-based solutions for real-world problems using appropriate algorithms and programming techniques.

Text Books	
1	Introduction to Algorithms : Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, MIT Press, Cambridge,4th Edition, 2022 https://iitdh.ac.in/~konjengbam.anand/courses/daa/CLRS4e2022.pdf
2	Data Structures and Algorithms Analysis in C++, Mark A. Weiss, Person, 4th Edition, 2014, ISBN-13: 978-0-13-284737-7

Reference Books	
1	Fundamentals of Data structures by Ellis Horowitz & Sartaj Sahni, Pub, 1983,AW
2	Data Structures and Program Design in C By Robert Kruse, PHI,
3	Theory & Problems of Data Structures by Jr. Symour Lipschetz, Schaums outline by TMH

Web links and Video Lectures (e – Resources)	
1	https://youtube.com/playlist?list=PLFW6lRTa1g83G4WDJOXocqhy_XdMraBJW&si=dnJ3KSNRHa-ns7Se
2	https://youtube.com/playlist?list=PLB3CD0BBB95C1BF09&si=ZpkpqCv7XWrmB7ap
3	https://youtube.com/playlist?list=PLUl4u3cNGP61Oq3tWYp6V_F-5jb5L2iHb&si=kT1Cs5HQ8PLdxy5t

CO – PO & PSO MAPPING

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

Semester: III						
BASICS OF ROBOTICS AND AUTOMATION LAB						
Course Code	**:**	1BECL307D		**Credits**	**:**	1
Hours/Week (L:T:P)	**:**	0:0:28:02		**CIE**	**:**	50 Marks
Total Hours	**:**	30		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Engineering Graphics / Engineering Drawing, CAED, Differential calculus, Laplace Transform and Linear Algebra, Basic Programming
Knowledge on Fundamental Concepts	Physics, Design Thinking
Knowledge on Connected Tools (If any)	CAD Tools

Course Learning Objectives: This course will enable the students to	
CLO1	Introduce the fundamentals of **robot components and mechanisms**, including motors, sensors, gears, wheels, and robotic structures.
CLO2	Develop proficiency in **3D modeling and assembly design** using CAD tools such as SolidWorks
CLO3	Provide knowledge of **robot simulation environments** such as Gazebo, RoboDK, and V-REP for validating robotic designs
CLO4	Enable understanding of **engineering analysis concepts** such as load, stress, torque, and motion characteristics in robotic systems.
CLO5	Encourage hands-on learning through **prototyping, testing, and mini-project development**, focusing on real-world robotic applications

Experiments	
List of Experiments to execute in the Laboratory	
1.	Study, Identification, and Disassembly of Robot Parts (Motors, Wheels, Chassis, Sensors)
2.	Introduction to SolidWorks for Robot Modeling
3.	Design of Gears and Wheels in SolidWorks
4.	Design of Chassis and Gripper in SolidWorks
5.	Design and Modeling of a 2-DOF Robotic Arm
6.	Assembly of Robot Components in SolidWorks (Arm, Chassis, Wheels)
7.	Complete Mobile Robot Assembly in SolidWorks
8.	Load and Structural Analysis of Robotic Arm (SolidWorks Simulation)
9.	Torque and Speed Analysis for Robotic Wheel Selection
10.	Design of Pick-and-Place Robot Simulation (Robot Studio / V-REP /Gazebo/ RoboDK)
	Open Ended Experiments
1.	Design 3D Printing using Robotic Part (e.g., Gripper, Chassis Component, Wheel Hub)
2.	Design and Demonstration of a Real-World Task-Oriented Robot System

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply CAD tools to design and model robotic components including gears, wheels, chassis, and manipulators.
CO2	Design and assemble robotic systems and validate them using simulation tools such as RoboDK and Gazebo.
CO3	Analyze robotic systems by performing structural, load, torque, and speed analysis using simulation environments.
CO4	Demonstrate practical skills in prototyping and evaluating robotic components using 3D printing.
CO5	Design, simulate, and implement task-oriented robotic systems for real-world applications.

Text Books	
1	**Engineering Design with SolidWorks** – David C. Planchard, SDC Publications, 2024

Reference Books	
1	**Robot Modeling and Control** – Mark W. Spong, first edition, JOHN WILEY & SONS, INC.

Web links and Video Lectures (e – Resources)	
1	https://www.robotshop.com/blog/en/robot-components-101-12023 https://www.youtube.com/watch?v=7U2Xy9v1o8o , - SolidWorks Beginner to Advanced https://www.youtube.com/watch?v=6nJvZZfA2sU, - SolidWorks Assembly Basic

CO – PO & PSO MAPPING

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

Semester: III					
Community Project					
Course Code	:	1BCP308	**Credit**	:	1
Hours/Semester (L:T:P:SL)	:	0:0:0:30	**CIE**	:	50 Marks
Total Hours	:	30	**SEE**	:	50 Marks
Course Type	:	SDC	**SEE Duration**	:	2 Hours

Course Learning Objectives: This course will enable the students to	
CLO1	Foster civic engagement and social responsibility by immersing students in communities to identify societal, welfare, and sustainability challenges.
CLO2	Apply engineering principles and interdisciplinary thinking to analyze community problems and design practical solutions.
CLO3	Develop professional skills in teamwork, project management, and effective communication with diverse community stakeholders.
CLO4	Instill an understanding of sustainable development, engineering ethics, and the long-term socio-economic impacts of technical interventions.
CLO5	To cultivate ethical engineering practices and an appreciation for sustainable development by analyzing the long-term impacts of technology on society.

Restrictions and professional conduct:

Community / Societal Projects shall remain academic, socially responsible, technically focused, and politically neutral. Students and faculty shall maintain professionalism, ethical conduct, public respect and institutional integrity while interacting with communities, public groups, organizations and stakeholders.

Students and faculty shall avoid the following during project execution:

- Association with political party activities, campaigns or propaganda.
- Participation in activities that may disturb communal harmony, public order or institutional reputation.
- Use of the project platform for personal, political, ideological or commercial promotion.
- Disrespectful, discriminatory or unethical interaction with community members or stakeholders.

Projects must also recognize constraints related to cost, resources, environment and safety, and stakeholder behavior/cooperation/acceptance when planning and implementing activities.

SET OF PROJECT ACTIVITIES (TW/SL = 30 HOURS)

Methods for project identification:

Students may identify the project topic using one or more of the following methods:

- Interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.
- Review of issues highlighted in print and electronic media, and social networks (WhatsApp, Facebook, X, Instagram, etc.).
- After selecting a broad topic, students shall collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and then define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

Sl. No.	Project title	Measurable engineering outcome	Mapped POs	SDGs
1	Rural and urban water conservation and management systems	Prepare a site-specific water-saving plan, estimate water demand–supply gap, and propose a feasible conservation intervention with quantified savings.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 6, SDG 11, SDG 12
2	Waste management and recycling	Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.	PO2, PO3, PO4, PO6, PO8, PO10	SDG 11, SDG 12, SDG 13
3	Afforestation	Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
4	Biogas generation and power generation	Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 11, SDG 12
5	DPR for solar power rural plant	Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 9, SDG 11
6	DPR for electrification of village/tribal community	Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 7, SDG 9, SDG 10
7	DPR for rural drainage system	Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction.	PO1, PO2, PO3, PO4, PO6, PO10	SDG 6, SDG 9, SDG 11
8	Sustainability and environmental health projects	Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.	PO2, PO3, PO4, PO6, PO7, PO8	SDG 3, SDG 6, SDG 11, SDG 12
9	Plastic free campaigns	Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.	PO2, PO3, PO6, PO7,	SDG 11, SDG 12, SDG 13

			PO8, PO10	
10	Health and nutrition awareness	Conduct baseline and post-program awareness survey and document improvement in awareness score or	PO2, PO6, PO7, PO8, PO9, PO10	SDG 2, SDG 3, SDG 11
11	Societal projects involving health wellness	Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.	PO2, PO3, PO6, PO8, PO9, PO10	SDG 3, SDG 11, SDG 17
12	Air quality monitoring system	Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.	PO2, PO3, PO4, PO5, PO6, PO10	SDG 3, SDG 11, SDG 13
13	Plastic waste reduction campaign	Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
14	Urban greening projects	Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
15	Smart agriculture solution	Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 9
16	Smart irrigation system	Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 12
17	Youth mentoring programmes	Deliver a structured mentoring activity and measure participation, engagement, and skill/awareness improvement.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 17
18	Adult education	Conduct learner-needs assessment, prepare instructional content, and measure improvement in basic literacy or numeracy indicators.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 17

19	Food security initiatives / cold storage system	Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 9, SDG 12
20	Human rights awareness with legal systems	Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding.	PO6, PO7, PO8, PO9, PO10	SDG 5, SDG 10, SDG 16
21	House tax collection through digital media	Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time.	PO2, PO3, PO4, PO5, PO10, PO11	SDG 9, SDG 11, SDG 16
22	Use of application / application program	Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement.	PO1, PO3, PO4, PO5, PO9, PO10	SDG 9, SDG 11, SDG 17
23	Creation of Panchayat library	Plan the library model, catalogue resources, and measure usage, accessibility, or participation outcomes.	PO6, PO8, PO9, PO10, PO11	SDG 4, SDG 10, SDG 11, SDG 17

Suggested Learning Resources:

Textbooks:

1. Phadke, N. D. Community Engagement and Social Innovation. 1st ed., Oxford University Press, New Delhi.
2. Garg, N. R. Project-Based Learning in Engineering Education. 1st ed., Pearson India Education Services, Noida.
3. Gupta, A. and P. Singh. Service Learning and Community Projects. 1st ed., McGraw-Hill Education (India), New Delhi.
4. Wilson, G. Practical Guide to Community Development Projects. 2nd ed., Routledge, London.

Reference books:

1. NPTEL courses on Project-Based Learning and Social Innovation.
2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: https://sdgs.un.org
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.

NGO and government field-action case studies related to sanitation, water, health, education, and environment.

Web links and Video Lectures (e-Resources):

1. NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
2. NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
3. Virtual Labs – Geotechnical Engineering Virtual Lab (IIT Kanpur): https://vlab.co.in
4. Geological Survey of India (GSI) – Maps, reports, and publications: https://www.gsi.gov.in

5. YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
6. American Society of Civil Engineers (ASCE) – Geotechnical resources and standards

Teaching Learning Process:

The suggested TLP for Community / Societal Project is as follows:

Week	Teaching–Learning Activity	Faculty Role	Student Activity	Output / Evidence
1	Course introduction, objectives, ethics, conduct, and assessment briefing	Explain course scope, rules, rubrics, and expected deliverables	Understand course requirements and form teams	Team list, course plan
2	Community problem identification and topic selection	Guide topic framing and feasibility	Identify local issues through discussion and observation	Shortlisted project topic
3	Stakeholder interaction and preliminary survey	Demonstrate survey methods and stakeholder engagement	Collect initial data from community/users	Survey notes, interview record
4	Problem statement and objective formulation	Review and refine problem statement	Prepare problem statement, scope, and objectives	Approved problem statement
5	Literature/case study review and baseline analysis	Suggest relevant references and examples	Study existing solutions and compare approaches	Baseline analysis summary
6	Project planning and role assignment	Help teams organize tasks, timeline, and responsibilities	Plan activities, divide roles, and prepare schedule	Work plan / Gantt chart
7	Feasibility analysis and solution brainstorming	Check technical feasibility and practicality	Generate possible engineering solutions	Solution alternatives sheet
8	Selection of final solution and design approach	Review final concept and design logic	Finalize concept, methods, and expected outcome	Concept note / design outline
9	Data processing / calculations / sizing / mapping	Support computations and technical review	Analyze data, perform calculations, prepare maps/charts	Technical analysis sheet
10	Prototype / model / audit / DPR / app development	Monitor progress and correct technical issues	Develop the selected output	Working model / draft DPR / map / app
	Testing,	Evaluate technical	Test prototype or	Test results /

11	refinement, and implementation planning	correctness and improvements	validate proposal with users	revised output
12	Field implementation / demonstration / awareness activity	Facilitate community interaction and documentation	Conduct implementation or demonstration	Photos, attendance, implementation record
13	Documentation of outcomes, feedback, and impact	Review report structure and completeness	Compile findings, stakeholder feedback, and observations	Draft report
14	Presentation preparation and viva practice	Conduct mock presentation and feedback	Prepare slides/poster and rehearse	Presentation deck
15	Final presentation, submission, and reflection	Evaluate performance using rubrics	Present project, submit report, reflect on learning	Final report, presentation, viva

Assessment structure:

A. Continuous Internal Evaluation (CIE) – 50 marks

- Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totaling 50 marks:

CIE pass requirement:

- A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.
- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

B. Semester End Examination (SEE) – 100 marks (scaled to 50)

- Examination duration: 2 hours.
- Maximum examination marks: 100 scaled to 50
- The SEE shall be conducted batch-wise by two examiners, one faculty from the same department and one from a different department appointed by the Principal.

SEE pass requirement and overall passing rule:

- For a pass in SEE, a student shall secure minimum 35 marks out of 100.
- For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40; otherwise, the student is awarded grade F (Fail).

CIE Rubric — Continuous Internal Evaluation (Total 50 marks):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry/ co mmunity	8	Problem is clearly identified with strong evidence of societal relevance and well-defined scope.	Problem is Relevant and scope is clear with adequate supporting evidence.	Problem defined but justificatio n or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.
Formation of		Problem	Problem	Problem	Problem

problem statement; Engineering approach, innovation & feasibility	10	statement is precise; approach is sound, innovative and clearly feasible.	statement adequate; approach feasible with minor gaps.	statement partial; approach feasibility is marginal.	statement missing or approach not feasible.
Interaction with stakeholders; Data collection, analysis & interpretation	8	Thorough stakeholder engagement; data collection is comprehensive; analysis is well-interpreted	Good engagement; data and analysis adequate with minor gaps.	Limited engagement; data incomplete and analysis superficial.	Little/no stakeholder contact; insufficient or no data/ analysis.
Project documentation; Clarity, organization & problem-solving demonstrated	10	Documentation is complete, well-organized, analytical, and shows strong problem-solving	Documentation complete and clear with some analytical content.	Documentation on basic with omissions; problem-solving limited.	Documentation missing/poorly organized; no clear problem-solving.
Communication& Presentation skills	6	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; weak responses.	Presentation poor or absent; unable to respond.
Contribution & Benefit to society (impact, sustainability)	8	Clear, demonstrable societal benefit and sustainability; realistic path to implementation.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear societal benefit; sustainability not well addressed.	No evident benefit or sustainability; project not community-oriented.

SEE Rubric — Semester End Examination (Will be conducted for 100 marks; later scaled to 50 marks):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry/ community	16	Problem and relevance are articulated clearly with strong evidence and context.	Problem relevance clear with reasonable evidence.	Problem stated but evidence/ context weak.	Problem poorly defined or irrelevant.
Formation of problem statement; Engineering approach, innovation & feasibility	20	Problem statement is precise; approach demonstrates engineering depth, novelty	Approach is technically sound and Feasible with minor limitations.	Approach basic; limited technical depth or feasibility concerns.	No viable engineering approach or infeasible plan.

		and feasibility.			
Interaction with stakeholders; Data collection, analysis & interpretation	16	Excellent stakeholder engagement; rigorous data collection and insightful analysis.	Good engagement and acceptable analysis.	Superficial data collection and limited analysis.	Inadequate or no data; poor analysis.
Project documentation; Clarity, technical rigor & problem-solving demonstrated	20	Report is comprehensive, technically rigorous, and demonstrates systematic problem-solving.	Report is complete and technically correct with minor gaps.	Report lacks technical depth or has notable omissions.	Report missing key elements or technically incorrect.
Communication, Presentation & Viva-voce responses	12	Candidate presents expertly, defends work persuasively and answers all queries correctly.	Good presentation and satisfactory answers to most queries.	Presentation adequate but fails to answer some technical questions.	Poor presentation and unable to defend work.
Contribution & Benefit to society; Impact assessment & sustainability	16	Clear, evidence-based assessment of social impact and Sustainability with scaling recommendations	Reasonable impact discussion and sustainability considerations.	Limited evaluation of impact or sustainability.	No coherent assessment of impact or sustainability

Course Outcomes: After completing the course, the students will be able to	
CO1	Investigate a community to identify unmet needs, sustainability gaps, or technical challenges using structured empathy, observations, and interviews.
CO2	Design a practical, engineering-based solution that directly addresses the identified community issue.
CO3	Apply engineering concepts and project management principles to execute and deploy the designed solution within community constraints.
CO4	Assess the social, environmental, ethical, and economic impacts of the project to ensure sustainable development and community welfare.
CO5	Function effectively individually or in a team, and communicate project progress and outcomes clearly to technical evaluators and community members.

CO – PO MAPPING

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

Semester: III					
NATIONAL SERVICE SCHEME **(Common to all Branches)**					
Course Code	**:**	**BNS309**	**Credit**	**:**	0
Hours/Semester (L:T:P:SL)	**:**	0:0:0:28	**CIE**	**:**	100 Marks
Total Hours	**:**	28	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	**---**
Knowledge on Fundamental Concepts	Basic understanding of social responsibility, environmental awareness, community welfare, sustainable development, ethics, teamwork, and communication skills.
Knowledge on Connected Tools (If any)	Basic use of smartphones, internet, digital communication tools (email, WhatsApp, Google Forms), presentation software (PowerPoint/Canva), video recording tools, and office productivity software (MS Word/Google Docs) for documentation and report preparation.

Course Learning Objectives: This course will enable the students to	
CLO1	**Understand** the community, identify its needs and problems, and apply knowledge to develop practical and sustainable solutions for community development and welfare.
CLO2	**Develop** social and civic responsibility, leadership, teamwork, communication, and community participation skills through collaborative learning, extension activities, and community engagement.
CLO3	**Demonstrate** ethical values, democratic attitudes, responsible citizenship, and a commitment to social service while contributing effectively to community welfare and nation-building

Activity– 1	**10 Hrs**
Sustainable Rural Development Organic Farming, Indian Agriculture, Sustainable Water Management, Agricultural Marketing	
Activity – 2	**09 Hrs**
Environmental Sustainability and National Development Waste Management, 5R's, Swachh Bharat, Digital India, Skill India, Atmanirbhar Bharat, Make in India, etc.	
Activity – 3	**09 Hrs**
Community Outreach and Social Responsibility Women's Information Club, Rural Awareness Programs, Social Connect and Responsibilities	

Topics for Self learning	
Activity – 1	Sustainable agriculture, organic farming, and water conservation practices.
	Digital marketing, e-NAM, and rural development strategies for farmers.
Activity – 2	Waste management, the 5R principles, and environmental conservation.
	Government flagship initiatives and the role of NSS volunteers in nation-building.

Activity – 3	Women empowerment, digital literacy, and community leadership.
	Rural outreach, public awareness campaigns, social responsibility, and volunteerism.

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. No.	**Topic**	**Group Size**	**Location**	**Activity Execution**	**Reporting**	**Evaluation of the Topic**
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / community area/ College 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.	Waste management – Public, Private and Govt organization , 5 R's.	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
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual al or team	Women empowerment groups/ Consulting NGOs & Govt. Teams / College 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 3rd 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 3rd 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 3rd 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	**Demonstrate** social responsibility by identifying and analyzing environmental and societal issues and proposing practical, sustainable solutions for community development.
CO2	**Implement and evaluate** government and community-driven initiatives to address societal challenges and promote community welfare.
CO3	**Apply** ethical values, teamwork, leadership, and civic responsibility while participating effectively in social service, community engagement, and nation-building activities.

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 MAPPING

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

Semester: III						
Physical Education **Common to All Branches**						
Course Code	**:**	1BPE309		**Credits**	**:**	0
Hours/Week(L:T:P:SL)	**:**	24:0:0:16		**CIE**	**:**	**100 Marks**
Total Hours	**:**	24		**SEE**	**:**	-
Course Type	**:**	NCMC		**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students to	
CLO1	Develop awareness about personal health, wellness, and the importance of an active lifestyle through pre-fitness evaluation and orientation.
CLO2	Improve general physical fitness through structured training in strength, speed, and warm-up exercises.
CLO3	Acquire sport-specific skills and techniques in traditional games such as Kabaddi or Kho-Kho through practical sessions.

Module – 1	**4 Hrs**
Orientation A. Lifestyle. B. Health & Wellness. C. Pre-Fitness test.	
Module – 2	**4 Hrs**
General Fitness & Components of Fitness A. Warming up (Free Hand exercises). B. Strength – Push-up / Pull-ups. C. Speed – 30 Mtr Dash.	
Module-3	**16 Hrs**
Specific games (Any one to be selected by the student) A. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. B. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.	

Topics for Self learning	
Module – 1	Healthy lifestyle practices, balanced nutrition, sleep and stress management, and awareness of personal health and wellness.
Module – 2	Components of physical fitness, principles of fitness training, benefits of regular exercise, and methods for monitoring personal fitness levels.
Module – 3	Rules and regulations of Kabaddi and Kho-Kho, history and development of indigenous sports, basic game strategies, sportsmanship, teamwork, and prevention of common sports injuries.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the principles of physical education, health, nutrition, fitness and wellness for maintaining a healthy and active lifestyle.
CO2	Perform exercises, sports, yoga, and recreational activities to improve physical fitness, mental well-being, teamwork and sportsmanship.
CO3	Apply health, fitness, and wellness practices to promote lifelong well-being and develop foundational skills for sports and fitness careers.

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				2
CO2						3	2	3	3		2
CO3						3	3	2	2	2	3

Semester: III					
Yoga **Streams: CSE/ECE/CV/ME**					
Course Code	**:**	1BYO309	**Credit**	**:**	0
Hours/Semester (L:T:P:SL)	**:**	14:0:0:16	**CIE**	**:**	100 Marks
Total Hours	**:**	30	**SEE**	**:**	---
Course Type	**:**	NCMC	**SEE Duration**	**:**	---

Prerequisites:	
Courses	**--**
Knowledge on Fundamental Concepts	• Basic understanding of physical fitness, health and personal hygiene. • Awareness of body posture, breathing, and general wellness practices.
Knowledge on Connected Tools (If any)	**--**

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the fundamental concepts, principles, and significance of Yoga for physical and mental well-being.
CLO2	Demonstrate Suryanamaskara and the fundamental techniques of selected Yogasanas by following proper procedures and precautions.
CLO3	Practice different categories of Yogasanas to promote flexibility, strength, balance, and overall wellness.

Module - 1	**04 Hrs**
Introduction and Foundations of Yoga: Introduction to Yoga: Origin, history, meaning, definitions, schools, aims and objectives of Yoga, Importance of prayer in Yoga practice, Foundations of Yogic Practice: Yogic practices for positive health, rules for practitioners, misconceptions about Yoga, and differences between yogic and non-yogic practices. **Text Book1: Ch. 1**	
Module - 2	**05 Hrs**
Suryanamaskara and Fundamentals of Asanas: Suryanamaskara (Sun Salutation): Prayer, meaning, need, importance, benefits, 12-count structure, and practice of two rounds, Introduction to Asanas: Meaning, need, importance, classification, general techniques, precautionary measures, and benefits. **Text Book1: Ch. 2, 3**	
Module - 3	**05 Hrs**
Types and Practice of Asanas: Sitting Asanas: Padmasana, Vajrasana, Standing Asanas: Vrikshasana, Trikonasana, Prone Lying Asanas: Bhujangasana, Shalabhasana, Supine Lying Asanas: Utthitadvipadasana, Ardhahalasana. **Text Book1: Ch. 4**	

Topics for Self learning	
Module – 1	Different Schools of Yoga (Hatha, Raja, Karma, Bhakti, Jnana Yoga) and their applications
Module – 2	Scientific benefits of Suryanamaskara and Yoga for stress management and lifestyle disorders
Module – 3	Advanced Asanas, precautions, common mistakes, and role of Yoga in daily life.

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize the philosophy, objectives, and health benefits of Yoga and yogic practices.
CO2	Demonstrate correct techniques while performing Suryanamaskara and selected Yogasanas safely.
CO3	Practice appropriate Yogasanas for improving physical fitness, mental concentration and healthy living.

Text Book	
1	The Illustrates Light on Yoga, BKS Iyengar, Element Publishers, ISBN-978-8172236069, 2005
2	Light on Yoga, BKS Iyengar, Thorsons Publishers, ISBN: 978-8172235017, 2006

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	1				2
CO2						3	2	1			2
CO3						3	2	2			3

Semester: III					
Music **Stream: CSE/ECE/ME/CV**					
Course Code	**:**	1BMU309	**Credit**	**:**	0
Hours/Semester (L:T:P:SL)	**:**	14:0:0:16	**CIE**	**:**	100Marks
Total Hours	**:**	30	**SEE**	**:**	NA
Course Type	**:**	NCMC	**SEE Duration**	**:**	NA

Prerequisites:	
Courses	Familiarity with school-level cultural or music activities is beneficial
Knowledge on Fundamental Concepts	Basic awareness of vocal music and musical instruments.
Knowledge on Connected Tools (If any)	Metronome or Tala application for rhythm practice. Audio playback device (mobile phone/laptop) for listening to compositions.

Course Learning Objectives: This course will enable the students to	
CLO1	Interpret the foundational concepts of Indian classical music
CLO2	Analyze the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
CLO3	Illustrate various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system

Module – 1	**05 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. **T-1** V-1 Ch. 1-3	
Module – 2	**05 Hrs**
Origin of the Indian Music Origin and Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. Notations of swara , tala and practice. **T-1** V-1 Ch. 3-4	
Module – 3	**04 Hrs**
Compositions Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. **T-2** Ch. 4-7	

Topics for Self learning	
Module – 1	Evolution of Carnatic and Hindustani music – similarities and differences
	Role of music in Indian Culture, Yoga, and Meditation
Module – 2	Study of popular Carnatic ragas and their emotional significance
	Importance of Gamakas in Carnatic Music
Module – 3	Life cycle of a Carnatic concert and the sequence of musical compositions
	Identification and practice of different ragas

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the fundamental concepts to promote and develop Indian music
CO2	Analyse the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala
CO3	Apply the basic Carnatic compositions using standard notation.

TextBooks	
1	South Indian Music – Vol. I to VI, Prof. P. Sambamoorthy, 2019thEdition,2021 .The Indian Music Publishing House, Chennai, ASIN : B093Y3TL52 Chapters:1,2,3,4
2	A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, 4th Edition ,2008,CBH Publications , ISBN 81 85 381 50 Chapters:4,5,6,7
3	Karnataka Sangeetha Charitre, Dr. V. S. Sampathkumaracharya, Kannada University, Hampi

ReferenceBooks	
1	History of South Indian (Carnatic) Music (From Vedic Times to the Present) , R Rangaramanuja ayyangar ,2019 edition ,Vipanchi charitable trust publisher ISBN: 9788187723158.
2	Music of India, B. Chaitanya Deva, 2nd edition , 1995 Munshiram Manoharlal Publishers. ISBN-10 : 8121501954
3	Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, 2013 Edition, Asian Educational Services
Web links and Video Lectures (e – Resources)	
1	https://youtu.be/DZA_cSb0Zo8?si=55M6QAC2T8VqZN39
2	https://www.youtube.com/live/RfM41AJQgCc?si=xfK0b6exvkBujugr
3	https://youtu.be/DZA_cSb0Zo8?si=55M6QAC2T8VqZN39

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	3		3	1	2	1	2	1	1		1

Semester: III					
National Cadet Corps - I **(Common to all Branches)**					
Course Code	**:**	1BNC309	**Credit**	**:**	0
Hours/Semester (L:T:P:SL)	**:**	14:0:0:16	**CIE**	**:**	100 Marks
Total Hours	**:**	30	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Nil
Knowledge on Fundamental Concepts	**-**
Knowledge on Connected Tools (If any)	**-**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the aim, organisation and philosophy of training of the NCC, and appreciate the importance of national integration
CLO2	Acquire general awareness of disaster management and civil affairs, and the cadet's role during emergencies
CLO3	Gain general knowledge of social awareness, community development and the youth's role in nation building

Module – 1	**05 Hrs**
The NCC and National Integration – General Awareness The NCC: Aims and Objectives of NCC; Organisation, Training and NCC Song; Incentives for NCC Cadets. National Integration: Religions, Culture, Traditions and Customs of India; Importance and Necessity of National Integration. Freedom Struggle and Nationalist Movement in India; National Interests, Objectives, Threats and Opportunities. Problems/Challenges of National Integration; Unity in Diversity; National Integration Council; Contribution of Youth in Nation Building.	
Module – 2	**05 Hrs**
Disaster Management and Civil Affairs – General Awareness Civil Defence Organisation and the National Disaster Management Authority (NDMA); Types of Emergencies/Natural Disasters. Fire Services and Fire Fighting (general awareness); Essential Services and their Maintenance during a disaster. Assistance during Natural/Other Calamities (Flood/Cyclone/Earthquake/Accident); Setting up of Relief Camps. Collection and Distribution of Aid Material during Disaster Management.	
Module – 3	**04 Hrs**
Social Awareness and Community Development – General Awareness Basics of Social Service and its Need; Rural Development Programmes (MGNREGA, SGSY, NSAP, etc.); Role and Contribution of NGOs. Contribution of Youth towards Social Welfare; Civic Responsibilities; Family Planning (general awareness). Causes and Prevention of HIV/AIDS and Role of Youth; Counter Terrorism (general awareness); Corruption. Social Evils – Female Foeticide, Dowry, Child Abuse/Trafficking; Right to Information (RTI) and Right to Education (RTE).	

Topics for Self learning	
Module – 1	Reading on the aims/objectives and organisation of NCC from the Cadet's Handbook; a short note on any one national integration theme (e.g., Unity in Diversity)
Module – 2	Case-note on a recent natural disaster and the civil administration's/NDMA's response; awareness reading on relief-camp organisation
Module – 3	Short write-up on one rural development programme (e.g., MGNREGA); awareness reading on RTI/RTE provisions

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the aim, organisation and philosophy of training of the NCC and describe the importance of national integration
CO2	Describe the role of civil defence, NDMA and the cadet during disaster management and relief operations
CO3	Explain the elements of social awareness, community development programmes and the youth's civic responsibilities

Text Books	
1	Cadet's Handbook – Common Subjects (SD/SW), Directorate General NCC, Ministry of Defence, Government of India, Edition dated 06 May 2013 (or latest edition).
2	NCC Handbook for 'A', 'B' and 'C' Certificate Examinations, Upkar Prakashan, Latest Edition.

Reference Books	
1	NCC General Knowledge and Current Affairs, Arihant Publications, Latest Edition.
2	National Disaster Management Authority (NDMA) – guidelines and awareness publications, Latest Edition.
3	NCC Directorate/Group HQ training literature and circulars, as issued from time to time.

Web links and Video Lectures (e – Resources)	
1	Directorate General National Cadet Corps – https://www.nccindia.gov.in/
2	National Disaster Management Authority – https://ndma.gov.in

CO – PO MAPPING

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

Semester: III						
Competency Enhancement Course-1 **Stream: CSE/ECE/ME/CV**						
Course Code	**:**	1BCE310		**Credits**	**:**	0
Hours/Week (L:T:P:SL)	**:**	36:0:0:24		**CIE**	**:**	**100 Marks**
Total Hours	**:**	60		**SEE**	**:**	-
Course Type	**:**	NCMC		**SEE Duration**	**:**	-

Prerequisites:	
Courses	Fundamentals of Mathematics & English
Knowledge on Fundamental Concepts	Arithmetic operations, fractions, decimals, and elementary algebra. comprehension of basic English
Knowledge on Connected Tools (If any)	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Gain a strong foundation in aptitude skills such as number systems, percentages, ratio & proportion, and interest calculations to improve quantitative reasoning and problem-solving efficiency.
CLO2	Apply Vedic Mathematics techniques and shortcuts for rapid mental calculations, leading to increased accuracy and speed in aptitude-based assessments.
CLO3	Master logical reasoning topics like syllogisms, blood relations, puzzles and seating arrangements to develop structured thinking and effective decision-making skills.
CLO4	Understand and solve problems involving coding-decoding, visual sequences, clocks, calendars and analogies to enhance pattern recognition and reasoning speed.
CLO5	Utilize aptitude and reasoning skills to perform well in competitive exams, campus placements, and workplace situations, contributing to overall academic and professional success.

Module – 1	**6 Hrs**

Introduction to Aptitude and Vedic Mathematics

Understanding Aptitude

Overview of aptitude skills and their significance in problem-solving and decision-making. Types of aptitude skills commonly assessed in competitive exams and professional settings.

Vedic Mathematics Techniques

Introduction to Vedic Mathematics for faster and more efficient calculations. Key techniques and shortcuts to improve speed and accuracy in quantitative problems.

Importance of Aptitude Skills

The role of aptitude in career development and academic success. How strong aptitude skills enhance analytical thinking, logical reasoning, and performance in assessments.

Number System

Divisibility & Remainder, Multiples & Factors, Integers, LCM & HCF, Complete a number Series, Find the Missing Term and Wrong Term, Simplification, BODMAS Rule, Approximation, Decimals, Fractions, Surds & Indices

Percentage

Calculation-oriented basic percentage, Profit and Loss, Successive Selling type, Discount & MP, Dishonest Dealings

Text Book 1: C1-11

Module – 2	**6 Hrs**
Coding Decoding: Letter Coding, Number Coding, symbol coding Clocks and Calendar **Reasoning -** Blood Relation, Sense of Direction, Arithmetic & Alphabet. Visual Sequence, Visual analogy and classification. **Analytical Reasoning -** Single & Multiple comparisons, Linear Sequencing. **Text Book 3: C2,3,4,6,7,10,12**	
Module-3	**6 Hrs**
Logical Aptitude - Syllogism, Venn-diagram method, Three statement syllogism, Deductive and inductive reasoning. Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions. **Linear Seating Arrangement** Single or Double rows facing each other or away from each other in the same direction **Circular Seating Arrangement** Uni- & Bi-directional problems on Circular, Square, Rectangular, Hexagonal tables **Text Book 2: C2, 5. R-1- C1-3**	
Module-4	**6 Hrs**
Ratio and Proportion Simple Ratios, Compound Ratios, Comprehend and Dividend, Direct & Indirect Proportions, Problems on ages, Mixtures & Allegation **Text Book1: C12,13&16**	
Module-5	**6 Hrs**
Partnerships Interest Simple Interest, Compound Interest, Mixed Interest, Installments. **Text Book1: C14, 15, 17, 29**	

Topics for Self-learning	
Module – 1	Divisibility rules and digital root techniques, Advanced Vedic Mathematics shortcuts (multiplication, squaring, cube roots), Roman numerals and number patterns
	Applications of percentages in banking and business, Practice using online aptitude platforms (IndiaBIX, Testbook, etc.)
Module – 2	Coding-Decoding and Analytical Reasoning, Mirror and water images, Paper folding and paper cutting, Embedded figures and figure completion
	Ranking and ordering problems, Introduction to non-verbal reasoning puzzles
Module – 3	Family tree puzzles, Floor and flat-based puzzles, Scheduling and arrangement puzzles
	Statement–Conclusion and Cause–Effect reasoning, Critical reasoning questions from competitive examinations
Module – 4	Ratio and Proportion, Variation (Direct, Inverse and Joint Variation). Average and weighted average, Time and Work fundamentals
	Pipes and Cisterns (introductory concepts), Real-life applications of ratio and proportion in engineering and finance
Module – 5	Partnership and Interest, Banking concepts related to loans and EMIs, Compound annual growth rate (CAGR)
	Basics of financial literacy and investment, Recurring Deposits (RD) and Fixed Deposits (FD) calculations, Introduction to annuities and financial planning

Course Outcomes: After completing the course, the students will be able to	
CO1	Solve numerical problems using Vedic Math and number systems to boost speed and accuracy.
CO2	Apply logical reasoning to puzzles, syllogisms, seating and classification problems.
CO3	Develop letter, number and symbol patterns and solve visual reasoning tasks.
CO4	Accurately solve problems on percentages, profit-loss, interest, ratios and partnerships.
CO5	Utilize aptitude and reasoning skills to excel in competitive exams and improve employability.

Text Books	
1	**Quantitative Aptitude for Competitive Examinations** by R.S. Aggarwal Chand Publishing. – 2023.
2	**Vedic Mathematics** by Bharati Krishna Tirthaji (ISBN- 978-8120801639), Sixteenth Reprint, Published by Motilal Banarsidass Publishers, - 1985
3	**Logical and Analytical Reasoning** by A.K. Gupta (ISBN- 978-9350127766), 39th Edition, Ramesh Publishing House - 2024

Reference Books	
1	**Puzzle Test & Seating Arrangements** by K. Kundan (ISBN: 9789394666023),1st Edition, BSC Publishing Company Pvt Ltd. - 2023
2	**Logical Reasoning and Data Interpretation for the CAT** by Nishit K. Sinha, (ISBN: 978-9353946616) 7th Edition, Pearson Education -2020

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=ZXcULvjpQlM
2	https://www.youtube.com/watch?v=ZXcULvjpQlM
3	https://www.youtube.com/watch?v=OHZ40sOT7mk
4	https://www.youtube.com/watch?v=9UtPPSX_vnk
5	https://www.youtube.com/watch?v=DIbjA3b21ow

CO – PO MAPPING

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

Semester: III					
Additional Mathematics - I **(Common for all the Branches)**					
Course Code	**:**	1BMATDIP311	**Credits**	**:**	PP
Hours/Semester (L:T:P:SL)	**:**	42:0:0:48	**CIE**	**:**	100
Total Hours	**:**	90	**SEE**	**:**	0
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Basic Mathematics
Knowledge on Fundamental Concepts	Basic differentiation and integration
Knowledge on Connected Tools (If any)	Basic computer knowledge.

Course Learning Objectives: This course will enable the students to	
CLO1	Demonstrate the geometric properties of curves using differential calculus.
CLO2	Investigate the concepts of linear algebra to solve systems of linear equations and to determine eigenvalues and eigenvectors.
CLO3	Describe the vector differentiation and integration techniques to analyze scalar and vector Fields.
CLO4	Interpret the first-order ordinary differential equations to solve complex differential equation in engineering applications.
CLO5	Implement numerical techniques to solve algebraic and transcendental equations, perform interpolation using finite differences and compute numerical integration.

Module – 1	**08 Hrs.**
Differential Calculus: Successive differentiation-problems. Taylor's & Maclaurin's series expansions-problems. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.	
Module – 2	**08 Hrs.**
Linear Algebra: Introduction, Rank of a matrix by elementary row operations, Consistency of system of linear equations, Solution by Gauss Elimination method. Eigenvalues and eigenvectors of a square matrix. Problems.	
Module – 3	**08 Hrs.**
Vector Differentiation: Differentiation of vector functions. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.	
Module – 4	**08 Hrs.**
Ordinary Differential Equations (ODEs): Introduction-solutions of first order and first-degree differential equations: Variable separable method, Homogeneous differential equations, linear differential equations. Exact differential equations.	

Module – 5	**08 Hrs.**
Numerical Methods-I: Finite differences, Interpolation/extrapolation using Newton's Forward and Backward difference formulae (No derivation), Problems. Solution of polynomial and transcendental equations by Newton–Raphson and Regula–Falsi methods (no derivation), Problems. Numerical Integration: Simpson's 1/3rd rule and 3/8th rule, problems.	

Topics for Self-learning	
Module – 1	**Applications:** Maxima and minima for function of two variables.
	Self-study: Method of Lagrange's undetermined multipliers
Module – 2	**Applications:** Analyze real-world problems such as traffic flow.
	Self-study: Inverse of a square matrix by Caley- Hamilton theorem.
Module – 3	**Applications**: Velocity and Acceleration in scalar and vector fields.
	Self-Study: Conservation of laws, Analysis of streamlines.
Module – 4	**Applications:** Area, Velocity and population.
	Self-Study: Bisection method, Lagrange's inverse Interpolation**.**
Module – 5	**Applications:** Orthogonal trajectories: Cartesian and polar form.
	Self-Study: Rate of Growth or Decay. Solving of nonlinear differential equations by x and y.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply and interpret the geometric properties of curves in polar coordinates by applying the principles of differential calculus.
CO2	Solve the systems of linear equations, determine eigenvalues and eigenvectors and analyze real-world problems such as traffic flow.
CO3	Apply differentiation to solve the vector differentiation and integration techniques to analyze scalar and vector Fields.
CO4	Evaluate first-order ordinary differential equations.
CO5	Analyze the numerical techniques to solve algebraic and transcendental equations, perform interpolation using finite differences and compute numerical integration.

Text Books	
1	Higher Engineering Mathematics, B. S. Grewal,44th Edition, 2021, Khanna Publishers, ISBN:978-81-933284-9-1. **Chapter. 2:** 2.7(1), 2.10(1,3), 2.15, **Chapter. 4:** 4.3(4), 4.4 **Chapter. 5:** 5.2, 5.4(2), 5.5 - 5.7, 5.11 - 5.12. **Chapter. 8:** 8.1-8.2, 8.3(1), 8.4-8.7, 8.18(1,2), 8.19-8.21. **Chapter. 11:** 11.9-11.11, 11.12(4), 11.13 - 11.14, 12.3, 12.6. **Chapter. 28:** 28.6(1,2), 28.7(2), 28.2,28.2(2), 28.2(3), **Chapter. 29:** 29.1, 29.1(1,2,3), 29.6-29.10, 30.6,30.7-30.8

Reference Books	
1	Kreyszig, E., Kreyszig, H., & Norminton, E. J. (2011). *Advanced Engineering Mathematics* (10th ed.). Wiley India Pvt. Ltd. ISBN: 9788126554232
2	Bali, N. P., & Goyal, M. *A Textbook of Engineering Mathematics*. Laxmi Publications (P) Ltd., New Delhi. ISBN: 9788131808320.
3	Dass, H. K., & Verma, R. *Higher Engineering Mathematics*. Revised Edition. New Delhi: S. Chand Publishing. ISBN: 978812193890
4	Ramana, B. V. *Higher Engineering Mathematics*. 25th Edition, McGraw Hill Education (India) Pvt. Ltd., ISBN: 9780070634190

Web links and Video Lectures (e – Resources)	
1	http://nptel.ac.in/courses.php?disciplineID=111
2	http://www.class-central.com/subject/math(MOOCs)
3	http://academicearth.org/

CO – PO & PSO MAPPING

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

	CSE Stream		ECE Stream		CIVIL Stream		Mechanical Stream	
	PSO1	PSO2	PSO1	PSO2	PSO1	PSO2	PSO1	PSO2
CO1	1	-	-	1	-	1	-	1
CO2	1	-	-	1	-	1	-	1
CO3	1	-	-	1	-	1	-	1
CO4	1	-	-	1	-	1	-	1
CO5	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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