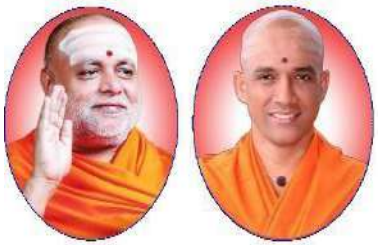

Estd : 1986

||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 & AE), Gold Rated by QS I-Gauge

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

www.sjcit.ac.in

3rd & 4th Semesters

Scheme and Syllabus of B.E. Programme

Electronics and Communication Engineering

(Applicable for students admitted from the Academic Year 2024 – 2025 and onwards)

SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

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

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

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

3rd Semester

Electronics and Communication Engineering													
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**TD/ PSB**	**Teaching Hours / Week**			**Examination**				
					L	**T**	**P**	**SEE Duration(Hrs)**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
1	BMATE301	Mathematics-III for EC Stream	ASC	MAT	3	2	0	**3**	**50**	**50**	**100**	**4**
2	BEC302	Digital System Design using Verilog	IPCC	ECE	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BEC303	Electronic Principles and Circuits	IPCC	ECE	3	0	2	**3**	**50**	**50**	**100**	**4**
4	BEC304	Network Analysis	PCC	ECE	3	0	0	**3**	**50**	**50**	**100**	**3**
5	BECL305	Analog and Digital Systems Design Lab	PCCL	ECE	0	0	2	**3**	**50**	**50**	**100**	**1**
6	BEC306x	ESC/ETC/PLC	ESC	ECE	3	0	0	**3**	**50**	**50**	**100**	**3**
7	BSC307	Social Connect and Responsibility	UHV	ANY DEPT	0	0	2	**-**	**100**	**-**	**100**	**1**
8	BEC308x	Ability Enhancement Course/Skill Enhancement Course – III	AEC/ SEC	ECE	0	0	2	**2**	**50**	**50**	**100**	**1**
9	BES309	Environmental Studies	MC	Civil	1	0	0	**1**	**50**	**50**	**100**	**1**
10	BNS310	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	**-**	**100**	**-**	**100**	**0**
	BPE310	Physical Education (PE) (Sports and Athletics)		Physical Education Director								
	BYO310	Yoga		Yoga Teacher								
	BMU310	Music		Music Teacher								
11	BCE311	Competency Enhancement Course-1	NCMC	CDCAC		2		**-**	**100**	**-**	**100**	**0**
									700	**400**	**1100**	**22**

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

Engineering Science Course (ESC/ETC/PLC) (Note- Student should opt for the course which should not be similar to the course opted in 1st Year)

Course Code	Course Name	Course Code	Course Name
BEC306A	Microcontrollers	BEC306C	Computer Organization and Architecture
BEC306B	Electronic Instrumentation	BEC306D	Electronic Devices

Ability Enhancement Course/Skill Enhancement Course – III

Course Code	Course Name	Course Code	Course Name
BEC308A	Microcontrollers Lab	BEC308C	IoT Lab
BEC308B	LABVIEW programming	BEC308D	Typesetting using LATEX

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

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

Semester: III						
Mathematics-III for EC Stream						
Course Code	**:**	BMATE301		**Credits**	**:**	4
Hours/Week (L:T:P)	**:**	3:2:0		**CIE**	**:**	50Marks
Total Hours	**:**	50 Hrs		**SEE**	**:**	50Marks
Course Type	**:**	ASC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Mathematics
Knowledge on Fundamental Concepts	Basic Differentiation, Integration
Knowledge on Connected Tools (If any)	Basic computer knowledge

Course Objectives: This course will enable the students to	
CLO1	To find the association between attributes and the correlation between two variables
CLO2	Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series and Fourier transforms.
CLO3	Analyze signals in terms of Fourier transforms
CLO4	Develop the knowledge of solving differential equations and their applications in Electronics & Communication engineering.
CLO5	Solve higher-order linear ordinary differential equations (ODEs) with constant and variable coefficients using inverse differential operators and standard methods.

Module - 1	**10 Hrs**
Curve fitting, Correlation, and Regressions: Principles of least squares, Curve fitting by the method of least squares in the form y=$a+b$, $y=a+bx+cx^2$, and $y=ax^b$. Correlation, Coefficient of correlation, rank correlation, Lines of regression. **Applications:** Data visualization, Trend analysis. **Self-Study:** Angle between regression lines. Text book 1: Ch.24: 24.5(a),24.5(b),24.6(1), Ch. 25: 25.12-25.14	
Module - 2	**10 Hrs**
Ordinary Differential Equations of Higher Order: Higher-order linear ODEs with constant coefficients - Inverse differential operator, problems. Linear differential equations with variable Coefficients-Cauchy's differential equations – Problems. **Applications:** RLC Circuits. **Self-Study:** Method of Variation of Parameters, Legendre's differential equations. Text book 1: Ch.13: 13.1-13.5,13.8,13.9 Text book 2: Ch.2: 2.2-2.6,2.8	

Module - 3	10 Hrs
Fourier series and practical harmonic analysis: Fourier series expansion of functions Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: Half-range Fourier series. Practical harmonic analysis. **Applications:** signal processing, spectrum analysis. **Self-Study:** periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Text book 1: Ch.10: 10.2,10.3,10.5-10.7,10.11 Text book 2: Ch.5: 5.2-5.7,5.9,5.11,5.12,5.15	
Module - 4	**10 Hrs**
Fourier Transforms: Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT). **Applications:** Vibration analysis and modal testing using Fourier methods. **Self-Study:** Fast Fourier transform (FFT). Text book 1: Ch.22: 22.2-22.6	
Module - 5	**10 Hrs**
Z-transforms: Definition, Z-transforms of basic sequences and standard functions. Properties: Linearity, scaling, first and second shifting, multiplication by n. Initial and final value theorem. Inverse Z- transforms. Application to difference equations. **Applications:** Image Processing, Digital signal processing. **Self-Study:** Unit impulse, Sinusoidal and exponential-sinusoidal sequences. Text book 1: Ch.23: 23.1,23.3,-23.7,23.9,23.10,23.15,23.16	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the principles of least squares to perform curve fitting and Analyze data using correlation and regression techniques.
CO2	Solve linear differential equations with variable coefficients, including Cauchy's and Legendre's equations.
CO3	Apply the principles of Fourier Series to represent periodic functions using Dirichlet's conditions
CO4	Evaluate the inverse Fourier transforms to reconstruct functions from their frequency domain representations. Analyze standard sequences using Z-transforms
CO5	Analyze applications in image processing and Solve difference equations using inverse Z-transforms.

Text Books	
1	Higher Engineering Mathematics, B.S. Grewal,43rd Edition,2015, Khanna Publishers, ISBN:978-81-933284-9-1.
2	Advanced Engineering Mathematics, E. Kreyszig, Volume _II 10th Ed, 2018, John Wiley & Sons. ISBN:978-81-265-5121-7.

Reference Books	
1	Higher Engineering Mathematics, B. V. Ramana, 11th Ed., 2017, McGraw-Hill Education
2	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 MAPPING

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

Semester: III						
Digital System Design using Verilog						
Course Code	:	BEC302		**Credits**	:	4
Hours/Week (L: T:P)	:	3:0:2		**CIE**	:	50 Marks
Total Hours	:	40+12 Hrs		**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. Text book 1: 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) Text book 2: 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, Shift Registers(SISO,PISO,SIPO,PIPO), Universal Shift Register, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers (Ring and Johnson), Design of Synchronous mod-n Counter using clocked T, J K, D and SR flip-flops. Text book 2: 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. Text book 3: Ch.1: 1.1-1.6,1.6.4, 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). **Verilog Structural description**: Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder. Text book 3: Ch.3: 3.1- 3.4, Ch.4: 4.1,4.2	
Course Outcomes: After completing the course, the students will be able to	
CO1	Apply optimization techniques to simplify Boolean function.
CO2	Apply the knowledge of Boolean functions to construct Combinational and Sequential circuits.
CO3	Analyze and design combinational and sequential logic circuits.
CO4	Design Combinational and sequential circuits using Verilog.
CO5	Develop a simple digital system using modern tool.

PRACTICAL COMPONENT OF IPCC (Experiments can be conducted either using any circuit simulation software or discrete components)

Sl. No	**Experiments**
1	To implement a Verilog program for simplifying given Boolean expressions using dataflow or behavioral modeling.
2	Design and simulate Full/Half Adders and Subtractors using Verilog dataflow description.
3	Develop a 4-bit Arithmetic Logic Unit (ALU) using Verilog behavioral modeling.
4	To model and verify the following code converters using Verilog behavioral description: a) Gray to Binary and vice versa b) Binary to Excess-3 and vice versa
5	To create an 8:1 multiplexer using Verilog behavioral description.
6	To design an 8:3 encoder using Verilog behavioral modeling.
7	Write a Verilog program behavioral model for a 3:8 decoder.
8	To implement a 2-bit comparator using Verilog behavioral modeling.
9	Model and simulate the following flip-flops using Verilog behavioral description: a) JK type b) SR type c) T type d) D type
10	Design and test binary up/down counters using Verilog behavioral description.
Open Ended Experiments (For CIE only–not to be included for SEE) Use FPGA/CPLD kits for downloading Verilog codes and check the output for interfacing experiments.	
11	Verilog Program to interface a Stepper motor to the FPGA/CPLD and rotate the motor in the specified direction (by N steps).
12	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working

Text Books	
1	Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 1st Edition, 2012 reprint, Cengage Learning Publisher, ISBN 978-8131500583.
2	Digital Principles and Design, Donald D Givone, 1st Edition, 2018 reprint, McGraw-Hill Publisher, ISBN 9780072525038.
3	HDL Programming VHDL and Verilog, Nazeih M Botros, 1st Edition, 2015 reprint, Dream tech press Publisher, ISBN 978-8177226973.

Reference Books	
1	Fundamentals of logic design, 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, Cyril PR, 1st Edition 2019 reprint, Pearson Education Publisher, ISBN 9788131732472.

Web links	
1	https://nptel.ac.in/courses/108105113
2	https://nptel.ac.in/courses/106105185

CO – PO MAPPING

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

Semester: III						
Electronic Principles and Circuits						
Course Code	**:**	BEC303		**Credits**	**:**	4
Hours/Week (L:T:P)	**:**	3:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	40+12 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	IPCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Electronics
Knowledge on Fundamental Concepts	BJT, MOSFET, OPAMPS
Knowledge on Connected Tools (If any)	Multisim, T Spice

Course Learning Objectives: This course will enable the students to	
CLO1	Design and analyse the BJT circuits as an amplifier and voltage regulation.
CLO2	Design of MOSFET Amplifiers and analyse the basic amplifier configurations using small signal equivalent circuit models
CLO3	Design of operational amplifiers circuits as Comparators, DAC and filters.
CLO4	Analyze Power amplifier circuits in different modes of operation.
CLO5	Understand the thyristor operation and the different types of thyristors.

Module – 1	**08 Hrs**
Transistor Biasing: Voltage Divider Bias, 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. **Voltage Amplifiers:** Voltage gain, Loading effect of Input Impedance. Text book 1: Ch.8: 8.1-8.5, Ch.9: 9.1-9.7, Ch.10: 10.1,10.2, Ch.11: 11.1,11.2	
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: 4.5-4.7	
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:** Concept of feedback, Condition for Oscillation, The Wein-Bridge Oscillator, RC Phase Shift Oscillator, The Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator. **555 timer:** Monostable Operation, Astable Operation. Text book 1: Ch.22: 22.1-22.3, Ch.23: 23.1-23.4,23.7-23.9	

Module – 4	**08 Hrs**
Negative Feedback: Four Types of Negative Feedback **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 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	

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize the configurations of BJTs and MOSFETs for switching and amplifier circuits.
CO2	Design amplifiers and oscillators with different configurations
CO3	Construct the feedback topologies and approximations in the design of active filters
CO4	Infer power control circuits using thyristors for high voltage engineering
CO5	Design and test the various electronic circuits using modern tool.

PRACTICAL COMPONENT OF IPCC (Experiments can be conducted either using any circuit simulation software or discrete components)

Sl. No	**Experiments**
1	Design and Test (i) Bridge Rectifier with Capacitor Input Filter (ii) Zener voltage regulator
2	Design and Test Biased Clippers – a) Positive, b) Negative, c) Positive-Negative Positive and Negative Clampers with and without Reference.
3	Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.
4	Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
5	Design and test (i) Emitter Follower, (ii) Darlington Connection
6	Design and plot the frequency response of Common Source JFET/MOSFET amplifier
7	Test the Op-amp Comparator with zero and nonzero reference and obtain the Hysteresis curve.
8	Design and test Full wave Controlled rectifier using RC triggering circuit.
9	Design and test Precision Half wave and full wave rectifiers using Op-amp
10	Design and test RC phase shift oscillator

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, 6thEdition, 2015, Oxford.ISBN:978-0-19-808913-1
3	Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, 4th Edition, 2000, Pearson Education. ISBN: 8120320581

Reference Books	
1	Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, 2015, McGraw-Hill.
2	Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, January 2015, Pearson. ISBN 0132783746

Web links and Video Lectures (e – Resources)	
1	https://www.ti.com/design-resources/design-tools-simulation/analog circuits/overview.html
2	https://www.analog.com/en/education/education- library/tutorials/analogelectronics.html

CO – PO MAPPING

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

Semester: III						
Network Analysis						
Course Code	:	BEC304		**Credits**	:	3
Hours/Week (L: T:P)	:	3:0:0		**CIE**	:	50 Marks
Total Hours	:	40 Hrs		**SEE**	:	50 Marks
Course Type	:	PCC		**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Basic Electrical Engineering
Knowledge on Fundamental Concepts	Knowledge of resistors, capacitors, Inductors, and their behaviors in circuits. Knowledge of complex number operations and polar forms.
Knowledge on Connected Tools (If any)	Multisim, Every circuit

Course Learning Objectives: This course will enable the students to	
CLO1	Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power.
CLO2	Explain Thevenin's, Millman's, Superposition, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits.
CLO3	Analyze the behavior of networks subjected to transient conditions.
CLO4	Use applications of Laplace transform to solve network problems.
CLO5	Utilize Laplace transform techniques to analyze electrical circuits with step, ramp, and impulse inputs, and apply initial and final value theorems to deduce time-domain responses.

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	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply basic electrical laws and circuit reduction techniques to solve DC and AC networks.
CO2	Analyze and verify network theorems for various linear electrical networks.
CO3	Solve for various two port network Parameters and and evaluate series and parallel resonance characteristics.
CO4	Evaluate transient responses and calculate initial and final conditions in RL, RC, and RLC circuits under switching operations
CO5	Apply Laplace Transform techniques to solve network problems, derive time-domain responses.

Text Book	
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.
4	Basic Engineering Circuit Analysis, J. David Irwin and R. Mark Nelms, 12th Edition, 2020, John Wiley & Sons, ISBN: 978-1-119-50201-2

Web links	
1	https://nptel.ac.in/courses/108/106/108106070

CO – PO MAPPING

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

Semester: III						
Analog and Digital Systems Design Lab						
Course Code	:	BECL305		**Credits**	:	1
Hours/Week(L:T:P)	:	0:0:2		**CIE**	:	50 Marks
Total Hours	:	12 Hrs		**SEE**	:	50 Marks
Course Type	:	PCCL		**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Basic Electronics
Knowledge on Fundamental Concepts	Transistors, Boolean Algebra and Logic Circuits
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the electronic circuit schematic and its working
CLO2	Realize and test amplifier and oscillator circuits for the given specifications
CLO3	Realize the op-amp circuits for the applications such as DAC, implement mathematical functions and precision rectifiers.
CLO4	Design and test the combinational and sequential logic circuits for their functionalities.
CLO5	Use the suitable ICs based on the specifications and functions.

SL. No.	Experiments (All the experiments have to be conducted using discrete components)
1	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product.
2	Design and set-up BJT i) Colpitts Oscillator, ii) Crystal Oscillator
3	Design and set up the circuits using Op-amp: i) Adder ii) Comparator
4	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16
5	Design and implement (a) Half Adder & Full Adder using basic gates and NAND gates, (b) 4-variable function using IC74151 (8:1MUX).
6	Realize (i) Binary to Gray code conversion & vice-versa (ii) BCD to Excess-3 code conversion and vice versa
7	Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop
8	Realize the shift registers using IC7474/7495: (i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring counter and (vi) Johnson counter.
9	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490

Demonstration Experiments

10	Demonstrate the principles of diode Clipping and Clamping Circuits.
11	Demonstrate intensity Controlled LED using LDR.
12	Design and test an audio amplifier by connecting a microphone input and observe the output using a loud speaker.

Course Outcomes: After completing the course, the students will be able to	
CO1	Design and analyze the BJT amplifier and oscillator circuits.
CO2	Design and test Op-amp circuits to realize the mathematical computations.
CO3	Construct and test the combinational logic circuits for the given specifications.
CO4	Develop the sequential logic circuits for the given functionality.
CO5	Demonstrate the Applications of Electronic Circuits.

Suggested Learning Resources:	
1	Fundamentals of Electronic Devices and Circuits Lab Manual, David A Bell, 7th Edition, 2009, Oxford University Press, ISBN-13: 978-0195430363.
2	Electronic Principles, Albert Malvino, David J Bates, 9th Edition 2021, Mc Graw Hill Education, ISBN-13: 978-9354602399.
3	Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, 7th Edition, 2024, Cengage Learning India Private Limited,ISBN-13:978-9360535650.

CO – PO MAPPING

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

Semester: III						
Microcontrollers						
Course Code	**:**	BEC306A		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	ESC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic electronics and Introduction to C Programming
Knowledge on Fundamental Concepts	C Programming
Knowledge on Connected Tools (If any	Visual Studio, Eclipse, IDE and Dev C++

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the difference between Microprocessor and Microcontroller and embedded microcontrollers
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 and Serial port of 8051
CLO5	Illustrate the interrupt structure of 8051 and Interfacing I/O devices using I/O ports of 8051

Module – 1	**08 Hrs**
Microcontroller: Microprocessor Vs Microcontroller, Microcontroller & Embedded Processors, Processor Architectures-Harvard Vs Princeton & RISC Vs CISC, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM &RAM) interfacing. Text book 1: Ch.1: 1.1 Text book 2: Ch.1: 1.0,1.1, Ch.3: 3.0-3.3 Text book 3: Page 5-9	
Module – 2	**08 Hrs**
Instruction Set: 8051 Addressing Modes, Data Transfer Instructions, Arithmetic instructions, Logical Instructions, Jump & Call Instructions Stack & Subroutine Instructions of 8051 (with examples in assembly Language). Text book 2: Ch.5, Ch.6, Ch.7, Ch.8	
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, Programming the 8051 to transfer data serially & to receive data serially using C. Text book 2: Ch.3: 3.5 Text book 1: Ch.10: 10.1-10.3 except assembly language programs, 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**
I/O Port Interfacing & Programming: I/O Programming in 8051 C, LCD interfacing, DAC 0808 Interfacing, ADC 0804 interfacing, Stepper motor interfacing, DC motor control & Pulse Width Modulation (PWM) using C only. Text book1: Ch.7: 7.2, Ch.12: 12.1, Ch.13: 13.1,13.2, Ch.17: 17.2, 17.3	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the concepts of 8051 microcontroller
CO2	Examine various addressing modes and instruction set.
CO3	Develop Assembly language program to generate timings & waveforms using 8051 timers, to send & receive data using 8051
CO4	Develop C program to interface to I/O devices with 8051 Microcontroller and generate square wave on 8051 I/O port pin using interrupt and to send & receive serial data using 8051 serial ports
CO5	Engage in self-study to design and demonstrate the applications of microcontroller

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, 2006, ISBN:978-81317I0265.
2	The 8051 Microcontroller, Kenneth j. Ayala, 3rd edition, 2005, Thomson/ Cengage Learning, ISBN:13:9781401861582
3	Programming And Customizing The 8051 Microcontroller, Myke Predko, Indian edition 2006, Tata Mc Graw-Hill ,ISBN:13:978-0070421400
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.

Web links and Video Lectures (e – Resources)	
1	https://youtu.be/pA6K5NgWTow?si=zQqqgXQq50dVL -s

CO – PO MAPPING

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

Semester: III						
Electronic Instrumentation						
Course Code	**:**	BEC306B		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	ESC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Electronics, Fundamentals of Electrical Engineering, Introduction to IoT
Knowledge on Fundamental Concepts	Sensors: Mechanisms and fundamentals
Knowledge on Connected Tools (If any)	**-**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand various technologies associated in manufacturing of sensors
CLO2	Acquire knowledge about types of sensors used in modern digital systems
CLO3	Get acquainted about material properties required to make sensors
CLO4	Understand types of instrument errors and circuits for multirange Ammeters and Voltmeters.
CLO5	Describe principle of operation of digital measuring instruments and Bridges.

Module – 1	**08 Hrs**
Introduction to sensor-based measurement systems: General concepts and terminology, sensor classification, Primary Sensors, material for sensors, - Smart and Miniaturized Sensors. Text book 1: Ch.1: 1.1-1.4	
Module – 2	**08 Hrs**
Self-generating Sensors-Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, electrochemical sensors. Energy harvesting sensors (Wearable sensors such as accelerometer, gyroscope, Triboelectric Nanogenerators) Text book 1: Ch.6: 6.1-6.5	
Module – 3	**08 Hrs**
Principles of Measurement: Static Characteristics, Error in Measurement, Types of Static Error. Multirange Ammeters, Multirange voltmeter. Text book 2: Ch.1: 1.2-1.6, Ch.3: 3.2, Ch.4: 4.4 **Smart Instrumentation and IoT-enabled Measurement** – Concept of cloud-based logging and wireless measurement system. Text book 3: Ch.3: 3.1- 3.4	
Module – 4	**08 Hrs**
Analog to Digital Converters (ADC): Working principle, types (SAR, Sigma-Delta), resolution, and accuracy in embedded measurement systems. **Bridges:** Measurement of resistance: Wheatstone's Bridge, AC Bridges - Capacitance and Inductance Comparison bridge, Wien's bridge. Text book 2: Ch.6: 6.2,6.3 -6.3.2, 6.4 - 6.4.2, Ch.8: 8.8, Ch.11: 11.2,11.8 -11.10,11.14	
Module – 5	**08 Hrs**
Transducers: Introduction, Electrical Transducer Resistive Transducer, Resistive position Transducer, Resistance Wire Strain Gauges. Instrumentation Amplifier using Transducer Bridge, Temperature indicators using Thermometer Text book 2: Ch.13: 13.1-13.3,13.5,13.6 -13.6.1,13.7,13.8,13.11,C h.14: 14.3.3,14.4.1,14.4.3 Sensor Interfacing Protocols: I2C, SPI, UART	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify and explain the material properties required to manufacture sensors
CO2	Illustrate the principle of transducers for measuring physical parameters.
CO3	Apply the principles of sensor design to select appropriate types for specific engineering applications.
CO4	Analyze the instrument characteristics and errors.
CO5	Outline the principle of operation for various measurement instruments.

Text book 3: Ch.7: 7.5

Text Books	
1	Sensors and Signal Conditioning, Ramon Pallas Areny, JohnG. Webster,2nd edition, John Wiley and Sons,2001, ISBN 0-471-33232.
2	Electronic Instrumentation, H.S. Kalsi, Mc Graw Hill,3rd Edition, 2012, ISBN:9780070702066
3	INTERNET OF THINGS Architecture and Design Principles, Raj Kamal, 2nd edition, 2011, *ISBN*: 81-265-0919-8.

Reference Books	
1	Electronic Instrumentation & Measurements, David A. Bell Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.
2	Modern Electronic Instrumentation and Measuring Techniques, D. Helfrickand W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

Web links and Video Lectures (e – Resources)	
1	https://onlinecourses.nptel.ac.in/noc24_ee117/preview
2	https://www.udemy.com/course/learning-course-on-instrumentation-and-control-engineering/?srsltid=AfmBOoo8cEGA_X15UT7vsZ6ohrTTly1oaxs6PiOdPIt0PcyBtP4XHeVp

CO-PO Mapping

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

Semester: III						
Computer Organization and Architecture						
Course Code	**:**	BEC306C		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	ESC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Electronics
Knowledge on Fundamental Concepts	Number system, Combinational & Sequential circuits, Memories, Basic Programming
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Gain the knowledge of computer organization, including CPU, memory, and input/output units.
CLO2	Illustrate the concept of programs as sequences of machine instructions
CLO3	Demonstrate different ways of communicating with I/O devices
CLO4	Discuss the memory hierarchy and concept of virtual memory.
CLO5	Illustrate organization of simple pipelined processor and other computing systems

Module – 1	**08 Hrs**
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software **Machine Instructions and Programs**: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing Text book 1: Ch.1: 1.1 - 1.6, Ch.2: 2.1-2.4	
Module – 2	**08 Hrs**
Machine Instruction and Programs: Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instruction, Example Programs, encoding of Machine Instruction. Text book 1: Ch. 2: 2.5-2.11	
Module – 3	**08 Hrs**
Input/ Output Organization: Accessing I/O Devices, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O interfaces Text book 1: Ch. 4: 4.1-4.7	
Module – 4	**08 Hrs**
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Cache, Memories, Virtual Memories, Secondary Storage Text book 1: Ch. 5: 5.1-5.3,5.5,5.7,5.9	
Module – 5	**08 Hrs**
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control Text book 1: Ch. 7: 7.1-7.5	

Course Outcomes: After completing the course, the students will be able to	
CO1	Infer the basic organization of a computer system and machine instructions
CO2	Develop assembly programs using different instructions and addressing modes.
CO3	Analyze I/O performance by comparing several bus designs and speed and flexibility between hardwired and microprogrammed control.
CO4	Interpret memory hierarchy, types of RAM, cache mapping, and paging.
CO5	Demonstrate the Memory design and data flow instruction using modern design tool

Text Book	
1	Computer Organization ,Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5thEdition,2002, Tata McGrawHill, ISBN: 0-07-112218-4

Reference Books	
1	Computer Organization and Design-The Hardware/Software Interface ARM Edition ,David A. Patterson, John L. Hennessy, , 4th Edition,2009, Elsevier,ISBN: 978-0-12-374750-1
2	Computer Organization & Architecture , William Stallings, ,8th Edition,2006, PHI, ISBN-13: 978-0-13-607373-4
3	Computer Systems Design and Architecture, Vincent P. Heuring, Harry F. Jordan & T.G. Venkatesh: 2nd Edition,2008, Pearson Education, ISBN: 9788177584837

Web links and Video Lectures (e – Resources)	
1	https://os.ecci.ucr.ac.cr/ci0114/material/Stallings/Computer-Organization-Architecture-11th.pdf
2	https://youtube.com/playlist?list=PL-8LShlBMIjUuI9beQJHZUF14we25NToB&feature=shared
3	https://ocw.mit.edu/courses/6-823-computer-system-architecture-fall-2005/pages/lecture-notes/
4	https://online.vtu.ac.in/course-details/Advanced-Computer-Architecture
5	https://cse.iitkgp.ac.in/~chitta/coldvl/

CO – PO MAPPING

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

Semester: III						
Electronic Devices						
Course Code	:	BEC306D		**Credits**	:	3
Hours/Week(L:T:P)	:	3:0:0		**CIE**	:	50 Marks
Total Hours	:	40 Hrs		**SEE**	:	50 Marks
Course Type	:	ESC		**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Basic Electronics.
Knowledge on Fundamental Concepts	Atomic Structure, PN Junctions.
Knowledge on Connected Tools (If any)	Multisim

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basics of semiconductor physics and electronic devices.
CLO2	Outline the behavior of p-n junctions under various biasing conditions
CLO3	Describe the mathematical models BJTs and FETs along with the constructional details
CLO4	Understand the construction and working principles of optoelectronic devices
CLO5	Comprehend semiconductor device fabrication processes and integrated circuits

Module – 1	**08 Hrs**
Semiconductors: Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect. Text book 1: Ch.3: 3.1.1,3.1.2,3.1.3,3.1.4,3.2.1,3.2.3,3.2.4,3.4.1,3.4.2,3.4.3,3.4.5	
Module – 2	**08 Hrs**
PN Junctions: Forward and Reverse biased junctions-Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. Text Book 1: 5.3.1,5.3.3,5.4,5.4.1,5.4.2,5.4.3 **Optoelectronic Devices Photodiodes:** Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials. Text book 1: Ch.8: 8.1.1,8.1.2,8.1.3,8.2,8.2.1	
Module – 3	**08 Hrs**
Bipolar Junction Transistor: Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown. Text book 1: Ch.7: 7.1,7.2,7.3,7.5.1,7.6,7.7.1,7.7.2, 7.7.3	
Module – 4	**08 Hrs**
Field Effect Transistors: Basic pn JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET-Two terminal MOS structure-Energy band diagram, Ideal Capacitance-Voltage Characteristics and Frequency Effects, Basic MOSFET Operation MOSFET structure, Current-Voltage Characteristics. Text book 2: Ch.9: 9.1.1,9.4,9.6.1,9.6.2,9.7.1,9.7.2,9.8.1,9.8.2	
Module – 5	**08 Hrs**
Fabrication of p-n junctions Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. Text book 1: Ch.5: 5.1	

Integrated Circuits Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements Text book 1: Ch.9: 9.1,9.2,9.3.1,9.3.3	
Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the core concepts of semiconductor physics, including conductivity, doping, and mobility.
CO2	Interpret the various parameters of semiconductor devices.
CO3	Infer the principles, characteristics & Fabrication process of semiconductor devices.
CO4	Develop and analyze the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.
CO5	Design and demonstrate applications of semiconductor devices through self-directed study.

Text Books	
1	Solid State Electronic Devices, Ben. G. Streetman, Sanjay Kumar Banerjee, 7th Edition, Pearson Education, 2016, ISBN978-93-325-5508-2.
2	Semiconductor Physics and Devices, Donald A Neamen, Dhrubes Biswas, 4th Edition, McGraw Hill Education, 2012, ISBN 978-0-07- 107010-2.

Reference Books	
1	Physics of Semiconductor Devices, S.M. Sze, Kwok K. Ng, ,3rd Edition, Wiley,2018, ISBN 978-1119380930
2	Semiconductor and Electronic Devices, AdirBar-Lev, 3rd Edition, PHI, 1993 ISBN 978-8120303591

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=V9qhhko0s-w&t=737s (Fabrication)
2	https://www.youtube.com/@EngineeringPhysicsbySanjiv (Module 1)

CO – PO MAPPING

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

Semester: III					
Social Connect & Responsibility					
Course Code	**:**	BSC307	**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	12 Hrs	**SEE**	**:**	-
Course Type	**:**	UHV	**SEE Duration**	**:**	-

Course Objectives: This course will enable the students to	
CLO1	Understand and appreciate the importance of environmental sustainability, cultural heritage and traditional practices
CLO2	Apply experiential learning through field visits, case studies and community interaction
CLO3	Develop skills in documentation, reporting and creative presentation through photo blogs or documentaries
CLO4	Demonstrate awareness of organic farming, waste management, water conservation and their implementation in campus or community settings
CLO5	Recognize the significance of indigenous crafts, culinary traditions and their socio-cultural value

Module 1	**03 Hrs**
Plantation and adoption of a tree Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - Objectives, Visit, case study, report, outcomes. Text book 1	
Module 2	**03 Hrs**
Heritage walk and crafts corner Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives, Visit, case study, report, outcomes. Text book 2	
Module 3	**03 Hrs**
Organic farming and waste management Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes. Text book 3	
Module 4	**03 Hrs**
Water conservation Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices – Objectives, Visit, case study, report, outcomes. Text book 4	
Module 5	**03 Hrs**
Food walk City's culinary practices, food lore, and indigenous materials of the region used in cooking - Objectives, Visit, case study, report, outcomes. Text book 5	

Course Outcomes: After completing the course, the students will be able to	
CO1	Elucidate the significance of tree plantation, cultural heritage, organic farming, waste management, water conservation and traditional food practices
CO2	Demonstrate the ability to plan and execute community-focused environmental and cultural activities
CO3	Prepare and present photo blogs or documentaries to document and communicate findings.
CO4	Apply sustainable practices learned from field visits in campus or community projects
CO5	Appreciate and promote indigenous knowledge, crafts and culinary traditions as part of cultural preservation

Text Books	
1	Environmental Studies – Erach Bharucha, University Grants Commission, New Delhi.
2	Cultural Heritage of India – Haridas Bhattacharyya, Volumes 1–6, The Ramakrishna Mission Institute of Culture.
3	Organic Farming: Principles and Practices – P. Bhattacharyya & D. Chakraborty, Scientific Publishers.
4	Water Resource Engineering – Larry Mays, Wiley.
5	Indian Food: A Historical Companion – K. T. Achaya, Oxford University Press

CO – PO MAPPING

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

Semester: III						
Microcontrollers Lab						
Course Code	:	BEC308A		Credits	:	1
Hours/Week(L:T:P)	:	0:0:2		CIE	:	50 Marks
Total Hours	:	12 Hrs		SEE	:	50 Marks
Course Type	:	AEC		SEE Duration	:	2 Hours

Prerequisites:	
Courses	Basic Electronics, Introduction to C-Programming
Knowledge on Fundamental Concepts	Number Systems, Logic Gates, C-programming Concepts
Knowledge on Connected Tools (If any)	Turbo C

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basic programming of Microcontrollers.
CLO2	Develop the 8051 Microcontroller-based programs for various applications using Assembly Language.
CLO3	Develop the 8051 Microcontroller-based programs for various applications using C Programming.
CLO4	Develop Testing and experimental procedures on 8051 Microcontroller, Analyze their operation under different cases.
CLO5	Program 8051 Microcontroller to control an external hardware using suitable I/O ports.

Sl. No.	**I. Assembly Language Programming**
Data Transfer Programs:	
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 Data a. Internal RAM to Internal RAM. b. Internal RAM to External RAM.
Arithmetic & Logical Operation Programs:	
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	Separate positive and negative in a given array using ALP.
5	Separate even or odd elements in a given array using ALP.
6	Arrange the numbers in Ascending & Descending order using ALP.
7	ALP to find Largest & Smallest number from a given array starting from 20h & store it in Internal Memory location 40h.
Counter Operation Programs:	

8	ALP for the following. a. Decimal Counter b. Hexadecimal Counter
II. C Programming	
1	Find the sum of first 10 Integer Numbers by using 8051 C program.
2	Find Factorial of a given number by using 8051 C program
3	Find the Square of a number (1 to 10) using Look-Up Table by using 8051 C program.
4	Count the number of Ones and Zeros in two consecutive memory locations by using 8051 C program.
III. Hardware Interfacing Programs	
1	8051 C Program to rotate stepper motor in Clock & Anti-Clockwise direction.
2	8051 C program to Generate Sine & Square waveforms using DAC interface.
3	8051 C program to Display a message using 7 segment Display.
4	8051 C program to control the Traffic Lights.

Suggested Learning Resources:
The 8051 Microcontroller: Hardware, Software and Applications, V Udayashankara and M S Mallikarjuna Swamy, 1st edition, 2017, McGraw Hill Education.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply different 8051 microcontroller instructions to develop assembly language code for illustrating data transfer and arithmetic operations using Keil tool.
CO2	Develop assembly language code by using different 8051 microcontroller instructions for illustrating logical operations using Keil tool.
CO3	Design and develop assembly language program for 8051 using different branch control instructions in Keil.
CO4	Apply Embedded C concepts to develop code for 8051 microcontroller using modern tool like Keil.
CO5	Design and develop code for interfacing different modules like stepper motor and DAC with 8051 using embedded C with Keil.

CO – PO MAPPING

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

Semester: III						
LAB VIEW Programming						
Course Code	**:**	BEC308B		**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	12 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Basic Electronics
Knowledge on Fundamental Concepts	Logical operations, Arithmetic operations
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Use LabVIEW to perform basic arithmetic and logic operations
CLO2	Apply loops (for and while) to solve algorithmic problems
CLO3	Utilize arrays and array functions in data processing tasks
CLO4	Create simple virtual instruments for real-world applications
CLO5	Assess LabVIEW Virtual Instruments to achieve optimal performance and accuracy

Sl. No.	**Experiments**
1	Basic arithmetic operations: addition, subtraction, multiplication and division.
2	Boolean operations: AND, OR, XOR, NOT and NAND.
3	Sum of ‘n’ numbers using ‘for’ loop.
4	Factorial of a given number using ‘for’ loop.
5	Determine square of a given number.
6	Factorial of a given number using ‘while‘ loop.
7	Sorting even numbers using ‘while’ loop in an array.
8	Finding the array maximum and array minimum.
	Demonstration Experiments (For CIE)
9	Build a Virtual Instrument that simulates a heating and cooling system. The system must be able to be controlled manually or automatically.
10	Build a Virtual Instrument that simulates a Basic Calculator (using formula node).
11	Build a Virtual Instrument that simulates a Water Level Detector.
12	Demonstrate how to create a basic VI which calculates the area and perimeter of a circle.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply basic arithmetic and logic operations using LabVIEW.
CO2	Develop programs using loops and conditional structures
CO3	Analyze and manipulate data using arrays in LabVIEW
CO4	Design and simulate basic virtual instruments for control systems
CO5	Evaluate Virtual Instruments to meet functional specifications using LabVIEW.

Text Books	
1	Virtual Instrumentation using LABVIEW, Jovitha Jerome, 1st Edition, 2011, PHI Learning Pvt. Ltd., ISBN: 978-81-203-4030-5.
2	Virtual Instrumentation using LABVIEW, Sanjay Gupta and Joseph John, 2nd Edition, 2011, McGraw Hill Education (India) Pvt. Ltd., ISBN: 978-0-07-070028-4

Web links (e – Resources)	
1	https://www.ni.com/en/support/documentation/supplemental/08/labview-for-loops-and-while-loops-explained.html?srsltid=AfmBOoonpdBRXG3bIuvUnoonhMk1QE6jXmBBhQktRd36UrL121Js-TJh&utm_source=chatgpt.com
2	https://www.youtube.com/watch?v=1WiE__onbeY

CO – PO MAPPING

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

Semester: III						
IoT Lab						
Course Code	:	BEC308C		**Credits**	:	1
Hours/Week(L:T:P)	:	0:0:2		**CIE**	:	50 Marks
Total Hours	:	12 Hrs		**SEE**	:	50 Marks
Course Type	:	AEC		**SEE Duration**	:	2 Hours

Prerequisites:	
Courses	Basic Electronics, Introduction to IoT
Knowledge on Fundamental Concepts	Programming Languages -C and Python
Knowledge on Connected Tools (If any)	Keil, Arduino IDE

Course Learning Objectives: This course will enable the students	
CLO1	Understand the fundamental concepts of microcontrollers and their development platforms (Arduino, ESP32, Raspberry Pi).
CLO2	Interface basic input/output components such as LEDs, buzzers, buttons, and sensors.
CL03	Develop programs to interface sensors and actuators using microcontroller boards.
CL04	Implement real-time data communication using Bluetooth and Cloud (ThingSpeak, MQTT).
CL05	Demonstrate practical skills in IoT system integration and visualization using OLED and mobile apps.

Experiments	
Sl. No.	Conduct the following experiments on an **Arduino /ESP32/Raspberry Pi** evaluation board .
1	i) Write a program to 'turn ON' LED /Buzzer for 1 sec after every 2 seconds. ii) Write a program to 'turn ON' LED(Push button/Digital sensor (IR/LDR))when a push button is pressed or at sensor detection.
2	i) Develop a program to interface the Soil Moisture Sensor. ii) Develop a program to interface the LDR/Photo Sensor.
3	Develop a program to interface an Ultrasonic Sensor
4	Interface a DHT11 sensor to a microcontroller, and implement code to display real-time measurements of temperature and humidity.
5	Interface the motor using a relay to 'turn ON' the motor when a push button is pressed.
6	Interface OLED with microcontroller and write a program to print temperature and humidity readings on it.
7	Interface Bluetooth with Microcontroller and write a program to send temperature and Humidity to smartphone using Bluetooth.
8	Develop a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth

9	Develop a program to upload temperature and humidity data to thingspeak cloud.
10	Develop a program to interface LED using Telegram App.
11	Develop a program to publish temperature data to the MQTT broker
12	Design an IoT-based system that can monitor electricity usage in a home and automatically turn off lights and appliances when not needed. The system should also send alerts to the user's phone via Bluetooth or cloud.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply digital I/O programming techniques to control actuators (LEDs, buzzers, relays) on microcontroller platforms with precise timing.
CO2	Implement actuator control mechanisms using relay and motor interfaces.
CO3	Interface microcontroller with Bluetooth modules and cloud platforms like Thing Speak and MQTT for data communication.
CO4	Design and demonstrate an IoT system to visualize temperature and humidity using OLED and mobile apps like Telegram
CO5	Design, integrate, and evaluate an IoT-based energy management prototype that automates control and sends real-time alerts to users.

Web links (e – Resources)	
1	https://www.nielit.gov.in/ajmer/content/internet-things-iot-lab
2	https://onlinecourses.nptel.ac.in/noc21_cs17/preview

CO – PO MAPPING

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

Semester: III						
Typesetting Using LATEX						
Course Code	**:**	BEC308D		**Credits**	**:**	1
Hours/Week(L:T:P: S)	**:**	0:0:2		**CIE**	**:**	50 Marks
Total Hours (10 slots)	**:**	12 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	-
Knowledge on Fundamental Concepts	Basic computer skills and text formatting
Knowledge on Connected Tools (If any)	Text Editor (Notepad, WordPad)

Course Learning Objectives: This course will enable the students to	
CLO1	Learn the basic syntax and semantics of the LaTeX scripting language.
CLO2	Understand the presentation of tables and figures in the document.
CLO3	Illustrate the LaTeX syntax to represent the theorems and mathematical equations.
CLO4	Use the libraries (Tikz, algorithm) to design the diagram and algorithms in the document.
CLO5	Know the structure of a complete report or article by incorporating citations, bibliography and graphics

<table>
<tr><th>Sl. No.</th><th>Experiments</th></tr>
<tr><td>1</td><td>Create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. Also include header [title of document] and footer [institute name, page number] in the document.</td></tr>
<tr><td>2</td><td>Create a document that displays the sample Abstract/Summary.</td></tr>
<tr><td>3</td><td>Create a simple title page of the VTU project Report [Use suitable Logos and text formatting].</td></tr>
<tr><td>4</td><td>Create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry].</td></tr>
<tr><td>5</td><td>Create a document that contains the following table with proper labels.
<table>
<tr><th rowspan="2">S.No.</th><th rowspan="2">USN</th><th rowspan="2">Student Name</th><th colspan="3">Marks</th></tr>
<tr><th>Subject1</th><th>Subject2</th><th>Subject3</th></tr>
<tr><td>1</td><td>4XX22XX001</td><td>Name1</td><td>89</td><td>60</td><td>90</td></tr>
<tr><td>2</td><td>4XX22XX002</td><td>Name2</td><td>78</td><td>45</td><td>98</td></tr>
<tr><td>3</td><td>4XX22XX003</td><td>Name3</td><td>67</td><td>55</td><td>59</td></tr>
</table></td></tr>
<tr><td>6</td><td>Include the side-by-side graphics/pictures/figures in the document by using the subfigure concept.</td></tr>
</table>

7	Create a document that consists of the following two mathematical equations: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2-4*(1)*(-8)}}{2*1}$ $= \frac{-2 \pm \sqrt{4+32}}{2}$ $\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \operatorname{sgn}(\pi)\varphi_\sigma^\lambda \varphi_\pi^\lambda$ $= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma)\varphi_\sigma^\lambda \varphi_{\sigma^{-1}\tau\sigma}^\lambda$ $= A_{\sigma t}\varphi_\sigma^\lambda$
08	Demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document.
09	Create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section.
10	Develop a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library.
11	Develop a document to present an algorithm using algorithm/algorithmic/algorithm2e library.
12	(A) Develop a short technical report by using suitable commands and formats of user choice. (B) Develop an article as per standard format(like IEEE Template)

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply basic commands to create and format structured documents.
CO2	Develop script to present the tables and figures in the document.
CO3	Illustrate script to present theorems and mathematical equations in the document.
CO4	Design graphics and algorithms in the document using Tikz library.
CO5	Analyze the structure of a complete report or article by incorporating citations and bibliography using LaTeX libraries.

Suggested Learning Resources

- BOOK: A Short Introduction to LaTeX BY FIRUZA KARMALI (AIBARA), A book for beginners, 2019
- BOOK: Formatting Information: A Beginner's Introduction to Typesetting with LaTeX, BY PETER FLYNN, Comprehensive TeX Archive Network (2005)
- LaTeX TUTORIAL: [https://latex-tutorial.com/tutorials/]
- LaTeX TUTORIAL: [https://www.javatpoint.com/latex]

CO – PO MAPPING

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

Semester: III						
Environmental Studies						
Course Code	**:**	BES309		**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	1:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	12 Hrs		**SEE**	**:**	50 Marks
Course Type	**:**	MC		**SEE Duration**	**:**	1 Hour

Prerequisites:	
Courses	Basic Science
Knowledge on Fundamental Concepts	Environmental
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Create environmental and sustainability awareness among the students.
CLO2	Creating knowledge of relationship between the biotic and abiotic component
CLO3	Apply their ecological knowledge to illustrate and grasp the problem and describe the realities that managers face when dealing with complex issues.
CLO4	Develop skills, critical thinking and demonstrate socio-economic skills for Environmental protection
CLO5	Gain knowledge on different types of pollution in the environment, waste management and Environmental legislation

Module – 1	**03 Hrs**
Ecosystem and Sustainability: Ecology and Ecosystem: Structure of Ecosystem, components, Types: Forest, Desert, Wetlands, River, Oceanic ecosystems. **Sustainability:** 17SDG targets and possible actions. **Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation. Text book 1: Ch.1, Ch.2, Ch.3	
Module – 2	**03 Hrs**
Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. **Natural Resource Management** (Concept and case-studies): Disaster Management, Sustainable Mining - case studies and Carbon Trading Text book 2: Ch.3, Ch.4	
Module – 3	**03 Hrs**
Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. **Waste Management:** Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge. Text book 2: Ch.5, Ch.16	
Module – 4	**03 Hrs**
Global Environmental Issues Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology. Text book 3: Ch.9, Ch.10	

Module – 5	03 Hrs
Environmental Legislation: Solid Waste Management Rules 2016, Biomedical Waste Management Rules, 2016. BBMP, BWSSB Norms **Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** GIS & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. Text book 1: Ch.10, Ch.11, Ch.12	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the principles of ecology and environmental issues that apply to air, land and water issues
CO2	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components
CO3	Conduct survey to describe the realities of waste management system.
CO4	Identify the major challenges of environmental issues on a global scale
CO5	Apply their environmental legislation to illustrate problems and describe the realities that managers face when dealing with complex issues.

Text Books	
1	Environmental Studies, Benny Joseph, 2005,Tata McGraw – Hill Publishing Company Limited.
2	Environmental Studies, S.M. Prakash, 2007, Elite Publishers Mangalore.
3.	Environmental Studies – From Crisis to Cure, R Rajagopalan, 2005, Oxford University Press.

Reference Books	
1	Environmental Studies ,R.J.Ranjit Daniels and Jagadish Krishnaswamy, 2009 , Wiley India Private Ltd., New Delhi
2	Environmental Science – working with the Earth ,G.Tyler Miller Jr., 10th Edition ,2004, Thomson Brooks /Cole,
3	Elements of Environmental Science and Engineering ,P. Meenakshi, 2006 , Prentice Hall of India Private Limited, New Delhi,

Web links and Video Lectures (e – Resources)	
1	https://sdgs.un.org/goals
2	https://archive.nptel.ac.in/courses/109/105/109105190/
3	https://kspcb.karnataka.gov.in/waste-management/biomedical-waste

CO – PO MAPPING

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

Semester: III						
National Service Scheme						
Course Code	:	BNS310		**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2		**CIE**	:	100 Marks
Total Hours	:	24 Hrs		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

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

Activity– 1	**08 Hrs**
Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	
Activity – 2	**08 Hrs**
Waste management– Public, Private and Govt. organization, 5 R's	
Activity – 3	**08 Hrs**
Setting of the information imparting club for women leading to contribution in social and economic issues	

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

Sl.	**Topic**	**Group Size**	**Location**	**Activity Execution**	**Reporting**	**Evaluation of the Topic**
1.	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 managemen t– Public, Private and Govt organization	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Gov ernment	Site selection /proper consultation/ Continuous monitoring/ Information	Report should be submitted by individual to the concerned	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

	, 5 R's.		Schemes officers/ campus etc.	board	evaluation authority	
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/pro per 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	Exploit the importance of his / her responsibilities towards society.
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field of societal problems.
CO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Assessment Details for CIE (100 Marks)

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

semester with Report	
Total Marks for the course in the semester	**100 Marks**

Suggested Learning Resources:	
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

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

Semester: III						
Physical Education (PE) (Sports & Athletics)						
Course Code	:	BPE310		**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2		**CIE**	:	100 Marks
Total Hours	:	24 Hrs		**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	**04 Hrs**
Orientation A. Lifestyle B. Health & Wellness C. Pre-Fitness test.	
Module – 2	**04 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.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Elucidate core concepts of physical education, health, nutrition and fitness for personal well-being
CO2	Demonstrate exercises, sports and practices that enhance physical and mental development
CO3	Apply foundational skills for careers in physical education, sports and fitness
CO4	Participate in sports competitions with discipline, teamwork and sportsmanship
CO5	Promote healthy lifestyles through wellness concepts and traditional/indigenous activities

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	PSO1	PSO2
CO1	3	1					2	2	2		1		
CO2	2	2			2	2	2	2	2		1		
CO3	3					2	2				2		
CO4	2					2	3	2	2		3		
CO5	2				2	3	3	2	2		1		

Semester: III						
Yoga						
Course Code	:	BYO310		**Credits**	:	-
Hours/Week(L:T:P)	:	0:0:2		**CIE**	:	100 Marks
Total Hours	:	24 Hrs		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the history, various schools of yoga along with its aims, objectives and significance in holistic well-being.
CLO2	Demonstrate basic yoga practices and how to do them safely, clearing up common misunderstandings.
CLO3	Apply suryanamaskara with proper understanding of its structure, significance and health benefits.
CLO4	Describe the types, methods and benefits of various Asanas.
CLO5	Utilize the knowledge of specific asanas regularly to improve physical health and mental well-being.

Module - 1	**04 Hrs**
Introduction to Yoga: Origin, history, and development of Yoga, Meaning and definitions of Yoga, Different schools of Yoga, Aims and objectives of Yoga, Importance of prayer in Yoga practice. Text book 1: Ch.1: Part 1	
Module - 2	**04 Hrs**
Foundations of Yogic Practice: Yogic practices for a common man to promote positive health, Rules to be followed during yogic practices by the practitioner, Misconceptions about Yoga, Difference between yogic and non-yogic practices. Text book 1: Ch.1: Part 1	
Module - 3	**06 Hrs**
Suryanamaskara (Sun Salutation): Prayer and its meaning, Need, Importance and benefits of Suryanamaskara, 12-count structure and practice of 2 rounds. Text book 1: Ch. 2: Part 2	
Module - 4	**04 Hrs**
Introduction to Asanas: Asana - Meaning, need, and importance, Classification of Asanas, General technique, precautionary measures, and benefits of each Asana. Text book 1: Ch.1: Part 1 & 2, Ch.2: Part 1 & 2	
Module - 5	**06 Hrs**
Types of Asanas and Practice: Sitting Asanas - Padmasana, Vajrasana, Standing Asanas - Vrikshasana, Trikonasana, Prone Lying Asanas - Bhujangasana, Shalabhasana, Supine Lying Asanas - Utthitadvipadasana, Ardhahalasana. Text book 1: Ch.2: Part 2	

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize the history and major schools of yoga, highlighting their purpose in promoting holistic well-being.
CO2	Demonstrate basic yoga practices with correct techniques, ensuring safety and addressing common misconceptions.
CO3	Apply suryanamaskara sequences with proper understanding of its structure, significance, and health benefits.
CO4	Classify the types, methods, and benefits of various asanas with appropriate examples.
CO5	Adopt the practice of specific asanas into a regular routine to enhance physical health and mental well-being.

Text Book	
1	The Illustrates Light on Yoga, BKS Iyengar, Harper Collins Publishers, ISBN-81:7223-606-9

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

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

CO – PO MAPPING

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

Semester: III					
Music					
Course Code	:	BMU310	**Credits**	:	0
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	100 Marks
Total Hours	:	24 Hrs	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

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

Module -I	**03 Hrs**
Preamble: Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition. Origin of the Indian Music: Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela Text book 1: V-1,Ch.1-Ch.4	
Module – II	**03 Hrs**
Compositions: Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. Text book 2: Ch.4-Ch.7	
Module –III	**03 Hrs**
Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysoro asudevacharya, Kanakadasa Text book 3: Ch.2-Ch.5	
Module –IV	**03 Hrs**
Music Instruments Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments. Text book 1: V-4,Ch.2-Ch.6	
Module –V	**12 Hrs**
Abhyasa Gana Singing the swara exercises (Sarale Varase Only), Botatio writing for sarale varase and sulafi sapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathi swara, oe krithi in a mela raga Text book 1: V-1,V-2	

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

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

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

CO – PO MAPPING

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

Semester: III						
Competency Enhancement Course-1						
Course Code	:	BCE311		**Credits**	:	0
Hours/Week(L:T:P)	:	2:0:0		**CIE**	:	100 Marks
Total Hours	:	40 Hrs		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Prerequisites:	
Courses	Fundamentals of Mathematics & English
Knowledge on Fundamental Concepts	Arithmetic operations, fractions, decimals, and elementary algebra. comprehension of basic English
Knowledge on Connected Tools	**-**

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	**08 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 Text book 1: Ch.1-Ch.11	
Module – 2	**08 Hrs**
Percentage Calculation-oriented basic percentage, Successive Selling type, Discount & MP, Dishonest Dealings **Profit and Loss** Cost Price (CP), Selling Price (SP), Marked Price (MP) / List Price, Discount, Profit (Gain), Loss, Profit Percentage, Loss Percentage, Discount Percentage, Relationship between CP, SP, and Profit/Loss Percentage, Successive Profits and Losses, False Weights and Dishonest Dealer Problems	

Blood Relation

Basic Family Relationships (Parent, Sibling, Child, etc.), Direct Relationship Questions, Pointing or Introducing Type Questions, Family Tree/Hierarchical Relationship Questions, Coded Blood Relations, Puzzle-Based Blood Relations, Mixed/Complex Blood Relations, Single-Person Blood Relation Problems, Generational Relationships (Grandparent, Great-Grandparent, etc.), Relationships by Marriage (In-laws, Step-relations)

Text book 3: Ch.2-Ch.4, Ch.6, Ch.7, Ch.10, Ch.12

Module-3	**08 Hrs**

Simple and Compound Interest

Definition of Simple Interest (SI), Calculation of Simple Interest, Principal, Rate, and Time, Amount in Simple Interest, Problems on SI (Direct, Inverse and Combined), Definition of Compound Interest (CI), Calculation of Compound Interest (Annual, Half-yearly, Quarterly, etc.), Difference between Simple and Compound Interest, Growth Factor and Compound Amount, Compound Interest for Fractional Years, Comparing SI and CI over Multiple Years, Depreciation and Appreciation Problems, Installment Payments (EMI-based Questions).

Averages

Definition and Formula of Average, Average of Numbers, Average of Consecutive Numbers, Average of Odd/Even Numbers, Weighted Average, Average in Groups (Merging and Replacement), Effect of Addition/Removal/Replacement on Average, Average Speed, Change in Average Due to Error (Wrong Entry), Shortcut Tricks and Applications

Direction Sense Test

Cardinal and intermediate directions, right and left directional movement, reference points and orientation, turns and angle-based movement, distance and displacement calculation, shadow and sun-based direction problems, shortest path and final position, direction sense using maps or diagrams, coded direction sense problems, complex/multiple person direction scenarios, error spotting in direction sense.

Text book 1: Ch.2, Ch.5

Module-4	**08 Hrs**

Ratio and Proportion and Variations

Definition of Ratio, Types of Ratio (Simple, Compound, Duplicate, Sub-duplicate, Triplicate), Properties of Ratio, Comparison of Ratios, Definition of Proportion, Types of Proportion (Direct, Inverse, Continued), Properties of Proportion, Mean Proportion, Fourth Proportion, Third Proportion, Relationship between Ratios and Proportions, Componendo and Dividendo Rules, Addendo and Subtrahendo, Applications of Ratio and Proportion in Problem, Direct Variation, Inverse Variation, Joint Variation, Combined Variation, Proportionality Constants, Word Problems on Variation, Application-based Variation Problems, Miscellaneous and Complex Variation Questions

Alligations and Mixtures

Definition of Alligation, Alligation Rule and Formula, Types of Mixtures (Simple and Compound), Problems on Mixing Two or More Quantities, Mean Price Calculation, Replacement of Quantities, Alligation on Solutions with Different Concentrations, Solving Alligation Questions Involving Profit and Loss, Application-Based Mixture Problems.

Series: Arithmetic Series, Geometric Series, Square Series, Cube Series, Fibonacci Series, Prime Number Series, Alternating Series, Factorial Series, Mixed Series, Exponential/Power Series. Text book 1: Ch.12, Ch.13, Ch.16

Module-5	**08 Hrs**

Articles and Prepositions

Usage of articles (a, an, the), definite and indefinite articles, zero article usage, prepositions of time, place, direction, phrasal verbs, prepositional phrases, and error spotting.

Tenses and Subject-Verb Agreement

Present, past, and future tense forms, auxiliary verbs, rules of agreement with different subjects, and error spotting

Change of Voice and Speech
Active-passive transformations in all tenses, direct and indirect speech conversions, and related pronoun, tense, and time changes
Error Spotting and Sentence Correction
Identifying common grammatical errors such as incorrect word usage, faulty subject-verb agreement, tense errors, sentence fragments, and contextual sentence corrections
Synonyms, Antonyms, and Verbal Analogy
Finding words with similar or opposite meanings, commonly confused words, verbal analogies, and contextual vocabulary usage
Sentence Completion and One-Word Substitution
Choosing appropriate words or phrases to complete sentences, idiomatic expressions, logical sentence completion, and replacing phrases with single-word substitutes
Text book 1: Ch.14, Ch.15, Ch.17, Ch.29

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

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

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

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CO1	3	2											
CO2	3	3											
CO3	2	3											
CO4	3	2											
CO5	2	2			1						2		