RNS TRUST ®

RNS INSTITUTE OF TECHNOLOGY

Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi
Approved By AICTE, New Delhi. Accredited by NAAC 'A+' Grade
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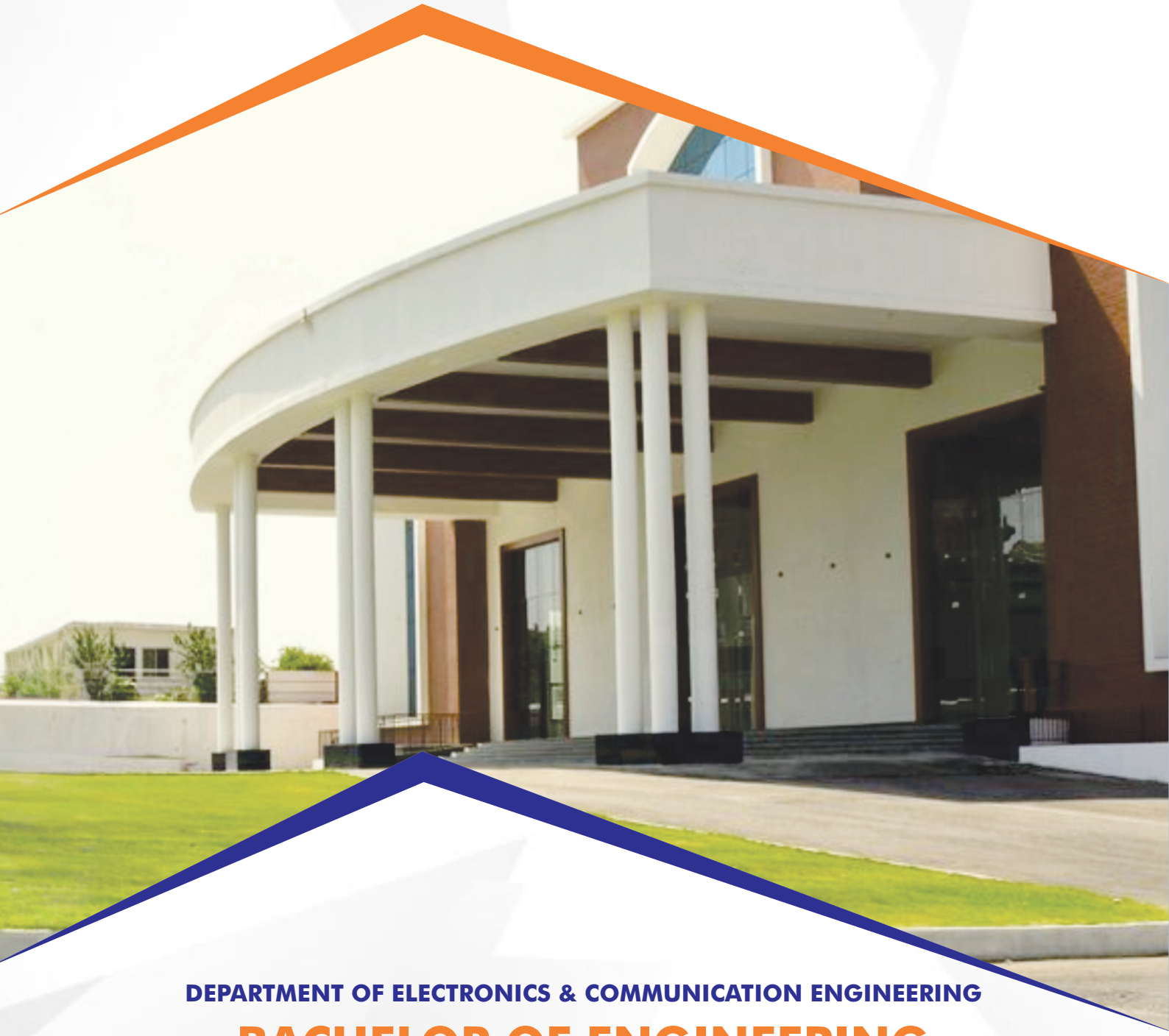
ESTD.: 2001
An Institute with a Difference

Dr. R N Shetty
Founder



DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

BACHELOR OF ENGINEERING

Scheme and Syllabus of III & IV Semesters

2024 SCHEME

INSTITUTION'S INNOVATION COUNCIL
(Ministry of HRD Initiative)

www.rnsit.ac.in

Scheme and Syllabus
Batch 2024 - 2028

(As per NEP-2020)
(Effective from the academic year 2024 – 25)

About RNSIT

RNS Institute of Technology, familiar as RNSIT was established in the year 2001. It is the brainchild of Dr. R. N. Shetty, a well-known industrialist, and a great philanthropist. The institution was established with the sole purpose of imparting quality education in Engineering, Technology and Management. Being one of the premier engineering colleges in the country RNSIT is marching towards placing itself in the global map by excelling in academics and placements.

Lush green campus, state of the art infrastructure, well equipped laboratories, hundreds of activities, numerous new initiatives, consistent VTU ranks, path breaking placements, cultural extravaganza, Sports events, 5600 + students and 300 + faculty – with all these RNSIT has become dream destination for engineering aspirants across the country.

Vision

Building RNSIT into a World Class Institution

Mission

To impart high quality education in Engineering, Technology and Management with a difference, enabling students to excel in their career by

- Attracting quality Students and preparing them with a strong foundation in fundamentals so as to achieve distinctions in various walks of life leading to outstanding contributions
- Imparting value based, need based, choice based and skill based professional education to the aspiring youth and carving them into disciplined, World class Professionals with social responsibility
- Promoting excellence in Teaching, Research and Consultancy that galvanizes academic consciousness among Faculty and Students
- Exposing Students to emerging frontiers of knowledge in various domains and make them suitable for Industry, Entrepreneurship, Higher studies, and Research & Development
- Providing freedom of action and choice for all the Stakeholders with better visibility

About ECE (Electronics and Communication Engg)

The Department of Electronics and Communication Engineering was started in 2001 and is currently running B. E. and Research programs. The Department has well qualified, committed and experienced Faculty members, in various domains of ECE, like Communication, Signal Processing, Image Processing, VLSI, Optical Communication, Antenna Design. The course covers the fundamental theoretical aspects as well as design level topics of all the above areas. The department has well structured labs to give students a practical exposure in the field of Analog Electronics, Analog Communications, Digital Signal Processing, Embedded Systems, Antennas and VLSI.

Vision

Conquering technical frontiers in the field of Electronics and Communication

Mission

The Department of Electronics and communication Engineering promotes an intellectual and ethical environment in which the strengths and skills of Electronics Professionals will flourish by:

- Achieving and fostering excellence in core Electronics and Communication engineering with focus on hardware, simulation and design.
- Pursuing Research, development and consultancy to achieve self-sustenance.
- Preparing industry ready graduates by providing skill training and nurturing innovation and creativity.

Programme Educational Objectives

ECE Graduates, within three-five years of graduation should be able to

- **PEO1:** Apply fundamental concepts obtained from mathematics, basic sciences and engineering subjects to solve challenging problems in Electronics, Communication and allied disciplines.
- **PEO2:** Exhibit technical and analytical skills for the design and development of innovative and cost effective solutions.
- **PEO3:** Pursue higher education and participate in Lifelong learning to emerge as good human beings and responsible citizens.
- **PEO4:** Adapt to rapid changes in tools and technology and work in multidisciplinary fields to come up with new sustainable technologies catering to societal needs.
- **PEO5:** Cultivate skills which helps in building leadership qualities, entrepreneurships, effective communication and ethics needed for a successful professional career.

Program Outcomes (Revised)

1. **PO1: Engineering Knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. **PO2: Problem Analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **PO3: Design/Development of Solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

4. **PO4: Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

5. **PO5: Engineering Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

6. **PO6: The Engineer and The World**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

7. **PO7: Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

8. **PO8: Individual and Collaborative Teamwork**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

9. **PO9: Communication**: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

10. **PO10: Project Management and Finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

11. **PO11: Life-Long Learning**: Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Programme Specific Outcomes (PSOs)

The graduates of the department will be able to:

- **PSO1:** Apply knowledge of Electronic circuits and Communication systems in the design, development and analysis of integrated electronic systems to enhance human life.
- **PSO2:** Demonstrate competence in using Modern hardware languages, IT tools and create innovative electronic technologies as per industry standards.

B.E. in ECE (Electronics and Communication Engg): Autonomous Scheme and Syllabus

3rd - Semester(Electronics and Communication EngineeringStream)													
SL NO	COURSE	COURSE CODE	COURSE TITLE	TD/PSB	TEACHING HOURS PER WEEK			Term work(TW) + Self learning(SL) per semester	EXAMINATION				CREDITS
					THEORY LECTURE (L)	TUTORIAL (T)	PRACTICAL /DRAWING (P)		DURATION IN HOURS	CIE MARKS	SEE MARKS	TOTAL MARKS	
1	PCC	BEC301	Mathematics - III for EC Engineering		3	0	0	45	3	50	50	100	3
2	IPCC	BEC302	Digital Systems Design using Verilog		3	0	2	45	3	50	50	100	4
3	IPCC	BEC303	Analog Electronic Circuits		3	0	2	45	3	50	50	100	4
4	PCC	BEC304	Networks & Control Systems		3	0	0	45	3	50	50	100	3
5	PCCL	BECL305	Analog and Digital Electronics lab		0	0	2	0	3	50	50	100	1
6	ESC	BEC306X	ESC/ETC/PLC		3	0	0	45	3	50	50	100	3
7	UHV	BSCK307	SOCIAL CONNECT AND RESPONSIBILITY		0	0	2	0	2	100	0	100	1
8	AEC/SEC	BECT358X	Ability Enhancement Course - III		IF COURSE IS THEORY				2	50	50	100	1
					1	0	0	15					
		BECL358X	Skill Enhancemebt Course - III		IF COURSE IS PRACTICAL				3				
					0	0	2	0					
9	MC	BNSK359	NATIONAL SERVICE SCHEME(NSS)		0	0	2	0		100	0	100	0
		BPEK359	PHYSICAL EDUCATION(PE) (SPORTS AND ATHLETICS)										
		BYOK359	YOGA										
	TOTAL									550	350	900	20

EMERGING SCIENCE COURSES / EMERGING TECHNOLOGY COURSES BUCKET LIST - A	
BEC306A	COMPUTER ORGANISATION &ARCHITECTURE
BEC306B	DATA STRUCTURES AND APPLICATIONS IN MACHINE LEARNING
BEC306C	MICROCONTROLLER 8051
BEC306D	SENSORS AND INSTRUMENTATION

ABILITY ENHANCEMENT COURSES / SKILL DEVELOPMENT COURSES BUCKET LIST - B	
BFLC358A	FOREIGN LANGUAGE COURSE 1- GERMAN
BFLC358B	FOREIGN LANGUAGE COURSE 1- SPANISH
BECL358C	IOT LAB
BECL358D	PROJECT BASED LEARNING
BECT358E	VIRTUAL INSTRUMENTATION USING LABVIEW

4th - Semester(Electronics and Communication Engineering Stream)													
SL NO	COURSE	COURSE CODE	COURSE TITLE	TD/PSB	TEACHING HOURS PER WEEK			Term work(TW)+ Self learning(SL) per semester	EXAMINATION				CREDITS
					THEORY LECTURE(L)	TUTORIAL (T)	PRACTICAL/DRAWING (P)		DURATION IN HOURS	CIE MARKS	SEE MARKS	TOTAL MARKS	
1	PCC	BEC401	Engineering Electromagnetics	ECE	3	2	0	45	3	50	50	100	4
2	IPCC	BEC402	Principles of Communication Systems	ECE	3	0	2	45	3	50	50	100	4
3	IPCC	BEC403	Basic signal Processing	ECE	3	0	2	45	3	50	50	100	4
4	PCCL	BECL404	Communication Laboratory	ECE	0	0	2	0	3	50	50	100	1
5	ESC	BEC405X	ESC/ETC/PLC	ECE	3	0	0	45	3	50	50	100	3
6	AEC/SEC	BXXT/L45	Ability Enhancement Course - IV	ECE/MBA	IF COURSE IS THEORY				2	50	50	100	1
				ECE	1	0	0	15					
			Skill Enhancement Course - IV	ECE	IF COURSE IS PRACTICAL				3				
				ECE	0	0	2	0					
7	BSC	BENS407	ENVIRONMENTAL STUDIES / BIOLOGY FOR ENGINEERS		2	0	0	30	2	50	50	100	2
8	UHV	BUHV408	UNIVERSAL HUMAN VALUES		1	0	0	15	2	50	50	100	1
9	MC	BNSK459	NATIONAL SERVICE SCHEME(NSS)		0	0	2	0		100	0	100	0
		BPEK459	PHYSICAL EDUCATION(PE) (SPORTS AND ATHLETICS)										
		BYOK459	YOGA										
	TOTAL									500	400	900	20
NOTE: 1st SEMESTER CHEMISTRY CYCLE SECTIONS WILL STUDY "ENVIRONMENTAL STUDIES" IN 4th SEMESTER & "Biology for Engineers" IN 5th SEMESTER													
NOTE: 1st SEMESTER PHYSICS CYCLE SECTIONS WILL STUDY "Biology for Engineers" IN 4th SEMESTER & "ENVIRONMENTAL STUDIES" IN 5th SEMESTER													

EMERGING SCIENCE COURSES / EMERGING TECHNOLOGY COURSES BUCKET LIST - A	
BEC405A	MICROELECTRONIC CIRCUITS
BEC405B	MATHS FOR MACHINE LEARNING
BEC405C	OBJECT ORIENTED PROGRAMMING USING C++
BEC405D	OPERATING SYSTEMS

ABILITY ENHANCEMENT COURSES / SKILL DEVELOPMENT COURSES BUCKET LIST - B	
BECL456A	LINUX PROGRAMMING
BECT456B	FINANCE ACCOUNTING
BECL456C	SYSTEM DESIGN USING SIMULINK
BECL456D	ADVANCED VERILOG LAB

III SEMESTER SUBJECTS

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**Mathematics – III for EC Engineering**		
Course Code:	**BEC301**	**CIE MARKS**	**50**
L : T : P:	**3:0:0 45hrs/semester**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3 Hours**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. 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.
2. Analyse signals in terms of Fourier transforms.
3. Develop the knowledge of solving differential equations and their applications in EC Engineering.
4. To find the association between attributes and the correlation between two variables.

Module-1: Ordinary Differential Equations of higher order **9 hrs**

Higher-order linear ODEs with constant coefficients - Inverse differential operator. Linear differential equations with variable Coefficients-Cauchy and Legendre differential equations. Representation of L-C and L-C-R circuits as linear differential equations.

Module-2: Fourier series and Practical harmonic analysis **9 hrs**

Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Triangle and half range expansions, Practical harmonic analysis, variation of periodic current.

Module-3: Fourier Transforms **9 hrs**

Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT), Fast Fourier transform (FFT).

Module-4: Probability Distribution **9 hrs**

Random variables (discrete and continuous), probability mass/density function, Binomial distribution, Poisson distribution and exponential distribution.

Stochastic Process: Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov Chains, higher transition probability- simple problems.

Module-5: Curve fitting, Correlation and Regression **9 hrs**

Principles of least squares (without proof), Curve fitting by the method of least squares in the form $y = a + bx$, $y = a + bx + cx^2$, and $y = ax^b$. Correlation, coefficient of correlation, lines of regression, angle between regression lines, standard error of estimate, Rank correlation, Auto correlation, Cross correlation.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand that physical systems can be described by differential equations and solve such equations.
CO2	Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory.
CO3	Apply Fourier transforms to analyze problems involving continuous-time signals.
CO4	Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field and illustrate examples of Markov chains related to discrete parameter stochastic process.
CO5	Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data.

ASSESSMENT DETAILS (Both CIE and SEE)			
Assessment Type	**Maximum Marks**	**Minimum PassingMarks**	**Evaluation Details**
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**18**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**

- The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.
- **If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.**

Suggested Learning Resources:

Text Books:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2021.
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, 2018.

Reference Books:

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Edition, 2017
2. N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Edition, 2022.
3. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw–Hill Book Co., New York, 6th Ed., 2017.
4. H.K. Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S.Chand Publication,3rd Edition, 2014.

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/
4. VTU e-Shikshana Program
5. VTU EDUSAT Program.

B.E. (Electronics and Communication Engineering) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	**Digital Systems Design using Verilog**		
Course Code:	**BEC302**	**CIE MARKS**	**50**
L : T : P:	**3:0:2**	**SEE MARKS**	**50**
Credits:	**4**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. To impart the concepts of simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques.
2. To impart the concepts of designing and analysing combinational logic circuits.
3. To impart design methods and analysis of sequential logic circuits.
4. To impart the concepts of Verilog HDL-data flow and behavioural models for the design of digital systems.

Module-1: Principles of Combinational Logic	**9 hrs**
Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms**.**	
Module-2: Logic Design with MSI Components and Programmable Logic Devices:	**9 hrs**
Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs).	
Module-3: Flip-Flops and its Applications	**9 hrs**
Master-Slave Flip-flops (Pulse-Triggered flip-flops):SR flipflops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, J K, D and SR flip-flops.	
Module-4: Introduction to Verilog.	**9 hrs**
Structure of Verilog module, Operators, Data Types, Styles of Description. Verilog Data flow description: Highlights of Data flow description, Structure of Data flow description.	
Module-5: Verilog Behavioural description	**9 hrs**
Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioural 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.	

PRACTICAL COMPONENT OF IPCC

(*Experiments can be conducted either using any circuit simulation software or discrete components*)

Sl. No:	Programs
1	To simplify the given Boolean expressions and realize using Verilog program.
2	To realize Adder/Subtractor (Full/half) circuits using Verilog data flow description.
3	To realize 4-bit ALU using Verilog program.
4	To realize the following Code converters using Verilog behavioural description a) Gray to binary and vice versa b) Binary to excess3 and vice versa.
5	To realize using Verilog behavioural description: 8:1 MUX, 8:3 Encoder, Priority Encoder
6	To realize using Verilog behavioural description: 1:8 DEMUX, 3:8 Decoder,2 –bit Comparator
7	To realize using Verilog behavioural description: Flip-flops: a) JK type b) SR type c) T type and d) D type
8	To realize Counters-up/down (BCD and binary) using Verilog behavioural description.
9	To realize Ring and Johnson Counter using Verilog behavioural description.
10	To realize Pseudorandom sequence generator using Verilog behavioural description.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Simplify Boolean functions using K-map and Quine-McCluskey minimization technique.
CO2	Analyse and design for combinational logic circuits.
CO3	Analyse the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequential circuits using Flip Flops.
CO4	Apply various Verilog modelling types to implement basic digital circuits.
CO5	Model Combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.

Evaluation (B)			
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**8**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**18**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**40**	**Final marks shall be the sum of marks scored in Components A, B, C and D**
• The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Suggested Learning Resources:

Text Books

1. John M Yarbrough, Thomson Learning "Digital Logic Applications and Design" , 2001.
2. Donald D Givone "Digital Principles and Design" , McGraw-Hill, 2002.
3. Nazeih M Botros "HDL Programming VHDL and Verilog", 2009 reprint, Dream techpress.
4. Samir Palnitkar, "Verilog HDL" IEEE1364-2001 Compliant. Pearson, 2nd Edition, 2003

Reference Books: -

1. Charles H Roth Jr.,"Fundamentals of logic design", Cengage Learning.
2. Sudhakar Samuel "Logic Design", Pearson/Sanguine, 2007.
3. Cyril PR "Fundamentals of HDL", Pearson/Sanguine2010.

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**Analog Electronic Circuits**		
Course Code:	**BEC303**	**CIE MARKS**	**50**
L : T : P:	**3:0:2**	**SEE MARKS**	**50**
Credits:	**4**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Design and analyse the BJT circuits as an amplifier and voltage regulation.
2. Design of MOSFET Amplifiers and analyse the basic amplifier configurations using small signal equivalent circuit models.
3. Design of operational amplifiers circuits as Comparators, DAC and filters.
4. Understand the concept of positive and negative feedback and construct Oscillator circuits.
5. Analyse Power amplifier circuits in different modes of operation.
6. Understand the thyristor operation and the different types of thyristors.

Module-1: Transistor biasing and Signal Amplification **9 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, Analysing an amplifier, H parameters, Relations between R and H parameters.

Voltage Amplifiers: Voltage gain, Loading effect of Input Impedance.

CC Amplifiers: CC Amplifier, Output Impedance.

Module-2: MOSFET **9 hrs**

Device structure and operation, I-V Characteristics

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, 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.

Module-3: Op-amp Applications-1 **9 hrs**

Linear Op-amp Circuits: Summing Amplifier and D/A Converter.

Nonlinear Op-amp Circuits: Comparator with zero reference, Comparator with non-zero references, Comparator with Hysteresis.

Oscillator: Theory of Sinusoidal Oscillation, The Wein-Bridge Oscillator, RC Phase Shift Oscillator, The Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator.

The 555 Timer: Monostable Operation, Astable Operation.

Module-4: Op-amp Applications-2	**9 hrs**
Negative Feedback: Four Types of Negative Feedback, VCVS Voltage gain, Other VCVS Equations, ICVS Amplifier, VCIS Amplifier, ICIS Amplifier (No Mathematical Derivation). **Active Filters:** Ideal Responses, First Order Stages, VCVS Unity Gain Second Order Low pass Filters, VCVS Equal Component Low Pass Filters, VCVS High Pass Filters, MFB Bandpass Filters, Band stop Filters.	
Module-5: Power Amplifiers and Thyristors	**9 hrs**
Power Amplifiers: Amplifier terms, two load lines, Class A Operation, Class B operation, Class B push-pull emitter follower, Class C Operation. **Thyristors:** The four layer Diode, SCR, SCR Phase control, Bidirectional Thyristors, IGBTs, Other Thyristors.	

PRACTICAL COMPONENT OF IPCC

(Experiments can be conducted using any circuit simulation software)

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 n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
4	Design and test Emitter Follower.
5	Design and plot the frequency response of Common Source MOSFET amplifier.
6	Design and test common drain MOSFET amplifier.
7	Test the Op-amp Comparator with zero and non-zero 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.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Analyse the characteristics of BJTs and FETs for switching and amplifier circuits.
CO2	Design and analyse amplifiers and oscillators with different circuit configurations and biasing conditions.
CO3	Analyse the feedback topologies and approximations in the design of amplifiers and oscillators.
CO4	Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.
CO5	Apply the power electronic device components and its functions for basic power electronic circuits.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

Assessment Type	Maximum Marks	Minimum PassingMarks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**8**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**18**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**40**	**Final marks shall be the sum of marks scored in Components A, B, C and D**

• The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Suggested Learning Resources:

Text Books:

1. Albert Malvino, David J Bates, "Electronic Principles", Mc Graw Hill Education, 7th Edition, 2017, ISBN:978-0-07-063424-4.
2. Adel S Sedra, Kenneth C Smith, "Microelectronic Circuits", Oxford, 6th Edition, 2015.ISBN:978-0-19-808913-1

Reference Books:

1. Jacob Millman, Christos C. Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", McGraw-Hill, 2015.
2. Boylestad & Nashelsky, "Electronic Devices and Circuit", 11th Edition, Pearson, 2015

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**Networks & Control Systems**		
Course Code:	**BEC304**	**CIE MARKS**	**50**
L : T : P:	**4:0:0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Apply mesh and nodal techniques to solve an electrical network.
2. Solve different problems related to Electrical circuits using Network Theorems and Two port network.
3. Familiarize, with the use of Laplace transforms to solve network problems.
4. Understand basics of control systems and design mathematical models using block diagram reduction, SFG.
5. Understand Time domain and Frequency domain analysis.
6. Familiarize with the State Space Model of the system.

Module-1: Basic concepts and Network Theorems **9 hrs**

Types of Sources, Loop analysis, Nodal analysis with DC and AC Excitations.
Superposition theorem, Thevenin's theorem, Norton's Theorem, Maximum Power transfer Theorem.

Module-2: Two port networks **9 hrs**

Two port networks: Short- circuit Admittance parameters, Open- circuit Impedance parameters, Transmission parameters, Hybrid parameters.
Laplace transform and its applications: Step Ramp, Impulse, Solution of networks using Laplace transform, Initial value and final value theorem.

Module-3: Basic concepts and representation of Control Systems **9 hrs**

Types of control systems, effect of feedback systems, mathematical modeling of physical systems (only electrical systems), Introduction to block diagrams, transfer functions, Signal Flow Graphs.

Module-4 Stability Analysis **9 hrs**

Time Response analysis: Time response of first order systems, Time response of second order systems, time response specifications of second order systems.
Stability Analysis: Concepts of stability, necessary condition for stability, Routh stability criterion, relative stability Analysis.
Root locus: Introduction to root locus concepts, construction of root loci.

Module-5 Stability and State Variable Analysis **9 hrs**

Frequency Domain analysis and stability: Correlation between time and frequency response and Bode plots. **State Variable Analysis:** Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous –Time systems, solution of state equations.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Analyse and solve Electric circuit by applying loop analysis, Nodal analysis and by applying network Theorems.
CO2	Evaluate two port parameters of a network and Apply Laplace transforms to solve electric networks.
CO3	Deduce transfer function of a given physical system from differential equation representation or Block Diagram representation and SFG representation.
CO4	Calculate time response specifications, perform frequency response analysis, draw root locus and hence determine stability of given system.
CO5	Represent State model of the system and find solution of state equations.

ASSESSMENT DETAILS (Both CIE and SEE)			
Assessment Type	**Maximum Marks**	**Minimum PassingMarks**	**Evaluation Details**
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**18**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**

- The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.
- **If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.**

Suggested Learning Resources:

Text Books

1. D Roy Choudhury, "Networks and Systems", New age international Publishers, 2nd Edition,2013.
2. M E Van Valkenburg, "Network Analysis", Pearson, 3rd Edition. 2019.
3. I J Nagrath, M. Gopal, "Control Systems Engineering", New age international Publishers, 5th Edition,
   2015.

Reference Books

1. William H Hayt, Jr, Jack E Kemmerly, Steven M Durbin, "Engineering circuit analysis", Mc Graw Hill
   Education, Indian Edition 8th Edition, 2013.
2. Katsuhiko Ogata, "Modern Control Engineering", 5th Edition, 2015.

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**Analog and Digital Electronics lab**		
Course Code:	**BECL305**	**CIE MARKS**	**50**
L : T : P	**0 : 0 : 2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Understand the electronic circuit schematic and its working.
2. Realize and test amplifier and oscillator circuits for the given specifications.
3. Realize the op-amp circuits for the applications such as DAC, implement mathematical functions and precision rectifiers.
4. Study the static characteristics of SCR and test the RC triggering circuit.
5. Design and test the combinational and sequential logic circuits for their functionalities.
6. Use the suitable ICs based on the specifications and functions.

Sl. No	Experiments
1	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.
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) Integrator, iii) Differentiator and iv) 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) Half subtractor & Full subtractor using NAND gates, (c) 4-variable function using IC74151(8:1 MUX).
6	Realize (i) Binary to Gray code conversion & vice-versa (IC74139), (ii) BCD to Excess-3 code conversion and vice versa.
7	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop b) Realize the shift registers using IC7474/7495: (i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring counter and (vi) Johnson counter.
8	Realize a) Design Mod-N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476 c) Synchronous counter using IC74192.
9	Design and Test the second order Active Filters and plot the frequency response, i) Low pass and High-pass Filter ii) Bandpass and Band-stop Filter.
10	Design and test the following using 555 timer i) Monostable Multivibrator ii) Astable Multivibrator.

	Demonstration
11	Design and Test a Regulated Power supply.
12	Design and test an audio amplifier by connecting a microphone input and observe the output using a loud speaker.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Design and analyse the BJT amplifier and oscillator circuits.
CO2	Design and test Op-amp circuits to realize the mathematical computations, DAC and precision rectifiers.
CO3	Design and test the combinational logic circuits for the given specifications.
CO4	Test the sequential logic circuits for the given functionality.
CO5	Demonstrate the basic circuit experiments using 555 Timer.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books:

1. David A Bell "Fundamentals of Electronic Devices and Circuits Lab Manual", Oxford University Press, 5th Edition, 2009.
2. Albert Malvino, David J Bates "Electronic Principles", Mc Graw Hill Education, 7th Edition, 2017.
3. Charles H Roth Jr., Larry L Kinney "Fundamentals of Logic Design", Cengage Learning, 7th Edition.2013.

B.E. (Electronics and Communication Engineering) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	**Computer Organization and Architecture**		
Course Code:	**BEC306A**	**CIE MARKS**	**50**
L : T : P	**3:0:0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Explain the basic sub systems of a computer, their organization, structure and operation.
2. Illustrate the concept of programs as sequences of machine instructions.
3. Demonstrate different ways of communicating with I/O devices.
4. Describe memory hierarchy and concept of virtual memory.
5. Illustrate organization of simple pipelined processor and other computing systems.

Module-1: Basic Structure of Computers:	**9 hrs**
Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance -Processor Clock, Basic Performance Equation. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, IEEE standard for Floating point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing.	
Module-2: Addressing Modes	**9 hrs**
Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions.	
Module-3: Input/ Output Organization:	**9 hrs**
Accessing I/O Devices, Interrupts -Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access.	
Module-4: Memory System	**9 hrs**
Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage- Magnetic Hard Disks.	
Module-5: Basic Processing Unit	**9 hrs**
Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control.	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Interpret the basic organization of a computer system.
CO2	Describe the addressing modes, instruction formats and program control statement.
CO3	Summarize different ways of accessing an input/ output device, including interrupts.
CO4	Differentiate the types of semiconductor and other secondary memories.
CO5	Illustrate a simple processor organization based on hardwired control and microprogrammed control.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Suggested Learning Resources:

Textbooks:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, Tata McGraw Hill, 5th Edition, 2002.

Reference Books:

1. David A. Patterson, John L. Hennessy, “Computer Organization and Design-The Hardware/ Software Interface ARM Edition”, Elsevier,4th Edition, 2009.
2. William Stallings, “Computer Organization &Architecture”, PHI, 2006.
3. Vincent P. Heuring & Harry F. Jordan, “Computer Systems Design and Architecture”, Pearson Education, 2nd Edition, 2004.

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**Data Structures and Application in Machine Learning**		
Course Code:	**BEC306B**	**CIE MARKS**	**50**
L : T : P	**3 : 0 : 0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**03**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Explain the basics of C Programming and describe types of ML and its real-world applications.
2. Implement stack operations and describe the correlation, causation, and regression.
3. Implement various types of queues and linked lists in C.
4. Construct and traverse binary trees and BSTs, and illustrate classification algorithm using decision trees.
5. Representation of graphs and describe clustering algorithms and graph-based ML.

Module-1: Structures and Pointers **9 hrs**

Structures: Definition, Array of Structures, Nested Structures, Structure and functions.
Pointers: Definition, Array and Pointers, Structure and Pointer.
Dynamic Memory Allocation: malloc ( ), calloc( ), realloc( ) and free( ) function.
Introduction to ML: What is Machine Learning, Types of Machine Learning- Supervised, Unsupervised and Reinforced Learning, Applications.

Module-2: Stack, Regression Analysis **9 hrs**

Stack - Definition and examples, primitive operations, representing and implementing stacks in C.
Regression Analysis: Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression.

Module-3: Queues and Lists **9 hrs**

Queues and Lists – The Queue and its sequential representation and implementation, Types of Queues, Linked Lists implementation, and primitive operations.
Other Lists - Circular linked lists definition and implementation, doubly linked lists and implementation, The Josephus problem.

Module-4: Decision Trees **9 hrs**

Trees – Binary Trees, binary tree representations, and applications, Binary Search tree- Definition and implementation, implementation of insertion and traversals, Introduction to Sequential search.
Decision Trees: Introduction to Decision Tree, Decision Tree for Classification, Impurity Measures for Decision Tree Construction, Properties of Decision Tree Classifier(DTC), Applications in breast cancer data.

Module-5: Hashing and Graph Clustering **9 hrs**

Hashing – Introduction, Static Hashing, Dynamic Hashing.
Graph – Graph Representation, Elementary graph operations, Minimum cost spanning trees.
Clustering - Introduction to Clustering, K-means Clustering, Graph-based ML.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply structured programming concepts to implement core data structures using C.
CO2	Analyse and apply stack and queue operations to solve structures algorithmic problem.
CO3	Interpret and compare regression-based machine learning models for classification and prediction.
CO4	Construct and traverse hierarchical and non-linear data structures like trees and graphs and relate them to ML use cases.
CO5	Analyse hashing, graph structures and its application in ML clustering techniques.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books:

1. Yedidyah, Augenstein, Tannenbaum, "Data Structures using C and C++", PearsonEducation, 2nd Edition, 2007.
2. Reema Thareja, "Data Structures using C", Oxford University Press, 2nd Edition, 2011
3. Horowitz, Sahni, Anderson, Fundamentals of Data Structures in C, freedUniversity Press, 2nd Edition, 2008
4. S Sridhar and M Vijayalakshmi, "Machine Learning", Oxford Press, 2021.
5. M N Murty and Ananthanarayana V S, "Machine Learning: Theory and Practice", University Press (India) Pvt. Limited. 2024.
6. William L. Hamilton, Graph Representation Learning. Synthesis Lectures on Artificial Intelligence and Machine Learning, Vol. 14, No. 3, 2020.

Reference Books:

1. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Edition, Cengage Learning, 2014.
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
3. Miroslav Kubat, "An Introduction to Machine Learning", Springer, 2017.

Web links and Video Lectures (e-Resources):

https://www.coursera.org/learn/data-structures-in-c
https://www.coursera.org/learn/data-structures

B.E. (Electronics and Communication Engineering) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	**Microcontroller 8051**		
Course Code:	**BEC306C**	**CIE MARKS**	**50**
L : T : P:	**3:0:0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

5. Understand the difference between Microprocessor and Microcontroller and embedded microcontrollers.
6. Analyse the basic architecture of 8051microcontroller.
7. Program 8051 microcontroller using Assembly Language and C.
8. Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
9. Understand the interrupt structure of 8051 and Interfacing I/O devices using I/O ports of 8051.

Module-1: Microcontroller	**9 hrs**
Microcontroller: Microprocessor Vs Microcontroller, Micro controller & 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.	
Module-2: Instruction Set	**9 hrs**
8051 Addressing Modes, Data Transfer Instructions, Arithmetic instructions, Logical Instructions, Jump & Call Instructions Stack & Subroutine Instructions of 8051 (with examples in assembly Language).	
Module-3: Timers/Counters	**9 hrs**
Introduction to Embedded C: Data types & Time delay in the 8051 using C. **Timers & Counters:** Basics of Timers & Counters, Programming 8051 Timers, Mode 1 & Mode 2 Programming, Counter Programming (Assembly Language only).	
Module-4: Serial Communication & Interrupts	**9 hrs**
Serial Communication: Basics of Serial Communication, 8051 Connection to RS232, Programming the 8051 to transfer data serially & to receive data serially using C. **Interrupts:** Basics of Interrupts, 8051 Interrupts, Programming Timer Interrupts, Programming Serial Communication Interrupts, Interrupt Priority in 8051(Assembly Language only)	
Module-5: I/O Port Interfacing & Programming	**9 hrs**
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.	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Describe the difference between Microprocessor and Microcontroller, Types of Processor Architectures and Architecture of 8051Microcontroller.
CO2	Discuss the types of 8051 Microcontroller Addressing modes & Instructions with Assembly Language Programs.
CO3	Explain the programming operation of Timers/Counters and Serial port of 8051 Microcontroller.
CO4	Illustrate the Interrupt Structure of 8051 Microcontroller & its programming.
CO5	Develop C programs to interface I/O devices with 8051 Microcontroller.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Suggested Learning Resources:

Text Books:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollind, " The 8051 Microcontroller and
Embedded Systems – Using Assembly and C", Mckinlay; PHI, 2006 / Pearson, 2006.
2. Kenneth j. Ayala, "The 8051 Microcontroller", Thomson/Cengage Learning, 3rd edition,2007.

3. Myke Predko, "Programming and Customizing The 8051 Microcontroller", Tata Mc Graw-Hill Edition, 2003.

Reference Books:

1. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems", McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson Education, 2005.

B.E. (Electronics and Communication Engineering) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	**Sensors and Instrumentation**		
Course Code:	**BEC306D**	**CIE MARKS**	**50**
L : T : P:	**3:0:0**	**SEE**	**50**
Credits:	**3**	**EXAM HOURS**	**3 hr**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Acquire knowledge about types of sensors used in modern digital systems
2. Get acquainted about material properties required to make sensors
3. Understand types of instrument errors and circuits for multirange Ammeters and Voltmeters.
4. Describe principle of operation of digital measuring instruments and Bridges.
5. Understand the operations of transducers and instrumentation amplifiers.

Module-1: Introduction to sensor-based measurement systems	**9 hrs**
General concepts and terminology, sensor classification, Primary Sensors, Secondary sensors, Active and Passive sensors, material for sensors, microsensor technology.	
Module-2: Self-generating Sensors	**9 hrs**
Principle and working of different types of Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors.	
Module-3: Principles of Measurement	**9 hrs**
Principles: Static Characteristics, Error in Measurement, Types of Static Error. Multirange Ammeters, Multirange voltmeter. **Digital Voltmeter:** Ramp Technique, Dual slope integrating Type DVM, Direct Compensation type and Successive Approximations type DVM	
Module-4: Digital Multimeter	**9 hrs**
Digital Frequency Meter and Digital Measurement of Time, Function Generator. **Bridges:** Measurement of resistance: Wheatstone's Bridge, AC Bridges - Capacitance and Inductance Comparison bridge, Wien's bridge.	
Module-5: Transducers	**9 hrs**
Introduction, Electrical Transducer, Resistive Transducer, Resistive position Transducer, Resistance Wire Strain Gauges, Resistance Thermometer, Thermistor, LVDT. Instrumentation Amplifier using Transducer Bridge, Temperature indicators using Thermometer, Analog Weight Scale	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Assess the material properties required to make sensors
CO2	Explain the principle of transducers for measuring physical parameters.
CO3	Describe the manufacturing process of sensors
CO4	Analyse the instrument characteristics and errors.
CO5	Describe the principle of operation and develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Suggested Learning Resources:

Text Books

1. Ramon Pallas Areny, John G. Webster, “Sensors and Signal Conditioning", John Wiley and Sons, 2nd Edition, 2000
2. H.S.Kalsi, "Electronic Instrumentation", Mc Graw Hill 3rd Edition 2012. ISBN:9780070702066.

Reference Books:

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

B.E. (Common to All Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – III			
Course Title:	**Social Connect and Responsibility**		
Course Code:	**BSCK307**	**CIE MARKS**	**100**
L :T : P	**0:0:2**	**SEE MARKS**	**-**
Credits:	**1**	**EXAM HOURS**	**-**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. Create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identifytheneedsandproblemsofthecommunityandinvolvetheminproblem–solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills inmobilizingcommunityparticipationtoacquireleadershipqualitiesanddemocraticattitudes.

General Instructions - Pedagogy:

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

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

Module-1	**3 Hours**

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of BE students. (ONESTUDENT-ONE TREE).

Students can prepare either a Report or a Poster describing the plant's origin, its usage in daily life, its appearance in folklore and literature.

Module-2	**3 Hours**

Heritage walk and crafts corner Heritage walk- Heritage tour, knowing the history and culture of the city, connecting to people around through their history. crafts corner- Knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms.
Module-3 **3 Hours**
Organic farming and waste management **Organic Farming:** History of organic farming, objective of organic farming, types of organic farming, Usefulness of organic farming. **Waste Management:** Study of wet waste management in college, Hostel and neighboring villages, and implementation in the campus.
Module-4 **3 Hours**
Water conservation Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.
Module-5 **3 Hours**
Food walk City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Course outcomes

At the end of the course, the student will be able to:

CO1	Communicate and connect to the surrounding.
CO2	Create a responsible connection with the society.
CO3	Involve in the community in general in which they work.
CO4	Notice the needs and problems of the community and involve them in problem – solving.
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project.
Field Visit Plan, Discussion	10 Marks	

Commencement of activities and its progress	20 Marks	• The last report should be signed by SCR Coordinator, the HOD and Principal. • At last report should be evaluated by the SCR Coordinator. • Finally, the consolidated marks sheet should be sent to the CoE/ university and to be made available at LIC visit.
Case study-based Assessment Individual performance with report	20 Marks	
Sectorwisestudy&itsconsolidation5*5=25	25 Marks	
Videobasedseminarfor10minutesbyeach student at the end of semester with Report. **Activities1to5,5*5=25**	25 Marks	
Total marks for the course in each semester	**100 Marks**	
Foreach activity, 20marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.		
Studentsshouldpresenttheprogressoftheactivitiesasperthescheduleintheprescribedpracticalsessioninthefield. Thereshouldbepositiveprogressintheverticalorderforthebenefitofsocietyingeneralthroughactivities.		

Guideline for Assessment Process:

Continuous Internal Evaluation(CIE)

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learnedinthesocialconnectperiod.Thereportshouldbesignedbythementor.Thereportshall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activitycompleted.Marksallottedforthediaryareoutof50.Planningandschedulingthesocial connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below:

Excellent :80 to100
Good :60 to79
Satisfactory :40to59
Unsatisfactory and fail : <39

SPECIAL NOTE:NO SEMESTER END EXAM (SEE)– COMPLETELYPRACTICALANDACTIVITIES-BASEDEVALUATION

ACTIVITIES

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSETOPICS

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversion will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

DURATION

A total of30 - 35 hours engagement per semester is required for the 3rd semester of the B.E./B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentors. Faculty mentors will design the activities (particularly Jamming sessions open mic, and poetry) Faculty mentors have to design the evaluation system as per VTU guidelines of scheme & syllabus.

PEDAGOGY–GUIDELINES

Itmaydifferdependingonlocalresourcesavailableforthestudyaswellasenvironmentand climatic differences, location and time of execution.

Sl. No	Topic	Group size	Location	Activity Execution	Reporting	Evaluation of the Topic
1.	**Plantation and adoption of a tree:**	May be individual or team of 5	Farmers land/ parks / Villages /roadside/ community area / College campus etc…..	Sites election /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 Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team of 5	Temples/monumental places / 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 Faculty
3.	**Organic farming and waste management:**	May be individual or team of 5	Farmers land/parks/ Villages visits /roadside/community area / College campus etc…..	Groups election / 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 Faculty

4.	**Water conservation:** & conservation techniques	May be individual or team of 5	Villages/City Areas/ Grama panchayat/public associations/Government Schemes officers / campus etc…..	Sites election / 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 Faculty
5.	**Food walk: Practices in society**	May be individual or team of 5	Villages/City Areas/ Grama panchayat/public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned Evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of Action(Execution of Activities)

Sl. NO	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Execution of Activity - Plantation and adoption of a tree
4	Execution of Activity - Heritage walk and crafts corner
5	Execution of Activity - Organic farming and waste management
6	Execution of Activity - Water conservation
7	Execution of Activity – Food walk
8	Case study-based Assessment, Individual performance
9	Sector/Team wise study and its consolidation
10	Videobasedseminarfor10minutesbyeachstudentAttheendofsemesterwith Report.

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- Atlastconsolidatedreportofallactivitiesfrom1stto5th, compiled report should be submitted as per the instructions and scheme.

B.E. (Common to all Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – III			
Course Title:	**FOREIGN LANGUAGE COURSE 1- GERMAN**		
Course Code:	**BFLC358A**	**CIE MARKS**	**50**
(L :T : P) + SL	**(1:0:0) + (15 Hours/ Sem)**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**02**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. To develop basic communication skills in German.
2. To introduce German grammar and sentence structure.
3. To enhance vocabulary in everyday and academic contexts.
4. To enable students to comprehend and respond in spoken and written German.
5. To build intercultural awareness through authentic material like short films and dialogues.

Module 1	**3 Hours**
Vocabulary for day to day activities, Time – official/in official, Possessive articles, Speaking about family, Time prepositions, Worksheets, Short Film Textbook 1: Chapter 5, 6	
Module 2	**3 Hours**
Talk about hobbies, Talking about plans, Trennbareverben/seperable verbs, Going to a restaurant, Worksheets, Short Film Textbook: Chapter 5, 6	
Module 3	**3 Hours**
Talking about jobs, Talking about the workplace, Helping verbs in Past tense , Attending events in your town, Worksheets, Short Film Textbook: Chapter 7,8	
Module 4	**3 Hours**
Daily routine, Body parts, Common illnesses, Visiting the doctor, Healthy living, Worksheets, Short Film Textbook: Chapter 7,8	
Module 5	**3 Hours**
Daily Imperative, Small Talk…Worksheets, Short Film Textbook: Chapter 7,8	

Course outcomes

At the end of the course the student will be able to:

CO1: Understand and apply basic German grammar and sentence structure.

CO2: Communicate using appropriate vocabulary and expressions in daily situations.
CO3: Fill out simple forms and conduct structured conversations.
CO4: Comprehend basic written and audio-visual content in German.
CO5: Recognize basic cultural and linguistic distinctions in German-speaking countries.

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Two Internal Assessment Tests (MCQs) each conducted for 25 marks.
Alternate Assessment (B)	20	-	Any two Assessment methods as per 24RNBE4.2, scaled to 25 marks.
Total CIE (A+B)	50	20	The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.
SEE (C)	50	18	Question papers having 50 MCQs with each question carrying 01 mark, and Examination duration is 2 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 out of allotted 50 marks to appear for SEE.			

Textbooks

1.Netzwerk A1 Neu Kursbuch
2.Netzwerk A1 Neu Ubungsbuch

Weblinks and Video Lectures(e-Resources)

- https://www.youtube.com/playlist?list=PLquImyRfMt6esqE6C4RdOeg0h0IBeYWri
- https://www.youtube.com/playlist?list=PLWO81tQUNYnX7laegkYvzQiMrSghMXYCZ
- https://www.youtube.com/watch?v=4-eDoThe6qo
- https://learngerman.dw.com/en/wer-spricht/l-56577891/e-57119877

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

- Role Play
- Flipped classroom
- Debate
- Films
- Quiz
- Games
- Handouts

B.E. (Common to all Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – III			
Course Title:	**FOREIGN LANGUAGE COURSE 1- SPANISH**		
Course Code:	**BFLC358B**	**CIE MARKS**	**50**
(L :T : P) + SL	**(1:0:0) + (15 Hours/ Sem)**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**02**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. To introduce learners to the basics of Spanish phonetics and vocabulary.
2. To familiarize learners with basic sentence elements such as articles, pronouns, and regular verbs.
3. To promote simple self-expression and comprehension in everyday scenarios.
4. To prepare the learners to introduce and describe a person.

Module 1	**3 Hours**

Introduction and Phonetics:

- Spanish alphabet and sounds.
- Numbers (0–50), days and months.
- Greetings and introducing yourself.

Textbook: Chapter 0 and Chapter 1 – Lesson 2

Module 2	**3 Hours**

Nouns and Articles

- Gender and number of nouns.
- Definite and indefinite articles.
- Simple sentence structure with nouns.

Textbook: Chapter 2 – Lesson 3

Module 3	**3 Hours**

Subject Pronouns and Regular Verbs

- Subject pronouns (yo, tú, él, etc.).
- Present tense of regular AR/ER/IR verbs.
- Making positive and negative sentences.

Textbook: Chapter 2 – Lesson 4

Module 4	**3 Hours**

Ser vs Estar and Adjectives

- Usage of 'ser' and 'estar'.
- Descriptive adjectives and agreement.
- Describing people and places.

Textbook: Chapter 6 – Lesson 11

Module 5	**3 Hours**

Demonstratives, Possessives, and Family • Demonstrative adjectives (este, esa, etc.). • Possessive adjectives (mí, tu, su, etc.). • Talking about family and relationships. Textbook: Chapter 4 – Lesson 7 & Lesson 8; Chapter 6 – Lesson 12

Course outcomes

At the end of the course the student will be able to:

CO1: Recognize and pronounce basic Spanish phonemes and vocabulary.
CO2: Use articles, nouns, subject pronouns and regular verbs in simple sentences.
CO3: Construct and understand basic descriptive sentences using 'ser' and 'estar'.
CO4: Identify and describe relationships using demonstratives and possessives.

Assessment Details(both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Two Internal Assessment Tests (MCQs) each conducted for 25 marks.
Alternate Assessment (B)	20	-	Any two Assessment methods as per 24RNBE4.2, scaled to 25 marks.
Total CIE (A+B)	50	20	The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.
SEE (C)	50	18	Question papers having 50 MCQs with each question carrying 01 mark, and Examination duration is 2 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
• The minimum marks to be secured in CIE are 20 out of allotted 50 marks to appear for SEE.			

Textbook:

1. Chicos Chicas 1
2. Resources and Exercises from Aventura Hispana

Weblinks:

- **YouTube channels:** Butterfly Spanish, Dreaming Spanish

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

- Role Play
- Debate
- Short videos
- Games
- Handouts

B.E. (ECE)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**IoT Lab**		
Course Code:	**BECL358A**	**CIE MARKS**	**50**
L : T : P	**0:0:2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Gain practical knowledge of common IoT hardware platforms, sensors, and actuators.
2. Interface I/O devices, sensors & communication modules
3. Remotely monitor data and control devices
4. Develop skills required to build IoT based projects

Sl. No	Experiments
1	Interface LED with ESP32 and write a program to turn ‘ON’ LED for 1 sec after every 2 seconds
2	Interface the push button with ESP32 and write a program to turn ‘ON’ LED / buzzer when a button is pressed.
3	Interface DHT11 sensor with ESP32 and write a program to print temperature and humidity readings
4	Interface OLED with ESP32 and write a program to print temperature and humidity readings
5	Interface soil moisture sensor with ESP32 and display the readings.
6	Interface LDR sensor with ESP32 and display the status.
7	Interface an Ultrasonic sensor with ESP32 and display the readings.
8	Interface DC Motor using a relay with ESP32 and write a program to turn ‘ON’ the motor when a push button is pressed.
9	Interface pressure sensor with ESP3 and measure the applied pressure.
10	Interface IR sensor with ESP32 to enable the detection of objects or motion using infrared light

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Program ESP32 through the Arduino platform
CO2	Identify and interface the hardware and software components essential in the IoT structure
CO3	Gain hands on experience on the principle of operation of sensors and actuators
CO4	Extend the concept of sensor interfacing with ESP32 for remote monitoring.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books

1. Sudip Misra, Anandarup Mukherjee, Arjit Ro "Introduction to IoT:", Cambridge University Press,2020
2. Dr. S.R.N Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A Practical Approach", ETI Labs

Reference Books:

1. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi,2021
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 2nd Edition, 2022.Tata McGraw Hill. ISBN: 9789390727384

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**Project Based Learning**		
Course Code:	**BECL358C**	**CIE MARKS**	**50**
L :T : P:	**0:0:2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. To emphasize project-based learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent and group learning by solving real world problems with the help of available resources.
3. To be able to develop applications based on the fundamentals of electronics and communication engineering by possibly the integration of previously acquired knowledge.
4. To get practical experience in all steps in the life cycle of the development of electronic systems: specification, design, implementation, and testing.
5. To be able to select and utilize appropriate hardware and software tools to design and analyse the proposed system.

Module-1: Latex Training	**Week 1-3**	**6 hrs**
Latex training: Hands on Latex training, enabling students to carry on technical training Introduction to Mendeley. **Synopsis preparation:** Survey through journals, patents or field visit (A problem can be theoretical, practical, social, technical and/or scientific), check the feasibility of solution, analyse the problem, design and find the values of components in discussion with guide. Synopsis preparation using Latex. Phase 1 presentation: Literature survey, Objectives and Methodology		
Module-2: Project Implementation	**Week 4-9**	**12 hrs**
Complete implementation of project: Hardware, software implementation. Phase 2 presentation		
Module-3: Prototype Development	**Week 10-12**	**6 hrs**
Testing and Validating the result of the project, Report writing.		
Module 4: Project Demo and Paper writing	**Week 13-14**	**4 hrs**
Project final demo and technical paper writing.		

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Identify the real-world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate / set relevant aim and objectives.
CO2	Propose a suitable solution based on the fundamentals of electronics and communication engineering by possibly the integration of previously acquired

CO3	Use the technology in proposed work and demonstrate learning in oral and written form.
CO4	Develop the ability to work as an individual and as a team member.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books:

1. John Larmer, John R. Mergen Doller, and Suzie Boss, “Setting the Standard for Project Based Learning”.
2. John Larmer and Suzie Boss, “Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences”.
3. Erin M. Murphy and Ross Cooper, “Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry”. M. Krašna, "Project based learning (PBL) in the teachers' education,"39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, 2016, pp. 852-856, doi: 10.1109/MIPRO.2016.7522258.

Web links and Video Lectures (e-Resources):

https://www.overleaf.com/

B.E. (Electronics and Communication Engineering) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER –III			
Course Title:	**Virtual Instrumentation using LabVIEW**		
Course Code:	**BECL358D**	**CIE MARKS**	**50**
L :T : P:	**0:0:2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Aware of various front panel controls and indicators.
2. Connect and manipulate nodes and wires in the block diagram.
3. Locate various toolbars and pull-down menus for the purpose of implementing specific functions.
4. Locate and utilize the context help window.
5. Familiar with LabVIEW and different applications using it.

Sl.NO	VI Programs (using LabVIEW software) to realize the following:
1	Implement basic arithmetic operations: addition, subtraction, multiplication and division.
2	Implement Boolean operations: AND, OR, XOR, NOT and NAND.
3	Construct a program to find sum of ‘n’ numbers using ‘for’ loop.
4	Construct a program to find factorial of a given number using ‘for’ loop.
5	Construct a program to find factorial of a given number using ‘while ‘loop.
6	Develop a LabVIEW program to find square of a given number.
7	Develop a program to sort even numbers using ‘while’ loop in an array.
8	Construct a program to find the array maximum and array minimum.
9	Build a Virtual Instrument that simulates temperature indicator
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.
13	Construct a LabVIEW program to plot the characteristics of different types of process control valves.
14	Creation of an oscilloscope using LabVIEW and measurement of frequency and amplitude.
Demonstration Experiments	
15	**Data acquisition using LabVIEW for temperature measurement with thermocouple.**

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Use LabVIEW to create data acquisition, analysis and display operations.
CO2	Create user interfaces with charts, graph and buttons.
CO3	Use the programming structures and data types that exist in LabVIEW.
CO4	Use various editing and debugging techniques.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books

1. Virtual Instrumentation using LABVIEW, Jovitha Jerome, PHI,2011
2. Virtual Instrumentation using LABVIEW, Sanjay Gupta, Joseph John, TMH, 2nd Edition,2011.

B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	**NSS-National Service Scheme**		
Course Code:	**BNSK359**	**CIE MARKS**	**100**
L : T : P: SL	**0:0:0:30**	**SEE MARKS**	**0**
Credits:	**0**	**EXAM HOURS**	**-**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

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

Module-1
Introduction and Basic Concepts of NSS Aims and Objective of NSS. Emblem, Moto, Flag Role and Responsibility of youth in various activities of NSS
Module-2
Youth Leadership Definition of Leadership and Important components (Social, Mental, Moral and Cultural) Qualities and Characteristics of good leaders Role of Youth leadership
Module-3
Community Work through NSS Community Work: Meaning and Nature Concept of regular activities undertaking of NSS
Module-4
NSS Activity-1
Module-5
NSS Activity-2

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the motto and concepts of NSS
CO2	Develop overall personality of volunteers and make them as leaders and responsible citizens of our nation
CO3	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO4	Communicate effectively with the community and with the officials.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
Evaluation based on Reports (A)	100	-	5 modules Reports, 5 modules X 10 M each = 50 M
Total CIE Theory (A)	**100**	**40**	
SEE (B)	**-**	**-**	**-**
CIE+SEE (A+B)	**100**	**40**	**Final marks shall be the sum of marks scored in Components A, B**
• The minimum marks to be secured in CIE is 40 out of allotted 50 marks with minimum 40 % scored in every component of CIE. • No SEE for this subject			

Reference Books

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

Weblinks

1. https://nss.gov.in/
2. https://pledge.mygov.in/

B.E. (Common to All Branches)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Course Title:	**Physical Education**		
Course Code:	**BPEK359**	**CIE MARKS**	**100**
L: T: P: S	**0:0:1:0**	**SEE MARKS**	**---**
Credits:	**---**	**EXAM HOURS**	**---**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Participate in the competition at regional/state / national / international levels.
4. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

Module-1 **5 Hours**

Orientation

A. Meaning and Importance of Physical Education
B. Lifestyle
C. Health & Wellness

Module-2 **5 Hours**

General Fitness & Components of Fitness

A. Meaning and Importance of Fitness
B. Warming up (Free Hand exercises)
C. Strength – Push-up / Pull-ups

Module-3 **5 Hours**

Specific games (Anyone to be selected by the student)

A. Kabaddi

a) Fundamental skills
Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.

b) Offensive Skills:
Raiding, Hand Touch, Toe Touch, Dubki, Squat Thrust

c) Defensive Skills:
Tackling, Ankle Hold, Thigh Hold, Waist Hold, Blocking, Chain Tackle

d) Other Important Skills:
Agility, Speed, Breath Control, Breath Holding

e) Rules and their interpretation and duties of the officials

B. Kho-Kho

a) **Fundamental skills**
Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

b) **Skills in Chasing:**
Sit on the box (Parallel & Bullet toe method), Get up from the box (Proximal & Distal foot method), Give Kho (Simple, Early, Late & Judgment), Pole Turn, Pole Dive, Tapping, Rectification of foul.

c) **Skills in running:**
Chain Play, Ring play and Chain & Ring mixed play.

d) **Game practice with application of Rules and Regulations.**

e) **Rules and their interpretations and duties of the officials.**

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness
CO2	Familiarization of health-related Exercises, Sports for overall growth and development
CO3	Participate in the competition at regional/state/national/international levels.
CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	-----	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz(B)	40	-----	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks

- The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.

Textbooks

1. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.

Reference Books

1. Saraswati Health and Physical Education Textbook
2. V.K. Sharma's Health and Physical Education

B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – III			
Course Title:	**Yoga**		
Course Code:	**BYOK359**	**CIE MARKS**	**100**
L: T: P: S	**0:0:1:0**	**SEE MARKS**	**---**
Credits:	**---**	**EXAM HOURS**	**---**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Physical, Mental & spiritual Objectives of Yoga
2. Explain the meaning of Yoga.
3. Discuss the importance of the Yoga and its scope.
4. Describe the aims and objectives of Yoga.
5. Clarify the misconceptions on Yoga

Module-1 **5 Hours**

Orientation

a) Introduction of Yoga
b) Aim, and Objectives of Yoga,
c) Yoga, its origin, history and development.

Module-2 **5 Hours**

Yoga

a) Yoga, its meaning, definitions.
b) Brief introduction of yogic practices for the common man
c) Rules and regulations
d) Misconceptions of Yoga
e) Suryanamaskara

Module-3 **5 Hours**

Asanas

Types of Asanas:

a)	**Sitting-**	1. Padmasana,	2. Vajrasana
b)	**Standing-**	1. Vrikshana,	2. Trikonasana
c)	**Prone line-**	1. Bhujangasana	2. Shalabh asana
d)	**Supine line-**	1. Utthita dvipadasana	2. Ardha halasana

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Yoga
CO2	Improves of health and related aspects, overall growth and development
CO3	Participate in the competition at regional/state/national/international levels.
CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	----	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz(B)	40	----	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks
• The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.			

Textbooks

1. The Yoga Sutras of Patanjali – Sri Swami Satchidananda.
2. Light on Yoga — B.K.S Iyengar.

Reference Books

1. The Heart of Yoga — T.K.V Desikachar.
2. "Asana Pranayama Mudra Bandha" by Swami Satyananda Saraswati.

IV SEMESTER SUBJECTS

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV

Course Title:	**Engineering Electromagnetics**		
Course Code:	**BEC401**	**CIE MARKS**	**50**
L: T: P:	**3:2:0**	**SEE MARKS**	**50**
Credits:	**4**	**EXAM HOURS**	**03**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Study different coordinate systems, Physical significance of Divergence, Curl and Gradient.
2. Understand the applications of Coulomb's Law and Gauss to different charge Distribution and Applications of Laplace's and Poisson's Equation to solve real time problems on capacitance of different current distributions.
3. Infer the effects of magnetic forces, materials and inductance.
4. Know the physical interpretation of Maxwell's Equation and applications for plane wave for their behaviour in different media.
5. Acquire knowledge of Poynting Theorem and its Applications of Power flow.

Module-1: Electrostatics **9 hrs**

Revision of Vector Calculus

Coulomb's Law, Electric Field Intensity and Flux density: Coulomb's Law, Electric Field Intensity and Flux density, Coulomb's law, Electric field intensity, Field due to continuous point charge distribution, Field of a line charge, Electric flux density, numerical Problems.

Module-2: Gauss Divergence Theorem, Energy & Potential, Current density **9 hrs**

Gauss Law: Gauss's law and Divergence Gauss's law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator and divergence theorem.

Energy, Potential and Conductors: Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient. Current and Current Density.

Module-3: Poisson and Laplace Equation, Steady Magnetic Field **9 hrs**

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations. Examples of the solution of Laplace's equation.

Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stoke's theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials.

Module-4 Maxwell's Equation **9 hrs**

Module-5 Uniform Plane Waves

9 hrs

Uniform Plane Wave: Wave propagation in free space, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Poynting's Theorem and wave power, Propagation in good Conductors, Skin effect or Depth of penetration, Numerical problems.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Evaluate Problems on electrostatic force, electric field due to a point, linear, volume charges by applying conventional methods and charge in a volume.
CO2	Interpret Gauss Law to evaluate Electric fields due to different charge Distributions, continuity equation by using Divergence Theorem.
CO3	Apply Biot Savart's and Ampere's law for evaluating Magnetic field for different current and potential Configuration.
CO4	Evaluate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
CO5	Apply Maxwell's Equations for time varying fields, EM waves in free space and Conductors and evaluate Power associated with EM waves using Poynting Theorem.

ASSESSMENT DETAILS (Both CIE and SEE)			
Assessment Type	**Maximum Marks**	**Minimum Passing Marks**	**Evaluation Details**
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**18**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE **(A+B+C)**	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. • **If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.**			

Suggested Learning Resources:

Text Books

1. W.H. Hayt and J.A. Buck, "Engineering Electromagnetics" Tata McGraw Hill, 8th Edition,2014, ISBN:978-93-392-0327-6.

Reference Books: -

1. Matthew N. O. Sadiku, S. V. Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2007, 6th Impression 2018.

2. Joseph Edminister, "Electromagnetics- Schaum Outline Series", McGraw Hill.

3. E. C. Jordan and K.G. Balman, "Electromagnetic Waves and Radiating systems" Prentice Hall India, 2nd Edition.

Web links and Video Lectures (e-Resources):

1. NPTEL video lectures: https://youtu.be/pGdr9WLto4A
2. NPTEL video lectures: https://youtu.be/xn2IpxI991M

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV

Course Title:	**Principles of Communication Systems**		
Course Code:	**BEC402**	**CIE MARKS**	**50**
L: T: P:	**3:0:2**	**SEE MARKS**	**50**
Credits:	**4**	**EXAM HOURS**	**03**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Understand and analyse the concepts of Analog modulation schemes viz; AM, FM
2. Design and analyse the electronic circuits for AM and FM modulation and demodulation
3. Understand and analyse concepts on digitization of signals viz; sampling, quantization and encoding
4. Evolve the concept of SNR in the presence of channel induced noise and study demodulation of analog modulated signals
5. Evolve the concept of quantization noise for sampled and encoded signals and study the concepts of reconstruction from these samples at a receiver

Module-1: Basic Communication Principles. **9 hrs**

Amplitude Modulation: Introduction, Amplitude Modulation: Time & Frequency Domain description, switching modulator, Envelope detector.

Double Sideband-Suppressed Carrier Modulation: Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.

Single Side–Band And Vestigial Sideband Methods Of Modulation: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.

Module-2: Angle Modulation. **9 hrs**

Angle Modulation: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver

Module-3: Noise in Analog Modulation **9 hrs**

Noise - Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth.

Noise in Analog Modulation: Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM

Module-4: Sampling and Quantization I **9 hrs**

Module-5: Sampling and Quantization II **9 hrs**

Sampling and Quantization (Contd): The Quantization Random Process, Quantization Noise, Pulse–Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing; Delta Modulation Application examples - (a) Video + MPEG and (b) Vocoders

PRACTICAL COMPONENT OF IPCC (*Experiments can be conducted using MATLAB/SCILAB/OCTAVE)*

Sl. No	Experiments
1	Basic Signals and Signal Graphing a) Unit Step b) Rectangular c) Standard Triangle d) Sinusoidal e) Exponential Signal
2	Illustration of signal representation in time and frequency domains for a rectangular pulse.
3	Amplitude Modulation and Demodulation: Generation and display the relevant signals and its spectrum.
4	Frequency Modulation and Demodulation: Generation and display the relevant signals and its spectrum.
5	Sampling and reconstruction of low pass signals. Display the signals and its spectrum.
6	Time division Multiplexing and demultiplexing.
7	PCM illustration: Sampling, Quantization and Encoding.
8	Generate a) NRZ and RZ b) PPM and PWM signals.
9	Illustration of Delta Modulation and the effects of step size selection in the design of DM. encoder.
10	Display the signal and its spectrum of an audio signal.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Analyse and compute performance of AM and FM modulation
CO2	Analyse and compute performance of digital formatting processes with quantization noise
CO3	Characterize the influence of channel noise on analog modulated signals
CO4	Gain understanding of the characteristics of pulse amplitude modulation, pulse position modulation, and pulse code modulation systems.
CO5	Demonstrate the use of digital formatting in multiplexers, vocoders and video transmission

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

Assessment Type	Maximum Marks	Minimum PassingMarks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**8**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**18**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**40**	**Final marks shall be the sum of marks scored in Components A, B, C and D**
• The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Suggested Learning Resources:

Text Books

1. Simon Haykins & Moher, "Communication Systems", John Willey, India Pvt Ltd, 5th Edition, 2021, ISBN 978-81-265-2151-7

Reference Books: -

1. B.P. Lathi, "Modern Digital and Analog Communication Systems", Oxford University Press, 4th edition.

2. Simon Haykins, "An introduction to Analog and Digital Communication", John Wiley India Pvt, Ltd, 2008, ISBN 978-81-265-3653-5

3. H.Taub & D.L. Schilling, "Principles of Communication Systems", TMH 2011.

4. Harold P.E, Stern Samy and A. Mahmond, "Communication Systems", Pearson Edition 2004.

Web links and Video Lectures (e-Resources):

1. NPTEL video lectures: https://archive.nptel.ac.in/courses/108/104/108104091/#

B.E. (Electronics and Communication Engineering))
Outcome Based Education(OBE) and Choice Based Credit System(CBCS)
SEMESTER – IV

Course Title:	**Signals and Systems**		
Course Code:	**BEC403**	**CIE MARKS**	**50**
L :T : P	**3:0:2**	**SEE MARKS**	**50**
Credits:	**4**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. To equip students with a basic foundation of Signal Processing by delivering the basics of quantitative parameters for the mathematical description of discrete time signals and systems
2. Analyzing the signals in the time domain using convolution sum.
3. Classifying signals into different categories based on their properties
4. Analyzing Linear Time Invariant (LTI) systems in time and transform domains.
5. Analyze Fourier Transform in time domain.

Module-1 **9 hrs**

Introduction and Classification of Signals: Definition of signal and Classification of signals.
Basic Operations on signals: Amplitude scaling, addition, multiplication, Differentiation, and Integration of signals. Time scaling, time shift, and time reversal.
Elementary signals/functions: Exponential, sinusoidal, step, impulse, ramp functions, triangular, and rectangular pulse.

Module-2 **9 hrs**

System and its properties: Definition of system, Linear-nonlinear, Time variant-invariant, causal-noncausal, static-dynamic, Stable and Unstable Systems.
Impulse response representation of LTI Systems: Convolution Sum & Convolution Integral (combination of Unit Step and Exponential). Properties of Impulse response representation for LTI systems.

Module-3 **9 hrs**

LTI system Properties in terms of impulse response: System Interconnection, Memory Less ,Causal, Stable, Invertible ,and Deconvolution ,Step response.
Fourier representation of Periodic Signal: CTFS Properties and Basic Problem.

Module-4 **9 hrs**

Fourier Representation of aperiodic Signals: Introduction to Fourier Transform & DTFT, Definition and basic Problem
Properties of Fourier Transform: Linearity, Time shift, frequency shift, Scaling, differentiation, Integration. Convolution and Modulation, Parseval Theorem, Problems on properties of Fourier Transform.

Module-5 **9 hrs**

Z-Transforms: Definition, Basic problems, Region of Convergence, Inverse Z Transform (Partial Fraction Method only). Causality, Stability, Transform Analysis of LTI System.

Sl. No	List of Experiments
1	Write a Matlab code to generate all types of Signals
2	Write a Matlab code operation on Signals: Amplitude, scaling, Addition, Multiplication Time Shifting, Time Reflection
3	Write a Matlab code of Convolution of two given sequences without using inbuilt function.
4	Write a Matlab code a. to perform verification of commutative property of convolution. b. to perform verification of distributive property of convolution. c. to perform verification of associative property of convolution.
5	Write a Matlab code to determination of a) impulse b) Magnitude c) phase response from the different equation representation of system.
6	Write a Matlab code to determination of step response from impulse response.
7	Write a Matlab code to generate square and triangular wave by summing fundamental and harmonics component.
8	Write a Matlab code to determination of discrete time fourier transform of a rectangular sequence.
9	Write a Matlab code to perform Auto corelation and verification of its properties
10	Write a Matlab code to perform cross co- relation and verification of its properties.
11	Write a Matlab code to find Z-transform and inverse Z-transform of a sequence.
12	Write a Matlab code to solve difference equation of a system.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Analyse different types of signals and systems.
CO2	Verify the properties of discrete-time signals & systems.
CO3	Apply the properties of LTI systems to analyse the behaviour and response of discrete-time systems.
CO4	Evaluate the Fourier Transform to interpret signals in the frequency domain.
CO5	Explore discrete time signals & systems using Z transforms.

ASSESSMENT AND EVALUATION REGULATIONS OF IPCC

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**8**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**18**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**40**	**Final marks shall be the sum of marks scored in Components A, B, C and D**

- The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.

Suggested Learning Resources:

Text Books

1 Simon Haykin and Barry Van Veen, "Signals and Systems", Wiley India, 2nd Edition, 2008, ISBN9971-51- 239-4.

Reference Books:-

1 Michael Roberts, "Fundamentals of Signals & Systems", Tata McGraw-Hill, 2nd edition, 2010, ISBN978-0- 07-070221-9

2 Alan V Oppenheim, Alan S WiIIsky and S Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2"" edition, 1997. Indian Reprint 2002

3 H P Hsu, R Ranjan, "Signals and Systems", Schaum's outlines, TMH, 2006.

4. B P Lathi, "Linear Systems and Signals", Oxford University Press, 2005.

5. Ganesh Rao and Satish Tunga, "Signals and Systems", Pearson/Sanguine

Web Links and video Lectures:

1. Lecture 1, Introduction | MIT RES.6.007 Signals and Systems, Spring 2011 - YouTube
2. Lecture 2, Signals and Systems: Part 1 | MIT RES.6.007 Signals and Systems, Spring 2011 - YouTube.

NPTEL video lectures signals and system:

3. https://www.youtube.com/watch?v=7Z3LE5uM-6Y&list=PLbMVogVj5nJQQZbah2uRZIRZ_9kfoqZyx

B.E. (Electronics and Communication Engineering) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV			
Course Title:	**Communication Laboratory**		
Course Code:	**BECL404**	**CIE MARKS**	**50**
L: T: P	**0: 0: 2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Gain understanding on the basic concepts of AM and FM modulation and demodulation
2. Design and analyse the electronic circuits used for AM and FM modulation and demodulation circuits.
3. Appreciate the concepts of sampling theory and design circuits which enable sampling and reconstruction of analog signals
4. Design circuits to perform Pulse amplitude modulation, Pulse position modulation and Pulse width modulation
5. Gain understanding on Data formatting and line code generation

Sl. No	Experiments
1	Design and test a high-level collector modulator circuit and demodulate the signal using a diode detector.
2	Test the balanced modulator/ Lattice modulator (Diode ring).
3	Design a frequency modulator using VCO and FM demodulator using PLL (Use IC566 and IC565).
4	Design and plot the frequency response of Pre-emphasis and De-emphasis circuits.
5	Design and test BJT mixer.
6	Design and test Pulse sampling, flat top sampling and reconstruction.
7	Design and test pulse amplitude modulation and demodulation.
8	Generation and detection of Pulse Position Modulation.
9	Generation and detection of Pulse Width Modulation.
10	PLL frequency synthesizer.
11	Data formatting and Line code generation.
12	PCM Multiplexer and Demultiplexer

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Illustrate the AM generation and detection using suitable circuits
CO2	Design of FM circuits for modulation, demodulation and noise suppression
CO3	Design and test sampling, multiplexing and pulse modulation techniques using electronic hardware
CO4	Design and demonstrate electronic circuits used for RF transmitters and receivers
CO5	Gain a practical understanding of how different line codes work and how they impact the reliability and efficiency of digital communication systems

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books

1. Louis E Frenzel, Principles of Electronic Communication Systems, 3rd Edition, Mc Graw Hill Education (India) Private Ltd, 2016, ISBN: 978-0-07-066755-6

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV

Course Title:	**Microelectronic Circuits**		
Course Code:	**BEC405A**	**CIE MARKS**	**50**
L: T: P:	**3:0:0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Understand Second order effects in MOS devices and MOSFET Scaling.
2. Determine the frequency response of discrete circuit Common-Source amplifier.
3. Comprehend IC design philosophy and analyse the Integrated circuit Common-Source, Common-Gate and Cascode amplifiers to determine performance parameters.
4. Analyse MOS based differential amplifiers and two-stage Op-amp, to determine CMRR and Bandwidth.
5. Analyse digital CMOS circuits and determine logical operation, transistor sizing and propagation delay.

Module-1: MOS device scaling and Frequency response of MOS amplifier **9 hrs**

Secondary issues in MOS devices: The body effect and other second order effects, Introduction to MOSFET scaling.

Frequency response of Common-Source (CS) amplifier: MOS Small signal models, Low frequency response of discrete circuit CS amplifier, MOS Internal capacitive effects, High frequency model and response of CS amplifier, Miller's theorem, SPICE Examples

Module-2: Single stage IC Amplifier circuits -I **9 hrs**

Useful tools for the analysis of high frequency response of amplifiers: High frequency gain function, Determining the 3-dB frequency, The method of open-circuit time constants and application of the same to the CS amplifier

Building blocks of IC: IC design philosophy, IC Biasing- Current sources, Current mirrors and Current steering circuits, Basic gain cell-CS amplifier with current source load, Intrinsic gain, Effect of the output resistance of the Current source load, Increasing the gain of Basic cell, SPICE Examples.

Module-3: Single stage IC Amplifiers-II **9 hrs**

IC Amplifier circuits: Common-gate Amplifier-CG circuit, Output resistance of a CS amplifier with a source resistance, Body effect, Cascode Amplifier-Cascoding, MOS Cascode amplifier, Distribution of voltage gain in a Cascode amplifier, Double Cascode, Folded Cascode, SPICE Examples.

Useful transistor pairings: CD-CS, IC Source follower and CD-CG.

Module-4: Differential and Multistage Amplifiers **9 hrs**

Differential Amplifiers: MOS differential pair--Operation with a common mode input voltage, Operation with a differential input voltage, Large signal operation, Small signal operation, Differential amplifier with a

current mirror load--Differential to Single-ended conversion, Current mirror-loaded MOS differential pair, Differential gain, Common-mode gain, CMRR, SPICE Examples.
Multistage Amplifier-Two stage CMOS Op-amp—voltage gain, input offset voltage.

Module-5: CMOS Digital Logic Circuits	**9 hrs**
CMOS logic gate circuits: CMOS Inverter, General structure of CMOS logic, Two-input NAND and NOR gates, Complex gate, AOI and OAI gates, Obtaining the PUN from the PDN and vice-versa, Ex-OR function **The CMOS inverter:** Circuit operation, Voltage-Transfer Curve, Dynamic operation of the CMOS inverter—Determining the propagation delay of the CMOS inverter, Transistor sizing in CMOS Inverter and other CMOS logic gates, SPICE Examples.	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply the concepts related to small signal, high frequency, second order effect representations suitably for MOS devices in amplifiers.
CO2	Analyse the discrete MOS CS amplifier to determine gain, input resistance, output resistance and bandwidth.
CO3	Analyse the IC CS, CG, Cascode, Differential and Operational amplifiers to determine relevant performance parameters.
CO4	Construct various CMOS digital logic circuits for a given logic expression and also determine noise margin, propagation delay, transistor sizing for CMOS inverter and other CMOS logic circuits.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Suggested Learning Resources:

Text Book

1. Adel S Sedra and Kenneth C Smith, "Microelectronic Circuits-Theory and Applications", 7th edition, Oxford University Press

Reference Books

1. Roger T H and Charles G S, "Microelectronics-An integrated approach", Pearson Education
2. B Razavi, "Fundamentals of Microelectronics", 3rd edition, John Wiley and Sons
3. D A Neaman, "Microelectronics- Circuit Analysis and Design", 4th edition, Mc Graw Hill

Web links and Video Lectures (e-Resources)

1. https://www.nptel.ac.in/courses/108107142
2. https://www.nptel.ac.in/courses/108104193
3. https://www.nptel.ac.in/courses/108107129

B.E. (Electronics & Communication Engineering)

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER – IV

Course Title:	**Mathematics for Machine Learning**		
Course Code:	**BEC405B**	**CIE MARKS**	**50**
L :T : P:	**3: 0: 0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Learn to use linear algebra, calculus, optimization and probability theory which are having strong linkage with machine learning.
2. Develop the knowledge of machine learning and their applications in decision making and analysis.
3. Analyse and detect patterns in data which can then be utilized for predictions and for developing models.

Module-1: Linear Algebra I **9 hrs**

Quadratic Forms and Matrix Properties: Definition and examples of quadratic forms; symmetric matrices and their spectral properties; conditions for positive definiteness and semi-definiteness. Applications in optimization theory and dimensionality reduction (e.g., PCA).

Eigenvalues and Eigenvectors: Conceptual and geometric understanding of eigenvalues and eigenvectors; diagonalization and spectral decomposition; relevance in system stability, feature extraction, and other machine learning applications.

Module-2: Linear Algebra II **9 hrs**

Singular Value Decomposition (SVD): Mathematical formulation and interpretation, relation to eigen decomposition, applications in dimensionality reduction**.**

Principal Component Analysis (PCA): Concept and motivation for dimensionality reduction, connection with SVD and covariance matrix, use cases in data preprocessing and feature extraction.

Module-3: Probability and Random Variables **9 hrs**

Probability Theory (building on prior distributions): Conditional probability, Bayes' theorem, Gaussian (Normal) distribution and its properties. Application: Naive Bayes classifier.

Random Variables: Joint, marginal, and conditional distributions; expectation, variance, covariance, correlation.

Module-4: Descriptive and Inferential Statistics **9 hrs**

Descriptive Statistics: Measures of central tendency: mean, median, mode; measures of dispersion: variance, standard deviation; skewness and kurtosis. Data visualization techniques: histograms, box plots, scatter plots.

Inferential Statistics: Sampling and sampling distributions, confidence intervals, hypothesis testing (null and alternative), t-tests, z-tests, and Chi-square test.

Module-5: Multivariate Calculus and Linear Regression **9 hrs**

Multivariate Calculus: Functions of several variables, gradients, Jacobian and Hessian matrices and Its Applications, Gradient descent and stochastic gradient descent.

Linear Regression: Parameter estimation, maximum likelihood estimation, overfitting in Linear Regression, Bayesian Linear Regression.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply concepts of matrices, quadratic forms, and eigenvalues to analyze data structures and transformations in machine learning.
CO2	Utilize Singular Value Decomposition (SVD) and Principal Component Analysis (PCA) for dimensionality reduction, feature extraction, and improving the performance and interpretability of machine learning models.
CO3	Apply principles of probability and random variables to model and analyze uncertainty in engineering and data-driven problems.
CO4	Analyze and interpret data using descriptive and inferential statistics to support evidence-based decision making.
CO5	Apply multivariate calculus techniques and implement linear regression models, including regularization and optimization methods.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Suggested Learning Resources

Text Books

1. Gilbert Strang,"Linear Algebra and its Applications", Thomson Brooks and Cole, 4th edition, 2005
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th edition, 2021.
3. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong,"Mathematics for Machine Learning", Cambridge University Press, 2020

Reference Books

1. David C. Lay,"Linear Algebra and Its Applications",, Pearson, 5th Edition.
2. Gilbert Strang, "Linear Algebra and Learning from Data", Wellesley-Cambridge Press, 2019.
3. Sheldon Ross,"Introduction to Probability and Statistics for Engineers and Scientists", Academic Press.
4. Christopher M. Bishop, "Pattern Recognition and Machine Learning",Springer, 2006.
5. Trevor Hastie, Robert Tibshirani, and Jerome Friedman, "The Elements of Statistical Learning", Springer, 2nd Edition.
6. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning",MIT Press, 2016.

7. Kevin P. Murphy,"Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
8. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani,“An Introduction to Statistical Learning”, Springer, Second edition

Web Links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/courses/111/107/111107137
2. https://archive.nptel.ac.in/courses/106/106/106106198

B.E. (Electronics and Communication Engineering)

Outcome Based Education(OBE) and Choice Based Credit System(CBCS)

SEMESTER – IV

Course Title:	**Object Oriented Programming using C++**		
Course Code:	**BEC405C**	**CIE MARKS**	**50**
L :T : P:	**3:0:0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

10. Introduce the fundamentals and develop skills in writing modular code using functions, including overloading and virtual functions.
11. Understand the principles of object-oriented programming through classes and objects.
12. Learn about constructors, destructors, and operator overloading for efficient memory and operation management.
13. Implement inheritance and polymorphism for code reusability and dynamic behaviour.
14. Perform file handling and exception management using C++ streams and mechanisms.

Module-1: Beginning with C++ and its features, Functions **9 hrs.**

Beginning with C++ and its features, Functions: What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++, Functions, Inline function, function overloading, friend and virtual functions.

Module-2: Classes and Objects **9 hrs.**

Classes and Objects: Specifying a class, Defining Member Function, C++ program with a class, Private Member Functions, Arrays within a class, Memory allocation for objects, Static data Members, Static Member functions, Array of objects, Objects as Function Arguments, Friendly Functions, const Member Functions, Pointers to Members.

Module-3: Constructors, Destructors and Operator overloading **9 hrs.**

Constructors, Destructors and Operator overloading: Constructors, Parameterized Constructors, Multiple constructors in a class, Constructors with default arguments, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators.

Module-4: Inheritance, Pointers, Virtual Functions, Polymorphism. 9 hrs.
Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, Inheritance, Making a Private Member Inheritable, multilevel inheritance, multiple inheritance, Pointers, Pointers to objects, this pointer, polymorphism, pointers to derived classes, Virtual and pure virtual functions
Module-5: Streams and working with files. 9 hrs.
Streams and working with files: C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF, Basics of Exception handling, Exception Handling Mechanism, Throwing Mechanism, Catching Mechanism.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Develop and debug C++ programs effectively. Implement various types of functions and understand their applications.
CO2	Design and implement classes and objects, manage memory efficiently, and utilize static
CO3	Utilize constructors, destructors, and effectively manage object initialization.
CO4	Implement inheritance and polymorphism to create complex class hierarchies.
CO5	Apply file input/output operations and implement error handling using exceptions in

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Suggested Learning Resources:

Text Books

1. E. Balagurusamy, *Object-Oriented Programming with C++*, 8th ed. New Delhi, India: McGraw Hill Education, 2020.

Reference Books:-

1. Herbert Schildt, *C++: The Complete Reference*, 5th ed., McGraw-Hill Osborne Media, March 7, 2012.
2. Robert Lafore, *Object Oriented Programming using C++*, Galgotia Publications, 2010.

B.E. (Electronics and Communication Engineering) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – IV			
Course Title:	**Operating Systems**		
Course Code:	**BEC405D**	**CIE MARKS**	**50**
L :T : P:	**3:0:0**	**SEE MARKS**	**50**
Credits:	**3**	**EXAM HOURS**	**3**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Understand the services provided by an operating system.
2. Explain how processes are synchronized and scheduled.
3. Understand different approaches of memory management and virtual memory management.
4. Describe the structure and organization of the file system
5. Understand Inter process communication and deadlock situations.

Module-1: Introduction to Operating Systems	**9 hrs**
OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems.	
Module-2: Process Management	**9 hrs**
OS View of Processes, PCB, Fundamental State Transitions of a process, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux.	
Module-3: Memory Management	**9 hrs**
Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux.	
Module-4: File Systems	**9 hrs**
File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access.	
Module-5: Message Passing and Deadlock	**9 hrs**
Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention.	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Classify and explain the objectives, structure, functionalities, and types of operating systems.
CO2	Apply and compare CPU scheduling algorithms to evaluate performance parameters such as turnaround time and waiting time
CO3	Describe the organization of file systems and explain the role of Input/Output Control Systems (IOCS).
CO4	Apply appropriate memory allocation techniques for managing contiguous and non-contiguous memory efficiently.
CO5	Illustrate inter-process communication methods and evaluate strategies for deadlock detection and prevention.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	50	20	CIE Evaluation is done for a maximum of 50 marks
SEE (C)	50	18	SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall befor 3 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 (40%) out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Suggested Learning Resources:

Text Books

1. D. M. Dhamdhere, *Operating Systems – A Concept-Based Approach*, New Delhi, India: Tata McGraw-Hill, 2nd ed. 2006..

Reference Books:-

1. A. Silberschatz and P. B. Galvin, *Operating System Concepts*, New Delhi, India: John Wiley India Pvt. Ltd., 5th ed. 2001.
2. W. Stallings, *Operating Systems – Internals and Design Principles*, Delhi, India: Pearson Education, 4th ed. 2006.
3. A. S. Tanenbaum, *Modern Operating Systems*, New Delhi, India: Tata McGraw-Hill, 2nd ed. 2001.

B.E. (Electronics and Communication Engineering)

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

SEMESTER – IV

Course Title:	**LINUX Programming**		
Course Code:	**BECL358D**	**CIE MARKS**	**50**
L : T : P	**0 : 0 : 2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

15. Demonstrate foundational knowledge of the Linux operating system.
16. Develop shell scripts to automate tasks and manage system behaviour in a Linux environment.
17. Write C programs that interact with the Linux kernel, including basic kernel modules
18. Apply inter-process communication and synchronization techniques, using System V mechanisms and POSIX threads in C.
19. Design client-server applications using sockets, and organize modular C projects using Makefiles.

Experiments

1	Execute the following Linux commands and note down the output. a) File/directory management: ls, cd, pwd, mkdir, rm, cp, mv b) File permissions: chmod, chown, umask c) Viewing files: cat, more, less, head, tail d) Wildcards and filters: grep, sed, cut, awk (basics)
2	Write a Shell script to do the following, a) Write a shell script to implement a basic calculator using case that supports addition, subtraction, multiplication, and division. b) **Write a shell script to check the status of a file entered by the user. The script should:** • Prompt the user to enter a filename. • Check if the file exists. • If it exists: Display whether it is a regular file, a directory, or a symbolic link. Show its read, write, and execute permissions. • If it does not exist: Display an appropriate message.
3	Execute the following linux commands related to process and user management and analyse the output.

	Commands: ps, top, kill, nice, jobs, bg, fg
4	Write a C Program to implement a) Create a basic Linux kernel module that prints a message "Hello Kernel!" upon insertion and removal using printk b) Load the module using insmod and unload it using rmmod. c) Use dmesg to verify the putput logs from the module.
5	Write a C Program to implement the following: a) Accept a process ID (PID) as a command-line argument. b) Access and parse /proc/[pid]/stat to display key process attributes such as state, priority, CPU time, and scheduling policy.
6	Write a C Program to implement System V shared memory (shmget, shmat, shmdt, shmctl)
7	Write a C program to implement System V message queues using msgget(), msgsnd(), msgrcv(), msgctl() System calls.
8	Write a C program to implement System V semaphores using semget(), semop(), semctl() system calls. Also demonstrate the synchronization using semaphores.
9	Write a C program to implement POSIX Threads (Pthreads). Create threads using pthread_create, pthread_join.
10	Write a C Program to implement the following, a) Mutual exclusion: pthread_mutex_t, pthread_mutex_lock, unlock b) Deadlock and prevention c) Use of pthread_cond_wait() and pthread_cond_signal()
11	Write a C Program to implement a) TCP echo client-server using socket(), bind(), listen(), accept(), connect() system calls also implement error handling wherever necessary. b) UDP Datagram sockets: sendto( ), recvfrom( )
12	Use of Makefile for building multi-file in C projects.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Apply Linux system utilities to manage files, directories, and user permissions.
CO2	Create and execute shell scripts to perform system automation and evaluation.
CO3	Develop basic kernel modules and character device drivers using C.
CO4	Implement IPC and multithreading with synchronization in C using System V and
CO5	Design socket-based communication and manage C projects using Makefiles.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books:

1. Robert Love, Linux System Programming, O'Reilly Media, 1st edition, 2007
2. Neil Matthew & Richard Stones, Beginning Linux Programming, 4th edition, 2007
3. W. Richard Stevens, UNIX Network Programming – Volume 1: The Sockets Networking API, 3rd edition, 2003.

Reference Books:

1. W. Richard Stevens, Stephen A. Rago, Advanced Programming in the UNIX Environment, O'Reilly Media, 3rd edition, 2013.
2. Richard Blum & Christine Bresnahan, Linux Command Line and Shell Scripting Bible, John Wiley & Sons, Inc., 3rd edition, 2015.

Suggested e-learning Resources:

1. Operating Systems – NPTEL (by Prof. P. K. Biswas, IIT Kharagpur) https://nptel.ac.in/courses/106105214
2. The Linux Documentation Project (TLDP), https://tldp.org/guides.html

B.E. (Electronics And Communication Engineering)
Outcome Based Education(OBE) and Choice Based Credit System(CBCS)
SEMESTER – IV

Course Title:	**Finance Accounting**		
Course Code:	**BECT456B**	**CIE MARKS**	**50**
L :T : P:	**1:0:0**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. To enable students to understand the foundational principles, objectives, and frameworks of accounting, including relevant international standards and key terminologies.
2. To develop a clear understanding of the complete accounting process, encompassing journal entries, ledgers, trial balances, subsidiary books, and the preparation of final accounts.
3. To introduce learners to contemporary and emerging practices in the field of accounting, such as forensic accounting, green accounting, and sustainability reporting.
4. To provide insights into the core concepts and scope of financial management, emphasizing the roles and responsibilities of finance professionals within the broader Indian financial system.
5. To equip students with knowledge of advanced topics in financial management, including risk assessment, behavioral finance, financial engineering, and the application of time value of money concepts in financial decision-making.

Module-1: Basics of Accounting **3 hrs**

Meaning and objectives, Branches of Accounting, GAAP, IAS, IFRS, Concepts and Conventions, Users of accounting, accounting terminologies.

Module-2: Accounting Cycle **3 hrs**

Journal, Ledgers, Trial balance, accounting equation, subsidiary books and final accounts (Only theory)

Module-3: Emerging accounting Practices **3 hrs**

Window dressing, forensic accounting, Green Accounting, Human resource accounting and sustainability reporting.

Module-4: Overview of Financial Management: **3hrs**

Meaning and scope- objectives of Financial Management-role and functions of finance managers.
Indian Financial System: Structure-types-Financial markets- Financial Instruments -Financial institutions and financial services- Non-Banking Financial Companies (NBFCs).

Module-5: Emerging areas in Financial Management **3 hrs**

Risk Management- Behavioural Finance- Financial Engineering- Derivatives (Theory).

Time Value of Money : Time value of money –Future value of single cash flow & annuity –Present value and discounting-present value of single cash flow, annuity & perpetuity. Simple interest & Compound interest - Capital recovery factor & loan amortization.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the basic accounting concepts and terminologies.
CO2	Understand the making of journal, ledger, trial balance subsidiary books and accounting Equation and final accounts.
CO3	Analyse emerging trends in accounting
CO4	Understand the basic terminologies and goals of financial management

Suggested Learning Resources:

Text Books

1. Narayanaswamy R," Financial Accounting: A Managerial Perspective "PHI April 2022, 7th edition.
2. Maheswari S. N, Maheswari Sharad ,"A Text book of Accounting For Management", Maheswari Vikas Publishing House (P) Ltd. 11th edition july 2018.
3. M.Y. Khan & P.K. Jain,"Financial Management" TMH 7th edition, 2017.
4. Prasanna Chandra," Financial Management", TMH 10th edition, 2019.

Reference Books:-

1.Neeraj Goyal, Rohit Sachdeva," Computerized Accounting", Kalyani Publishers 1st edition, 2018.
2.Jai Kumar Batra," Accounting and Finance for Non-finance Managers", Sage Publications Vikas Publishing House (P) Ltd., 1st edition, Nov 2018.
3.Ravi M Kishor," Financial Management", Taxmann's 6th edition.
4.Rajiv Srivastava & Anil Misra," Financial Management ",2nd edition,2011.
5.Sudhindra Bhat," Financial Management Principals And Practice", Excel Books Oxford University press 2nd edition.

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER –IV

Course Title:	**System Design using SIMULINK**		
Course Code:	**BECL456C**	**CIE MARKS**	**50**
L : T : P	**0 : 0 : 2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Gain practical knowledge and hands-on skills in signal generation. transformation, analysis, and system simulation using modern engineering tools like MATLAB/Simulink.
2. Emphasizes understanding of fundamental signal operations, frequency domain analysis, system behaviour, and basic communication techniques, preparing students for advanced applications in digital signal processing and embedded systems.
3. Develop the skills required to build the fundamentals on basic signal processing and communication systems.

Experiments

1	Generate basic signals (Sine, square, rectangular, sawtooth waveforms).
2	For a given waveform create a Simulink model to generate the same.
3	For a given signal perform the basic signal processing operation (delay, addition, subtraction, time and amplitude scaling time shifting).
4	Perform the linear and circular convolution of two signals using Simulink.
5	Verify the various system properties using Simulink blocks.
6	Compute the FFT of the given signal and analyse the frequency components and also estimate the power spectrum using spectrum Analyzer.
7	Design a low pass and high pass filter and observe the response in time and frequency domain.
8	Implement different data format and line coding using Simulink.
9	Generate random binary sequences.
10	Perform pulse position modulation using Simulink.
11	Perform pulse amplitude modulation using Simulink.
12	Perform pulse width modulation using Simulink.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Generate and manipulate basic analog and digital signals using MATLAB/Simulink for visualization and analysis.
CO2	Apply fundamental signal processing techniques—including convolution, time and amplitude scaling, and transformation—to interpret signal behaviour.
CO3	Verify the system properties such as linearity, causality, and time invariance using simulation tools to understand system dynamics.
CO4	Design and evaluate filters, modulation schemes (PAM, PPM), and digital coding strategies for signal transmission and processing.
CO5	Investigate frequency domain characteristics of signals using tools like FFT and spectrum analysers to estimate spectral content and power.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Text Books

1. Proakis and D. G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 4th ed. Upper Saddle River, NJ, USA: Prentice Hall, 2006.
2. Mitra, *Digital Signal Processing: A Computer-Based Approach*, 4th ed. New York, NY, USA: McGraw-Hill, 2011.

Reference Books:

1. MathWorks, *Digital Processing with MATLAB & Simulink*, MathWorks Documentation. [Online]. Available: https://www.mathworks.com/help/signal/signal-processing.html. [Accessed: Jul. 27, 2025].
2. MATLAB Academy, *Signal Processing Onramp*, MathWorks. [Online]. Available: https://matlabacademy.mathworks.com/details/signal-processing-onramp/signal-processing. [Accessed: Jul. 27, 2025].

B.E. (Electronics and Communication Engineering)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV

Course Title:	**Advanced Verilog Lab**		
Course Code:	**BECL456D**	**CIE MARKS**	**50**
L: T: P	**0: 0: 2**	**SEE MARKS**	**50**
Credits:	**1**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Provide practical exposure to the students on executing and debugging various combinational and sequential circuits.
2. Give the knowledge and practical exposure on applications of Digital Electronics.
3. Program FPGAs/CPLDs to synthesize the digital circuits.
4. Interface hardware to programmable ICs through I/O ports.

List of Experiments

1	Write a Verilog description to initialize even memory locations with logic 0 and odd memory locations with logic 1 using a for loop.
2	Write a Verilog description to count from 0 to 127 using a while loop and display the count.
3	Write Verilog code to compute the factorial of a 4-bit number using task and function.
4	Write Verilog code to calculate the parity of a 32-bit register using function.
5	Write Verilog code to illustrate the execution of sequential block with and without delay sequential and parallel block
6	Write a Verilog program to design a Clock division circuit to perform ½, 1/3rd and ¼th clock division of the given input clock. Verify on CRO by synthesizing the code.
7	Simulate and synthesize a Verilog program to implement Carry Lookahead Adder for 4-bit number
8	Simulate and synthesize a Verilog program to implement Booth's algorithm for 4-bit number.
9	Verilog Program to interface DAC to FPGA to generate Square, Triangular and Sine waveforms.
10	Verilog Program to interface Seven segment Display to FPGA to display 0 to F.
11	Verilog Program to interface a Stepper Motor to FPGA and rotate it clockwise and anticlockwise directions.
12	Verilog Program to interface to FPGA to implement Elevator Control.
13	Verilog Program to interface 4 X4 keyboard FPGA to identify key pressed.
14	Verilog Program to interface a DC motor to FPGA and vary the speed of the mot**or.**
15	Design a 4-bit ALU to perform addition (CLA), multiplication (Booth's algorithm), counters (Decade, Ring, Johnson counter), shift register (Left and Right shift) and pseudorandom sequence generator.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Design, simulate and synthesize combinational circuits. Verify the code using test bench and FPGA.
CO2	Design, simulate and synthesize sequential circuits. Verify the code using test bench and FPGA
CO3	Design and simulate delays, Functions and tasks in Verilog. Verify the code using test bench and FPGA
CO4	Design and synthesize HDL program to interface various hardware circuits.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	20	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 20 marks.
CIE Practical Test + Mini Project (B)	20+10	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20 + Mini Project (10 Marks)
Total CIE Practical (A+B)	**50**	**20**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.			

Suggested Learning Resources:

Textbooks

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition. 2001
2. Nazeih M Botros, "HDL Programming: VHDL and Verilog", Dreamtech Press, first Edition 2009.

Reference Books:

1. Donald E. Thomas, Philip R. Moorby, "The Verilog Hardware Description Language", Springer
   Science Business Media, LLC, Fifth edition. 2002.
   Michael D. Ciletti, "Advanced Digital Design with the Verilog HDL" Pearson (Prentice Hall), Second edition, 2011,
3. Padmanabhan, Tripura Sundari, "Design through Verilog HDL", Wiley, 2016.

B.E. (Common to All Branches) Outcome Based Education(OBE) and Choice Based Credit System(CBCS) SEMESTER – IV			
Course Title:	**Environmental Studies**		
Course Code:	**BENS407 / 507**	**CIE MARKS**	**50**
(L : T : P)+ SL	**(2:0:0) + (30 Hours/Sem)**	**SEE MARKS**	**50**
Credits:	**2**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Introduce the basic concepts of ecology and ecosystem functioning, including biodiversity and biogeochemical cycles.
2. Understand various types of environmental pollution, their sources, impacts, and preventive measures.
3. Explore causes of environmental degradation and methods of conservation with special emphasis on Indian biodiversity.
4. Create awareness about climate change, global warming, environmental legislation, and significant environmental movements in India.

Module-1	**6Hours**

Ecology: Basic concepts of ecosystem. Ecosystems (structure and function)- forest, desert, wetlands, river, oceanic and lake. Biotic and Abiotic components; Food chain; Ecological pyramid.

Biogeochemical Cycles:carbon cycle, nitrogen cycle, phosphorus cycle, water cycle

Sustainability: 17 Sustainable Development Goals (SDG)- history, targets, implementation, capacity development.

Module-2	**6Hours**

Environmental Pollution: Surface and ground water pollution, noise pollution, soil pollution, air pollution and marine pollution - sources, impacts on living beings, impacts on environment, preventive measures. case-study on marine pollution.

Water Chemistry: Significance and effect of pH, total dissolved solids and hardness. Case study on impact of fluoride on human health.

Module-3	**6Hours**

Environmental Degradation: Causes and effects of deforestation, desertification, soil erosion and glacier melting.

Environmental Conservation: Significance and key features of national parks, wildlife sanctuaries, reserved forest and mangrove forest. Importance of western ghats as biodiversity hotspot (flora and fauna)

Module-4	**6Hours**

Indian Monsoon and Global Warming

Climate- Impact on monsoons, significance of El Nino and La Nina on India climate.

Global warming: causes, greenhouse gases, effects on environment and human health. Causes and effects of acid rain and ozone depletion. Air sampler and its importance in assessing pollutants.
Module-5 **6Hours**
Environmental Legislation: Environmental Protection Act 1984: Definition, Significance and key features. **Indian Environmental Movements:** Bishnoi Movement, Chipko & Appiko movement.

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Describe the components and functions of ecosystems and explain major biogeochemical cycles and sustainability goals.
CO2	Understand various forms of pollution and environmental degradation, along with their impacts on ecosystems and human health.
CO3	Demonstrate awareness of climate issues, Indian environmental legislation, and the role of community-based movements in environmental protection.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Three Internal Assessment Tests each of 50 marks, scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20	-	Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**18**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration should be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Textbooks

1. Benny Joseph, "Environmental studies", 3rd ed.,TataMcGraw-Hill, 2017.
2. S M Prakash, "Environmental studies", 3rd ed., Pristine publishing house, 2018.

Reference Books:-

1. M. Anji Reddy, "Text book of environmental science and Technology", revised ed., B S publications, 2014.
2. Dr. B. S Chauhan,"Environmentalstudies",1st ed., University of science press, 2008.

B.E. (Common to all branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV / V			
Course Title:	**BIOLOGY FOR ENGINEERS**		
Course Code:	**BBOE407/507**	**CIE MARKS**	**50**
(L: T: P) + SL	**(2:0:0) + (30 Hours/Sem)**	**SEE MARKS**	**50**
Credits:	**2**	**EXAM HOURS**	**2**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Familiarize the students with the basic biological concepts and their engineering applications.
2. Enable the students with an understanding of bio design principles to create novel devices and structures.
3. Provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4. Motivate the students to develop interdisciplinary vision of biological engineering.

Module-1	**6 Hours**
Introduction to fundamentals of life. Structure and functions of a cell. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins, Enzymes and Lipids.	
Module-2	**6 Hours**
Introduction to applications of biomolecules, Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, Enzymes in biosensors fabrication, food processing, enzymes in biobleaching, Lipids in biodiesel and detergents production.	
Module-3	**6 Hours**
Introduction to adaptations of anatomical principles for bioengineering design, Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.	
Module-4	**6 Hours**
Introduction to nature inspired biomaterials and mechanisms, Echolocation, Photosynthesis. Bird flying, Lotus leaf effect, Plant burrs, Shark skin, Kingfisher beak. Artificial blood - haemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	

Module-5	6 Hours
Introduction to trends in bioengineering, Tissue engineering, stem cells and their applications, Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete.	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Corroborate the concepts of biomimetics for specific requirements.
CO2	Understand the basic biological concepts for relevant industrial applications. adaptation.
CO3	Evaluate the principles of design and development, for exploring engineering knowledge in biological
CO4	Think critically towards exploring innovative biobased solutions for socially relevant problems.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30		Average of Three Internal Assessment Tests each of 50 marks, scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	20		Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks.
Total CIE (A+B)	**50**	**20**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**18**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration should be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**40**	Final marks shall be the sum of marks scored in Components **A, B and C.**
The minimum marks to be secured in CIE is 20 out of allotted 50 marks to appear for SEE, with minimum 40 % scored in every component of CIE.			

Textbooks

1. Basuchandra's Biology for Engineers, Chandra shekara. B.M, Basavaraju B.C, 2025.
2. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.

Reference Books

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W.
3. Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
9. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha, A C Udayashankar, Lambert Academic Publishing, 2019.

B.E. (Common to All branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV			
Course Title:	**Universal Human Values(UHV)**		
Course Code:	**BUHV408**	**CIE MARKS**	**50**
(L: T: P) + S	**(1:0:0) + (15 HOURS / SEM)**	**SEE MARKS**	**50**
Credits:	**01**	**EXAM HOURS**	**02**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education tothe young enquiring minds.

Module-1	**3 Hours**

Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.

Self-Learning Activity: Self-exploration exercise where students write about their understanding of happiness and prosperity.

Module-2	**3 Hours**

Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Self-Learning Activity: Students will categorize their daily needs into 'self' and 'body' to understand their coexistence.

Module-3	3 Hours
Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order. **Self-Learning Activity**: Students will write and share a personal story where trust or respect played a key role in a relationship.	
Module-4	**3 Hours**
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. **Self-Learning Activity**: Students will have a nature walk to observe and reflect on coexistence and mutual fulfilment in nature.	
Module-5	**3 Hours**
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession. **Self-Learning Activity**: Students are engaged in drafting their personal code of professional ethics aligned with human values.	

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Identify and describe the role of self, family, society, and nature in achieving holistic human well-being.
CO2	Analyze real-life personal and societal problems through the lens of human values and ethical reasoning.
CO3	Apply human values to interpersonal and professional situations to ensure harmony in relationships and society.
CO4	Integrate sustainability, ethics, and lifelong learning into personal and professional practices.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	30	-	Average of Two Internal Assessment Tests (MCQs) each

			conducted for 25 marks.
Alternate Assessment (B)	20	-	Any two Assessment methods as per 24RNBE4.2, scaled to 25 marks.
Total CIE (A+B)	50	20	The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.
SEE (C)	50	18	Question papers having 50 MCQs with each question carrying 01 mark, and Examination duration is 2 hours.
CIE + SEE (A+B+C)	100	40	Final marks shall be the sum of marks scored in Components A, B and C.
The minimum marks to be secured in CIE are 20 out of allotted 50 marks to appear for SEE.			

Textbooks

1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2. The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III,

1972, Limits to Growth – Club of Rome's report, Universe Books.

16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
21. M Govindrajan, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

B.E. (Common to All Branches) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – IV			
Course Title:	**NSS-National Service Scheme**		
Course Code:	**BNSK459**	**CIE MARKS**	**100**
L : T : P	**0:0:0:30**	**SEE MARKS**	**0**
Credits:	**0**	**EXAM HOURS**	**-**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem – solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skillsin mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Module-1
Water conservation techniques – Role of different stakeholders– Implementation.
Module-2
Preparing an actionable business proposal for enhancing the village income and approach for implementation.
Module-3
Helping local schools to achieve good results and enhance their enrolment in Higher/technical/ vocational education.
Module-4
NSS Activity-1
Module-5
NSS Activity-2

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the significance of individual responsibilities towards society and contribute meaningfully to community welfare.
CO2	Analyze environmental and societal issues, and design feasible solutions to address them effectively
CO3	Critically evaluate existing systems and propose practical, sustainable solutions for long-term development.
CO4	Plan and implement government initiatives or self-driven projects effectively in real-life community settings.
CO5	Develop the capacity to respond to emergencies and natural disasters, while practicing national integration, social harmony, and unity in diversity.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
Evaluation based on Reports (A)	100	-	5 modules Reports, 5 modules X 10 M each = 50 M
Total CIE Theory (A)	**100**	**40**	
SEE (B)	**-**	**-**	**-**
CIE+SEE (A+B)	**100**	**40**	**Final marks shall be the sum of marks scored in Components A, B**

- The minimum marks to be secured in CIE is 40 out of allotted 50 marks with minimum 40 % scored in every component of CIE.
- No SEE for this subject

Reference Books:

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

Weblinks:

1. https://nss.gov.in/
2. https://pledge.mygov.in/

B.E. (Common to All Branches)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV

Course Title:	**Physical Education**		
Course Code:	**BPEK459**	**CIE MARKS**	**100**
L: T: P: S	**0:0:1: 0**	**SEE MARKS**	**---**
Credits:	**---**	**EXAM HOURS**	**---**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth and development
3. Participate in the competition at regional/state / national / international levels.
4. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

Module-1 **5 Hours**

Athletics

A. Track - Sprints
B. Throws - Shotput
C. Jumps - Long jump

A.Track Events

i. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block.
ii. Acceleration with proper running techniques.
iii. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug, Torso Finish.

B. Long Jump

Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing

C. Shot put

Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique)

Module-2 **5 Hours**

Volleyball

A. Fundamental skills

1. Service: Underarm Service, Side arm Service, Tennis Service, Floating Service
2. Pass: Under arm Pass, Overhead Pass

3. Spiking & Blocking
4. Game Practice with application of Rules & Regulations

B. Rules and their interpretation and duties of the officials

Module-3	**5 Hours**

Throwball

A. Fundamental skills

Overhand service, Side arm service, two hand catching, one hand overhead return, side arm return.

B. Rules and their interpretation and duties of the officials

COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness
CO2	Familiarization of health-related Exercises, Sports for overall growth and development
CO3	Participate in the competition at regional/state/national/international levels.
CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

ASSESSMENT DETAILS (Both CIE and SEE)

Zero-credit NCMC courses (MCQs for assessment)			
Assessment Type	**Maximum Marks**	**Minimum Passing Marks**	**Evaluation Details**
CIE – IA Tests (A)	60	---	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz(B)	40	---	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks

- The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.

Textbooks

1. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata

Reference Books: -

1. Saraswati Health and Physical Education
2. V.K. Sharma's Health and Physical Education
3. Oswaal Books: Educart Chapterwise Question Bank: Offers detailed coverage of concepts and questions by chapter.

B.E. (Common to All Branches)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – IV

Course Title:	**Yoga**		
Course Code:	**BYOK459**	**CIE MARKS**	**100**
L: T: P: S	**0:0:1:0**	**SEE MARKS**	**---**
Credits:	**---**	**EXAM HOURS**	**---**

COURSE LEARNING OBJECTIVES:

The purpose of the course is to facilitate the learner to:

1. Physical, Mental & spiritual Objectives of Yoga
2. Explain the meaning of Yoga.
3. Discuss the importance of the Yoga and its scope.
4. Describe the aims and objectives of Yoga.
5. Clarify the misconceptions on Yoga

Module-1 **5 Hours**

Patanjali Ashtanga Yoga

A. Yama: Ahimsa, satya, asteya, brahmacarya, aparigraha

B. Niyama: shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan

C. Suryanamaskara: 12 Counts, 4 Rounds

Module-2 **5 Hours**

Asana

a) Meaning, Need & Importance of Asana
b) **Different Types of Asanas:**
   i. **Sitting** - 1. Sukhasana, 2. Paschimottanasana
   ii. **Standing** - 1. ArdhakatiChakrasana 2. Parshva Chakrasana
   iii. **Prone line** - Dhanurasana
   iv. **Supine line**- Halasana
c) Asana Technique
d) Precautionary measures and benefits of each Asana

Module-3 **5 Hours**

Pranayama

A. Meaning, Need & importance of Pranayama.
Different types of pranayama, technique, precautionary measures and benefits of each Pranayama.
   1. **Suryanuloma -Viloma**
   2. **Chandranu loma-Viloma**

B. Kapalabhati
Meaning, importance and benefits of Kapalabhati.

COURSE OUTCOMES

After successfully completing the course, the student will be able to:

CO1	Understand the fundamental concepts of Yoga
CO2	Improves of health and related aspects, overall growth and development
CO3	Participate in the competition at regional/state/national/international levels.
CO4	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.

ASSESSMENT DETAILS (Both CIE and SEE)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	----	Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks.
Quiz(B)	40	----	Quiz for a maximum of 40 marks
Total CIE (A+B)	100	40	CIE Evaluation is done for a maximum of 100 marks
• The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.			

Textbooks

1. The Yoga Sutras of Patanjali – Sri Swami Satchidananda.
2. Light on Yoga — B.K.S Iyengar.

Reference Books: -

1. The Heart of Yoga — T.K.V Desikachar.
2. "Asana Pranayama Mudra Bandha" by Swami Satyananda Saraswati.

VISION

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- Imparting value based, need based, choice based and skill based professional education to the aspiring youth and carving them into disciplined, World class professionals with social responsibility.
- Promoting excellence in Teaching, Research and Consultancy that galvanizes academic consciousness among Faculty and Students.
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