BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi)

Avalahalli, Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Electronics and Communication Engineering

VI Semester Scheme and Syllabus
2022 Scheme – Autonomous
AY 2024-2025

Approved in the BoS meeting held on 01.03.2025

Vision and Mission of the Department

Vision

Be a pioneer in providing quality education in electronics, communication, and allied engineering fields to serve as a valuable resource for industry and society.

Mission

1. Impart Sound Theoretical and Practical Concepts.
2. Promote Interdisciplinary Research.
3. Inculcate Professional Ethics.

Program Educational Objectives (PEOs)

1. Establish successful careers in electronics, communication, and allied engineering domains by leveraging their technical expertise, problem-solving skills, and adaptability to emerging technologies.
2. Conduct cutting-edge research and pursue higher education to develop innovative solutions that contribute to the advancement of technology that address societal and global challenges.
3. Demonstrate leadership, effective communication, and teamwork while upholding ethical practices to positively impact industry, entrepreneurship, and society through sustainable engineering solutions.

Program Specific Outcomes (PSOs)

1. Demonstrate the knowledge of electronic devices, circuits, micro-nano electronics and other fundamental courses to exhibit competency in the domain of VLSI design.
2. Apply advanced techniques, technological innovations in communication and signal processing domain.
3. Exhibit the skills gathered to analyze, design, develop software applications and hardware products in the field of embedded systems and allied areas.

Program Outcomes (POs)

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.

PO2: ***Problem Analysis:*** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

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)

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)

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)

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)

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

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

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.

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.

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)

****

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

****

ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮತ್ತು ವ್ಯವಸ್ಥಾಪನಾ ಮಹಾವಿದ್ಯಾಲಯ
BMS Institute of Technology and Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

REVISED

Date: 18-12-2024

CONTINUOUS INTERNAL EVALUATION (CIE) AND SEMESTER END EXAMINATION (SEE) PATTERN

(Applicable to UG students admitted from the 2022 batch, effective from the Academic year 2024-25 onwards)

The UG students admitted from the 2022 batch onwards are hereby informed to note the following regarding Continuous Internal Evaluation and Semester End Examination pattern:

- The Weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examination (SEE) is 50%.
- The Minimum passing mark for the CIE is 40% of the Maximum marks (i.e. 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (i.e. 18 out of 50 marks).
- A student will be declared to have passed the course if they secure a minimum of 40% (i.e. 40 marks out of 100) in the combined total of the CIE and SEE.

The following tables summarize the CIE and SEE Patterns for the courses of various credits:

IPCC COURSES: 4 CREDITS OR 3 CREDITS						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	20	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **20 Marks**.
		CIE – Test 2 (1.5 hr)	40			

	CIE – CCA (Comprehensive Continuous Assessment)	CCA	10	05	-	Any one assessment method can be used from the list appended below.
	Total CIE Theory			**25**	**10**	
Practical Component	CIE - Practical		30	15	-	Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE Practical Test		20	10	-	One test after all experiments to be conducted for **20 Marks**
	Total CIE Practical			**25**	**10**	
Total CIE Theory + Practical				**50**	**20**	
SEE			100	50	18	SEE exam is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	
The laboratory component of the IPCC shall be for CIE only.						

Professional Core Courses (PCC) / Engineering Science Courses (ESC): 03 and 02 Credit						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any Two assessment methods can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	
SEE			100	50	18	SEE is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	

NON-IPCC COURSES: 01 Credit Course - MCQ						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation Component	CIE – IA Tests (MCQs)	CIE – Test 1 (1 hr)	40	40	-	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be **80 Marks**, and the same will be scaled down to **40 Marks**.
		CIE – Test 2 (1 hr)	40			
	CIE - CCAs	CCA	10	10	-	Any One Assessment method can be used from the list provided below.
	Total CIE			**50**	**20**	
SEE (MCQ Type)				50	18	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on higher Bloom's level. MCQ-type question papers of 50 questions with each question of a **01 Mark**, examination duration is 01 hour.
CIE + SEE				**100**	**40**	

Professional Core Course Laboratory (PCCL) /Ability Enhancement Course Laboratory (AEC) - 01 Credit					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE - Practical	30	30		Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE - Practical Test	50	20		One test after all experiments is to be conducted for **50 Marks** and to be scaled down to **20 Marks**.
	Total CIE	-	**50**	**20**	
Semester End Examination		100	50	18	SEE to be conducted for **100 Marks**.
CIE+SEE		**100**		**40**	

Learning Activities for CCAs:

A faculty member may choose the following CCAs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test
7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 18/12/2024

Dean AA 18.12.24

Principal 18/12/24

Copy To:

1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and students of 2022, 2023, and 2024 batch.
3. Examination Section

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institution Affiliated to VTU, Belagavi)

B. E. in Electronics & Communication Engineering

Scheme of Teaching and Examinations – 2022 Scheme

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

Effective from the Academic Year 2024-2025 onwards

VI Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Credits Distribution				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	
1	IPCC	BEC601	Computer Communication Networks	TD: ECE PSB: ECE	3	0	1	4	50	50	100	3	5
2	PCC	BEC602	Digital Communication		4	0	0	4	50	50	100	3	4
3	PCC	BEC603	VLSI Design		3	0	0	3	50	50	100	3	3
4	PEC	BEC604X	Professional Elective Course II		3	0	0	3	50	50	100	3	3
5	OEC	BEC605X	Open Elective Course I		3	0	0	3	50	50	100	3	3
6	PW	BEC606	Major Project Phase I		0	0	3	3	100	-	100	-	6
7	PCCL	BECL607	VLSI Laboratory		0	0	1	1	50	50	100	3	2
8	AEC	BEC608X	Ability Enhancement Course/Skill Enhancement Course		For Theory course				50	50	100	1	1
					1	0	0	1					
					For Practical course							2	2
					0	0	1	1					
9	NCMC	BNSK609	National Service Scheme (NSS)	NSS Coordinator	0	0	0	0	100	-	100	-	2
		BPEK609	Physical Education (Sports and Athletics)	PED									
		BYOK609	Yoga	Yoga Teacher									
		BNCK609	National Cadet Corps (NCC)	NCC officer									
		BMUK609	Music	Music Teacher									
10	NCMC	BIKS610	Indian Knowledge System	Any Department	1	0	0	0	100	-	100	-	1
TOTAL					**18**	**0**	**6**	**22**	**650**	**350**	**1000**	**-**	**--**

IPCC: Integrated Professional Core Course, **PCC**: Professional Core Courses, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PCCL**: Professional Core Course laboratory, **NCMC**: Non-Credit Mandatory Course, **ESC**: Engineering Science Course, **AEC**: Ability Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course II		Open Elective Course I		Ability Enhancement Course	
Course Code	**Course Name**	**Course Code**	**Course Name**	**Course Code**	**Course Name**
BEC604A	Information Theory and Coding	BEC605A	Sensors and Applications	BEC608A	Unix Shell Programming
BEC604B	Embedded System Design	BEC605B	Mobile Communication	BEC608B	Engineering Aptitude
BEC604C	Analog and Mixed Mode VLSI Design	BEC605C	Automotive Electronics	BEC608C	Soft Skill Training for Employability
BEC604D	Machine Learning and Deep Learning	BEC605D	5G Technology	BEC608D	Cyber Crime and Law
BEC604E	Data Structures using C++			BEC608E	Generative AI Lab

Integrated Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L: T: P) can be considered as (3: 0: 2) or (2: 2: 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga/NCC/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), Yoga (YOG), National Cadet Corps (NCC) and Music with the concerned coordinator of the course during the beginning of each semester starting from III semester to VII semester. In every semester, students should choose any one mandatory course among the available 5 courses without repeating the course again. Activities shall be carried out in each of the semesters from III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the program.
- The minimum students' strength for offering open electives is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

Project Phase-I: Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Computer Communication Networks (3:0:1) 4

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC601**	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40 hours theory +26 lab hours	Exam Hours	03

Course objectives:

This course will enable students to:

- Understand the layering architecture of OSI reference model and TCP/IP protocol suite with associated protocols.
- Analyze various protocols, algorithms for different networking architectures.
- Design a network for various network parameters using simulation tools.
- Simulate the networks with various protocols to analyze the network performance parameter

Preamble:

In an era of rapid technological advancements and a growing demand for seamless information exchange, computer communication networks are the backbone of modern society, enabling the interconnectedness of devices and facilitating global data flow, driving innovation across all sectors. This subject explores the fundamental principles, architectures, and protocols of computer communication networks, providing an overview of various network types, including LANs, WANs, and the Internet and their interoperability. This subject aims to deepen the understanding, through detailed explanations with real-world examples with theory as well as hands –on techniques of networking.

Module – 1

Significance and scope of Computer Communication Networks in current scenario, industry applications, research and innovations related to the course and impact of course on societal problems.

Introduction to computer networking: Introduction to Physical layer, Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN. Network Models: Protocol Layering: TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing

The OSI Model: OSI Versus TCP/IP. Data-Link Layer: Introduction, Link Layer addressing:

(8 Hours)

Module – 2

Data link layer: ALOHA, CSMA, CSMA/CD, CSMA/CA. Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Connecting Devices: Hubs, Switches, Routers. Virtual LANs: Membership, Configuration, Communication between Switches and Routers, Advantages.

Types of addresses, Data Link Control (DLC) services: Framing, Flow and Error Control, Simple Protocol, Stop and Wait protocol ARQ, go back N ARQ protocol, selective repeat ARQ protocol**.** **(8 Hours)**

Module – 3

Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution.
Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation
Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing. Virtual Private Network, Security in VPN.

(8 Hours)

Module – 4

Transport Layer: Introduction, Transport Layer Services, Connectionless and Connection oriented Protocols, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control, Techniques to improve QOS. **(8 Hours)**

Module – 5

Application Layer: Introduction: providing services, Application- layer paradigms, Standard Client Server Protocols: World wide web, Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection, Electronic Mail: Architecture, Wed Based Mail. Domain Name system: Name space, DNS in internet, Resolution, DNS Messages, Registrars, DDNS.

(8 Hours)

Practical component of IPCC

PART-A: Simulation experiments using NS2/ NS3/ OPNET/ NCTUNS/ NetSim/ QualNet/ Packet Tracer or any other equivalent tool

1. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.

2. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.

3. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.

4. Implementation of Link state routing algorithm.

PART B. Using C/C++

1. Write a program for a HLDC frame to perform the following.
   i. Bit stuffing
   ii. Character stuffing.

2. Write a program for distance vector algorithm to find suitable path for transmission.

3. For the given data, use CRC-CCITT polynomial to obtain CRC code. Verify the program for the cases
   i. Without error
   ii. With error

4. Write a program for congestion control using leaky bucket algorithm

Open Ended Experiments

Experiments to perform Network Diagnostics using Traceroute Analysis, Debugging Techniques, and packet tracing with open-source tools.

Course outcomes: The students will be able to:

CO1	Apply the concepts of computer networks like network models, addresses, channels, nodes and architectures to solve the real time connectivity issues.
CO2	Apply the knowledge of communication channels, protocols, algorithms for debugging, problem analysis and solution
CO3	Analyze the characteristics of communication channels, protocols, algorithms for performance measurement.
CO4	Simulate the networks with various networking tools, analyze the network performance parameters and identify the limitations of the simulation tools.

Text Books:

1. B. Forouzan, "Data Communications and Networking ", 5th Edition, McGraw Hill,2020.

Reference Books:

1. James J Kurose, Keith W Ross, "Computer Networks", 3rd Edition, Pearson Education,2023
2. Wayarles Tomasi, "Introduction to Data Communication and Networking", 3rd Edition, Pearson Education, 2007

Comprehensive Continuous Assessments (CCAs) suggested:

Mini Project: The students have to take up mini projects on WSN protocols or application in a team (not more than 4 students). The evaluation of AAT is based on project work demonstration and Report submission.

Web links/e-resources:

https://onlinecourses.nptel.ac.in/noc22_cs19/preview

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Digital Communication (4:0:0) 4

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC602**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

- Understand the mathematical representation of signal, symbol, noise and channels.
- Apply the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functional blocks.
- Compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
- Compute performance parameters and mitigate for these parameters in corrupted and distorted channel conditions.

Preamble:

Digital Communication is crucial in modern engineering, influencing technology and society. This course equips students with fundamental principles, techniques, and applications of digital communication. It covers mathematical representations of signals, symbols, noise, and channels, along with topics like signal conversion, modulation techniques, channel equalization, and error detection. Emphasizing both theory and practice, students will apply these principles to real-world scenarios, develop practical skills in digital modulation and demodulation, and understand system performance under various conditions. Rigorous assessments ensure comprehensive learning. The course aims to produce professionals capable of analyzing and designing advanced communication systems, ready to innovate in the field of electronics and communication engineering.

Module – 1

Bandpass Signal to Equivalent Lowpass: Hilbert Transform, Pre-envelopes, Complex envelopes, Canonical representation of bandpass signals, Complex low pass representation of bandpass systems, Complex representation of band pass signals and systems (Text 1: 2.8, 2.9, 2.10, 2.11, 2.12, 2.13).

Basic signal processing operations in digital communication. (Text 1).

Line codes: Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities (Text 1: Ch 6.10). Overview of HDB3, B3ZS, B6ZS (Ref. 1: 7.2) **(8 Hours)**

Module – 2

Detection and Estimation Techniques:

Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver (Text 1: 7.1, 7.2, 7.3, 7.4). **(8 Hours)**

Module – 3

Digital Modulation Techniques: Phase shift Keying techniques using coherent detection: generation, detection and error probabilities of BPSK and QPSK, M–ary PSK, M–ary QAM (Relevant topics in Text 1 of 7.6, 7.7).

Frequency shift keying techniques using Coherent detection: BFSK generation, detection and error probability (Relevant topics in Text 1 of 7.8).

Non coherent orthogonal modulation techniques: BFSK, DPSK Symbol representation, Block diagrams treatment of Transmitter and Receiver, Probability of error (without derivation of probability of error equation) (Text 1: 7.11, 7.12. 7.13).

(8 Hours)

Module – 4

Communication through Band limited channel: ISI, Nyquist's criterion for distortion less base-band binary transmission, correlative coding, eye pattern, base-band M-ary PAM systems, adaptive equalization for data transmission. (Text 3)

Channel Equalization: Linear Equalizers (ZFE, MMSE), Adaptive Equalizers (Text 2: 9.4.2).

(8 Hours)

Module – 5

Introduction to Spread Spectrum Communication: Block diagram of Spread Spectrum Communication Systems, Model of a Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Probability of error (statement only), Some applications of DS Spread Spectrum Signals, Generation of PN Sequences, Frequency Hopped Spread Spectrum, CDMA based on IS-95 (Text 2: 11.3.1, 11.3.2, 11.3.3, 11.3.4, 11.3.5, 11.4.2). **(8 Hours)**

Course outcomes: At the end of the course, the students will be able to:

CO1	Apply Hilbert transform for complex representation of band pass signals and systems.
CO2	Analyze the performance of various coherent and non-coherent digital modulation/demodulation systems.
CO3	Apply pulse shaping techniques and channel equalization techniques to mitigate Inter-Symbol Interference (ISI).
CO4	Evaluate optimal detection systems using coherent detection, matched filters, and maximum likelihood (ML) decoding techniques.
CO5	Apply Spread Spectrum Communication techniques to mitigate interference and enhance security to transmitted data.

Text Books:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, 1st Edition, 2014, ISBN 978-0-471-64735-5.
2. John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
3. Digital communications, Simon Haykin, John Wiley, 2003.

Reference Books:

1. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. John G Proakis and Masoud Salehi, "Communication Systems Engineering", 2nd Edition, Pearson Education, ISBN 978-93-325-5513-6.

Comprehensive Continuous Assessments (CCAs) suggested:

- Mini Project Work: Students can be assigned individual or group projects related to digital communication systems. Projects can include the design, simulation, and implementation of modulation techniques, error correction schemes, or channel equalization methods. This hands-on approach helps students apply theoretical knowledge to practical scenarios.

- Simulation Assignments: Using software tools like MATLAB or Simulink, students can simulate different digital communication techniques and analyze their performance. Assignments can include simulating modulation schemes, signal processing operations, and performance metrics under various conditions.

- Presentations: Students can prepare and deliver presentations on advanced topics in digital communication, such as the latest research developments, emerging technologies, or applications of digital communication in different fields. This helps in enhancing their research and communication skills.

Web links/e-resources:

- https://www.youtube.com/results?search_query=digital+communication+lectures
- https://onlinecourses.nptel.ac.in/noc22_ee10/preview

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

VLSI Design (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC603**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

Course Objectives: This course will enable students to:

- Impart knowledge of MOS transistor theory and CMOS technologies
- Learn the operation principles and analysis of inverter circuits.
- Design Combinational, sequential and dynamic logic circuits as per the requirements
- Infer the operation of Semiconductors Memory circuits.
- Demonstrate the concepts of CMOS testing

Preamble:

Very-Large-Scale Integration (VLSI) technology is at the heart of modern electronics, enabling the integration of millions of transistors onto a single chip. This course delves into the intricacies of VLSI, covering both theoretical and practical aspects, to equip students with the knowledge and skills necessary to excel in the field. This course includes the fundamental of MOS theory, fabrication process, delay calculation in design prescripts and memory etc. The course aim to produce the VLSI design engineer in the field of electronics engineering.

Module – 1

Introduction: A Brief History, MOS Transistors, CMOS Logic (1.1 to 1.4.8 of Text 2)
MOS Transistor Theory: Introduction, Long-channel I-V Characteristics, Non-ideal I-V Effects, DC Transfer Characteristics (2.1,2.2,2.4 and 2.5 of Text2)

(8 Hours)

Module – 2

Fabrication: CMOS fabrication, Stick diagram, Layout Design Rules, layout examples, (1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.5 of Text 2)
MOSFET scaling: Constant Field scaling and constant voltage scaling, MOSFET capacitances (3.5 of Text 1)

(8 Hours)

Module – 3

Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model, Logical Efforts of Paths (4.1 to 4.5 of Text 2, except subsection 4.3.7,4.4.5,4.4.64.5.5,4.5.6)
Compound gate, Input ordering delay effect, Asymmetric gates, skewed gates, Cascode voltage switch logic, dynamic logic, domino logic (9.2.1.2, 9.2.1.3, 9.2.1.4, 9.2.1.5,9.2.3, 9.2.4,9.2.4.1 of Text 2)

(8 Hours)

Module – 4

Sequential Circuit Design: Introduction, Circuit Design for Latches and Flip-Flops (10.1 and 10.3.1, 10.3.2 and 10.3.4 of Text 2)
Dynamic Logic Circuits: Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques. (9.4 and 9.5 of Text 1)

(8 Hours)

Module – 5

Semiconductor Memories: System Timing Considerations, Some commonly used Storage/Memory elements (9.1, 9.2.1,9.2.2, 9.2.3, 9.2.4, 9.2.5 of Text 3).

Testing and Verification: Introduction, Logic Verification Principles, Manufacturing Test Principles, Design for testability (15.1,15.3,15.5,15.6.1 to 15.6.3 of Text 1)

(8 Hours)

Course outcomes: At the end of the course, the students will be able to:

CO1	Apply the principles of MOS transistor operation, CMOS logic, and I-V characteristics to implement basic transistor-level circuits
CO2	Apply CMOS fabrication techniques, layout design rules, and stick diagrams to create circuit layouts, and utilize MOSFET scaling methods to optimize device performance.
CO3	Evaluate the performance and delay of MOS circuits in VLSI design by analyzing combinational and sequential digital circuits.
CO4	Analyze the operation and design considerations of sequential circuits, including latches and flip-flops, and examine the advantages and limitations of dynamic logic circuit techniques in CMOS design.
CO5	Apply the concepts of semiconductor memory design and system timing to develop memory elements and implement testing and verification techniques for ensuring functionality and reliability.

Text Books:

1. Sung Mo Kang & Yosuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill, Third Edition, 2002.
2. Neil H. E. Weste, and David Money Harris "CMOS VLSI Design- A Circuits and Systems Perspective", Pearson Education, Fourth edition, 2011
3. Douglas A Pucknell & Kamran Eshragian , "Basic VLSI Design ", PHI, Third Edition,1994.

Reference Books:

1. Adel Sedra and K. C. Smith, "Microelectronics Circuits Theory and Applications", Oxford University Pres, Sixth Edition,2009.

Comprehensive Continuous Assessments (CCAs) suggested:

Presentations: Students can present on advanced topics in VLSI DESIGN such as the latest research developments, emerging technologies, or applications of VLSI and submit the report. Mini Project Work: Students can take up the mini projects related to VLSI domain (minimum 2 or 4 in a group). Projects can include the design, layout and implementation of various Digital circuit using EDA tools. Work should be presented in front of course coordinator at end of the semester. The evaluation of this project is based on knowledge, effort of students, and Report submission.

Web links/e-resources:

https://www.youtube.com/watch?v=1oe5W-n9i7g

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Information Theory and Coding (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC604A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

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

Preamble:

This course is designed to introduce the fundamental principles of information theory, that has become a cornerstone of modern telecommunications, data compression, and error correction. It will provide insights into how information is quantified, transmitted, and preserved in various systems.

Module – 1

Introduction:

Information theory, Coding, Significance of information and coding in the current scenario, Industrial applications, research in the field of information theory, Impact of the information theory on societal problems and sustainable solutions.

Information Theory:

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

(9 Hours)

Module – 2

Source Coding:

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

(7 Hours)

Module – 3

Information Channels:

Communication Channels. Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of : Binary Symmetric Channel, Binary Erasure Channel, Muroga,s Theorem.

(7 Hours)

Module – 4

Error Control Coding:
Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting Hamming Codes, Table lookup Decoding using Standard Array.
Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection.

(8 Hours)

Module – 5

Some Important Cyclic Codes: Golay Codes, BCH Codes.
Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm (Text 2: 7.1 – 7.3, 7.6.3).

(9 Hours)

Course outcomes: The students will be able to:

CO1	Comprehend the measures of information, information sources, source encoding algorithms, communication channels and channel encoding techniques.
CO2	Apply the knowledge of information coding techniques/algorithms to solve problems related to entropy and information content of discrete sources.
CO3	Analyze different techniques/algorithms used for encoding and decoding of messages.
CO4	Analyse the error control coding techniques

Text Books:

1. K. Sam Shanmugam," Digital and analog communication systems" , John Wiley India Pvt. Ltd, 1996.
2. Simon Haykin ,"Digital communication" , John Wiley India Pvt. Ltd, 2008.
3. Muralidhar Kulkarni, K.S. Shivaprakasha," Information Theory and Coding" , Wiley India Pvt. Ltd, 2015, ISBN:978-81-265-5305-1.

Reference Books:

1. Ranjan Bose, "ITC and Cryptography" , TMH, II edition, 2007
2. J. Das, S. K. Mullick, P. K. Chatterjee,"Principles of digital communication", Wiley, 1986 - Technology & Engineering
3. Bernard Sklar, "Digital Communications – Fundamentals and Applications" , 2nd Edition, Pearson Education, 2016, ISBN: 9780134724058.
4. K.N.Haribhat, D.Ganesh Rao," Information Theory and Coding" , Cengage Learning, 2017.

Comprehensive Continuous Assessments (CCAs) suggested:

- Mini Project: Using software tools to simulate and model communication systems and coding schemes.

Web links/e-resources:

- https://archive.nptel.ac.in/courses/117/101/117101053/

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Embedded System Design (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC604B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

- Understand the basics of an embedded system.
- Understand the typical components of an embedded system.
- Understand different communication interfaces.
- Learn the design process of embedded system applications.
- Understand the RTOS and inter-process communication.

Preamble:

Embedded systems have emerged as a cornerstone of modern innovation. These specialized computing systems, designed to perform dedicated functions within larger systems, are integral to a vast array of applications, from consumer electronics and automotive systems to industrial automation and healthcare devices. Embedded systems are characterized by their ability to seamlessly integrate hardware and software to achieve specific, real-time tasks with high reliability and efficiency. Unlike general-purpose computers, these systems are optimized for particular functions, often with stringent constraints on power consumption, size, and performance.

Module – 1

Introduction to Embedded Systems: History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems. (Text1-1.3, 1.4, 1.5, 1.6, 3.1 Text2: 1.2)

(8 Hours)

Module – 2

Typical Embedded System: Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer. (Text1: 2.1, 2.2, 2.3.1, 2.3.2, 2.3.3.1, 2.3.3.2, 2.3.3.5, 2.3.3.6, 2.3.3.7, 2.6)

(8 Hours)

Module – 3

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM. (Text1: 2.4.1.1, 2.4.1.2, 2.4.1.5, 2.4.2(except 2.4.2.3))

(8 Hours)

Module – 4

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop-based approach, operating system-based approach; embedded firmware development languages-assembly language-based development, high level language-based development. (Text1: 9.1, 9.2.1, 9.2.2)

(8 Hours)

Module – 5

RTOS based Embedded System Design: Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques. (Text1: 10.1, 10.2, 10.3, 10.4, 10.5, 10.7, 10.8)

(**8 Hours)**

Course outcomes: The students will be able to:

CO1	Discuss the concepts of Embedded systems and design architectures
CO2	Apply the knowledge of Embedded hardware components and optimization of processor performance
CO3	Analyze the communication protocols to connect I/O devices and memory with processor in embedded system design
CO4	Design a small-scale embedded system design and presentation.

Text Books:

1. Introduction to Embedded Systems - Shibu K V, McGraw Hill Education, 2nd Edition, 2011.
2. Computers as Components. Principles of Embedded Computing System Design –Wayne Wolf, Morgan Kaufmann publishers, 2nd Edition, 2013.
3. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, Tammy Noergaard, Newnes publisher, 2nd Edition, 2012.

Reference Books:

1. Embedded System Design- A unified Hardware/software Introduction, Frank Vahid, Tony Grivargis, John Wiley and Sons, 2005.
2. Embedded Systems- An integrated approach, Lyla B Das, Pearson Education, 2012.
3. Embedded Systems –Architecture, Programming and Design, Raj Kamal, TMH, 2nd Edition, 2017.

Comprehensive Continuous Assessments (CCAs) suggested:

- Technical presentation in a group on Emerging technology trends in Embedded systems design

Web links/e-resources:

- https://nptel.ac.in/courses/108102045
- https://onlinecourses.nptel.ac.in/noc22_cs93/preview.

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Analog and Mixed Mode VLSI Design (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC604C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

- To understand the basic physics and operation of MOS devices.
- To study Single-Stage and Differential Amplifiers.
- To understand Single ended Differential Amplifier and operations.
- To learn basic operation of current mirrors and its characteristics
- To learn Data Converter Specifications and Architectures.
- To learn architecture of Data converter includes ADC (Analog to Digital) and DAC (Digital to Analog) Converters.

Preamble:

This course covers concepts of amplifiers, differential amplifiers, current mirrors, data converters designs. The concept used in the course is highly useful for the design of any functional integrated circuits. The course requires prerequisite: Analog electronics. If having studied basic VLSI is advantageous.

Module – 1

Review of Basic MOS Device Physics - General considerations, MOS I/V Characteristics, second order effects.

Amplifier Basic Concepts, Common source stage, MOS device models.

(9 Hours)

Module – 2

Single stage Amplifier: Source follower, common-gate stage, Cascode Stage, choice of device models.

(8 Hours)

Module – 3

Differential Amplifiers: Single ended and differential operation, Basic differential pair, Common mode response, Differential pair with MOS loads, Gilbert cell.

(8 Hours)

Module – 4

Passive and Active current mirrors: Basic current mirror, Cascode current mirror, active current mirror.

(7 Hours)

Module – 5

Data Converter Architectures: DAC & ADC Specifications, Current Steering DAC, Charge Scaling DAC, Flash ADC, Successive Approximation ADC.

(8 Hours)

Course outcomes: The students will be able to:

CO1	Comprehend the Basic MOS device physics, Basic MOS Models, single stage MOS amplifiers, differential amplifiers, current mirrors and data converter architectures

CO2	Apply the knowledge of MOS amplifiers, differential amplifiers, current mirrors and data converters for circuit design.
CO3	Analyze various parameters which affects circuits operation built using MOS amplifiers, differential amplifiers, current mirrors and data converters.
CO4	Simulate and test circuits built using MOS amplifiers, differential amplifiers, current mirrors and data converters with analog simulators

Text Books:

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", TMH 2007.
2. R. Jacob Baker, "CMOS Circuit Design, Layout and Simulation", Wiley Second Edition
3. Phillip E. Allen, Douglas R. Holberg," CMOS Analog Circuit Design", Oxford University Press Second Edition.

Comprehensive Continuous Assessments (CCAs) suggested:

- Mini Project works: Based on amplifier/Differential amplifier/current mirror/ Data converter circuits using Cadence/spice/ or any other analog simulators.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=Q3WYZF5wzgU&list=PLbMVogVj5nJQB44z6h0XO2644Vbv7OM8_
- https://www.youtube.com/watch?v=311XkpNGs8c&list=PL3pGy4HtqwD0rl7gQoESHR-chSq4OPN5p
- https://www.youtube.com/watch?v=eLTpf_5di2o&list=PLbMVogVj5nJRlMz5diOg9wBizaU6-egJc
- https://www.youtube.com/watch?v=dcCj_xAXm4k&list=PLLDC70psjvq5vtrb0EdII4xIKA15ec-Ij
- VTU e-learning Resources.

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Machine Learning and Deep Learning (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC604D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

- To introduce fundamental concepts of Machine Learning and Deep Learning, including their real-world applications.
- To develop an understanding of supervised, unsupervised, and reinforcement learning techniques with relevant algorithms.
- To explore deep learning architectures such as CNNs and RNNs and their optimization techniques.
- To provide hands-on experience on the various programming components and prepare students for research or industry application of machine learning techniques

Preamble:

This course, Machine Learning and Deep Learning, will equip students with the tools to study and unlock the potential of big data, exploring various Machine Learning algorithms and diving into Deep Neural Networks. Students will gain hands-on experience with popular programming tools and explore real-world applications.

Module – 1

Machine Learning and it's relationship to AI, Machine Learning Basics, Learning Algorithms, Capacity, Overfitting and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics. (Text1: 1.1, 5.1-5.6)

(8 Hours)

Module – 2

Supervised Learning Algorithms, Unsupervised Learning Algorithms, Stochastic Gradient Descent, building a Machine Learning Algorithm, Challenges Motivating Deep Learning. (Text1:5.7-5.11) **(8Hours)**

Module – 3

Deep Feedforward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and Other Differentiation Algorithms (Text 1:6.1-6.5)

(8 Hours)

Module – 4

Convolutional Networks: The operation, Pooling, Convolution and Pooling as an infinitely strong prior, Variants of the basic functions, efficient algorithms, Random or Unsupervised Features, Neuroscientific Basis for Convolutional Networks. (Text 1:9.1-9.5,9.8-9.10)

(8 Hours)

Module – 5

Recurrent and Recursive Networks: Recurrent Neural Networks (RNN), Bidirectional RNN, Encoder-Decoder Sequence to sequence architecture, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and other Gated RNNs, Optimization for Long Term Dependencies. (Text 1:10.2-10.6,10.10,10.11)

(8 Hours)

Course outcomes: The students will be able to:

CO1	Analyze machine learning fundamentals, including bias-variance tradeoff, overfitting, and Bayesian statistics
CO2	Apply fundamental machine learning algorithms, including regression, decision trees, and SVM, to solve classification and prediction problems.
CO3	Design deep learning models for CNNs and RNNs, to solve complex problems.
CO4	Apply recurrent architectures for RNNs and LSTMs to process sequential data.

Text Book:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.

References Books:

1. Josh Patterson, Adam Gibson Deep Learning: A Practitioner's Approach, O'Reilly Media, 2017.
2. Ethem Alpaydin, Introduction to Machine Learning, 2nd edition, MIT Press 2010.
3. Tom Mitchell, "Machine Learning", McGraw Hill, 1997.
4. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
5. Aurélien Géron "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow," Second Edition, O' Reilly Media, Inc., 2019.
6. S. O. Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson Education (India), 2016.

Comprehensive Continuous Assessments (CCAs) suggested:

- Mini project from the problem statements available in Kaggle or similar platforms

Web links/e-resources:

- Link: https://onlinecourses.nptel.ac.in/noc23_ee87/preview
- https://onlinecourses.nptel.ac.in/noc20_cs62/preview

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Data Structures using C++ (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC604E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

- Understand the principles of data structures and analyze algorithm complexity using asymptotic notations.
- Implement linear and non-linear data structures using C++ for efficient data organization and manipulation.
- Apply object-oriented programming concepts to design and develop modular data structures.
- Utilize advanced techniques like hashing and priority queues for optimized data storage and retrieval.
- Develop problem-solving skills by selecting and applying appropriate data structures for real-world applications.

Preamble:

This course introduces fundamental data structures and their applications using C++. It covers linear and non-linear data structures, including arrays, linked lists, stacks, queues, trees, and heaps. Students will learn to analyze algorithm complexity, apply object-oriented principles, and implement efficient data storage and retrieval techniques like hashing. The course emphasizes problem-solving through practical programming, preparing students for advanced topics in software development and computational efficiency.

Module – 1

Introduction: Inheritance, Pointers, Dynamic memory allocation, The Standard Template Library, Data Structures and Object-Oriented Programming, Computational and Asymptotic Complexity, Big-O Notation. Properties of Big-O Notation, Ω and Θ Notations.
(Text 2: 1.3, 1.4, 1.7, 1.9, 2.1, 2.2, 2.3, 2.4)

(8 Hours)

Module – 2

Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic
Linear Lists: Data objects and structures, Introduction to Linear and Non-Linear data structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. (Text 2: 5.1, 5.2, 5.3, 5.4, 5.5)
Arrays and Matrices: Arrays, Matrices, Special matrices, Sparse matrices. (Text 1: 7.1, 7.2, 7.3, 7.4)

(8 Hours)

Module – 3

Stacks: The abstract data types, Array Representation, Linked Representation, Applications- Parsing and Evaluation of arithmetic expressions, Parenthesis Matching, and Towers of Hanoi (Text 1: 8.2, 8.3, 8.4, 8.5 (8.5.1, 8.5.2)) **(8 Hours)**

Module – 4

Queues: The abstract data types, Array Representation, Linked Representation, Applications car arrangement, Priority Queues Hashing: Dictionaries, Linear representation, Hash table representation. (Text 1: 9.1, 9.2, 9.3, 9.4, 9.5 (9.5.1) , 10.1, 10.2, 10.3 10.5) .

(8 Hours)

Module – 5

Trees: Binary trees, Properties and representation of binary trees, Comm binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. Binary search trees operations and implementation. Heaps, Applications-Heap Sorting. (Text 1: 11.1,11.2, 11.3, 11.5, 11.6, 11.7, 11.8, 14.2, 12.4, 12.6 (12.6.1))

(8 Hours)

Course outcomes: The students will be able to:

CO1	Analyze algorithm complexity and apply object-oriented principles to develop efficient data structures.
CO2	Implement and apply linear data structures (arrays, linked lists, stacks, and queues) to solve computational problems.
CO3	Utilize advanced techniques like hashing and priority queues for efficient data storage and retrieval.
CO4	Design and manipulate non-linear data structures like trees and heaps for data management and operations to solve complex computational problems.

Text Books:

1. Data structures, Algorithms and Applications in C++, 2nd Edition, Sartaj Sahni, Universities Press, 2005.

2. Data structures and Algorithms in C++, Adam Drozdek, 4th edition, Cengage learning, 2012.

References Books:

1. "Data Structures Using C And C++" by Y. Langsam, M. Augenstein and A. M. Tenenbaum, Prentice-Hall Of India Pvt. Ltd., Edition 2, 2006.

Comprehensive Continuous Assessments (CCAs) suggested:

- Mini Project

Web links/e-resources:

- Scilab Textbook Companion for "Data Structures Using C And C++" by Y. Langsam, M. Augenstein And A. M. Tenenbaum, Created by Dharmesh Majethiya, NIT Tiruchirappalli, 2013.

MOOCs:

- "Data Structures and Algorithms" - https://nptel.ac.in/courses/106/102/106102 064/
- "Programming Data Structures and Algorithms" - https://nptel.ac.in/courses/10 6/106/106106133/

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Sensors and Applications (3:0:0) 3

Course Code	**BEC605A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

- Introduce the fundamental concepts of sensors and transducers, their classifications, and characteristics.
- Explore different types of mechanical sensors and their applications in measuring displacement, force, pressure, and flow.
- Understand thermal, optical, and radiation sensors and their real-world applications.
- Study RF sensing, high-frequency sensors, and MEMS-based sensors for advanced sensing applications.
- Familiarize students with Data Acquisition (DAQ) systems, signal conditioning, and sensor-based applications in various domains.

Module – 1

Introduction to sensors and transducers.

Need for sensors in the modern world. Different fields of sensors based on the stimuli - various schematics for active and passive sensors. Static and dynamic characteristics of sensors - zero, I and II order sensors – Response to impulse, step, ramp and sinusoidal inputs.

(7 Hours)

Module – 2

Sensors for mechanical systems or mechanical sensors

Displacement - acceleration and force - flow of fluids - level indicators - pressure in fluids - stress in solids. Typical sensors - wire and film strain gauge, anemometers, piezoelectric and magneto-strictive accelerometers, potentiometric sensors, LVDT.

(8 Hours)

Module – 3

Thermal sensors: Temperature – temperature difference – heat quantity. Thermometers for different situations – thermocouples thermistors – color pyrometry.

Optical sensors: light intensity – wavelength and color – light dependent resistors, photodiode, phototransistor, CCD, CMOS sensors.

Radiation detectors: radiation intensity, particle counter – Gieger Muller courter (gas based), Hallide radiation detectors.

(9 Hours)

Module – 4

RF sensing: Basic principle of EM fields, Antenna, RFID, Near Field and Far Field Sensing, Radar and Navigation, EMI & EMC sensing

High-frequency sensors: Microwave frequency sensors, and wavelength measuring sensors. MEMs and MEM-based sensors.

(9 Hours)

Module – 5

DAQ SYSTEMS and Sensor Applications: Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multichannel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

(7 Hours)

Course outcomes: On completion of the course, **t**he students will be able to:

CO1	Apply the fundamental concepts of sensors and transducers to classify sensors based on stimuli and evaluate their characteristics in modern applications.
CO2	Classify and analyze mechanical sensors used for measuring displacement, acceleration, force, flow, pressure, and stress in various engineering applications.
CO3	Apply the principles of thermal, optical, and radiation sensors in real-world applications such as temperature monitoring, imaging, and radiation detection.
CO4	Assess the principles and applications of RF and high-frequency sensors, including MEMS-based sensors, in communication, navigation, and industrial sensing.
CO5	Design and implement sensor-based DAQ systems with signal conditioning techniques for data acquisition and logging in automotive, aerospace, and environmental monitoring applications.

Text Books:

1. Patranabis. D, “Sensors and Transducers”, Second edition, Prentice-Hall of India Private Ltd, 2003.
2. Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim “Microsensors, MEMS and Smart Devices”, New York: Wiley, 2002.

Reference Books:

1. Gerard Meijer, Michiel Pertijs, Kofi Makinwa, “Smart Sensor Systems- Emerging Technologies and Applications”, First Edition, John Wiley., 2014.
2. Jocob Fraden,” Handbook of Modern Sensors, Physics, Designs, and Applications”, Springer, 2016
3. Manabendra Bhuyan,” Intelligent Instrumentation Principles and Applications”, First edition, CRC Press. 2010
4. Randy Frank,” Understanding Smart Sensors”, Second edition, Artech House. 2000.

Comprehensive Continuous Assessments (CCAs) suggested:

- Simulation and Integration of Sensor Circuits with real time parameters using DAQ in LabVIEW/ Embedded Processors.

Web links/e-resources:

- https://archive.nptel.ac.in/courses/108/108/108108147/
- NPTEL courses links https://onlinecourses.nptel.ac.in/noc21_ee32/preview

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Mobile Communications (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC605B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

Course Objectives: This course enables students to:

- Understand the application of multi user access in a cellular communication scenario.
- Understand the propagation mechanisms in an urban mobile communications using statistical and empirical models.
- Understand system architecture, call processing protocols and services of GSM GPRS and EDGE.
- Understand system architecture, call processing protocols and services of CDMA based systems IS95 and CDMA2000.

Preamble: Mobile is an important device of this era. Understanding the basic concept is very important. This Course highlights on the different mobile communication technologies such as CDMA, GSM.

Module – 1

Cellular Concept: Frequency Reuse, Channel Assignment Strategies, Interference and System Capacity, Power Control for Reducing Interference, Trunking and Grade of Service, Improving Capacity in Cellular Systems.

Mobile Radio Propagation: Large Scale path Loss- Free Space Model, Three basic propagation mechanisms, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models – Okumura, Hata, PCS Extension to Hata Model (explanations only) (Text 1). L1, L2

(8 Hours)

Module – 2

Mobile Radio Propagation: Small-Scale Fading and Multipath:

Small scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading, Rayleigh and Ricean Distributions, Statistical Model for Multipath Fading Channels (Clarke‘s Model for Flat Fading only). (Text 1) L1, L2.

(8 Hours)

Module – 3

System Architecture and Addressing:

System architecture, The SIM concept, Addressing, Registers and subscriber data, Location registers (HLR and VLR) Security-related registers (AUC and EIR), Subscriber data, Network interfaces and configurations.

Air Interface – GSM Physical Layer:

Logical channels, Physical channels, Synchronization- Frequency and clock synchronization, Adaptive frame synchronization, Mapping of logical onto physical channels, Radio subsystem link control, Channel coding, source coding and speech processing, Source coding and speech processing, Channel coding, Power-up scenario.

GSM Protocols:

Protocol architecture planes, Protocol architecture of the user plane, Protocol architecture of the signaling plane, signaling at the air interface (Um), Signaling at the A and Abis interfaces, Security-related network functions, Signaling at the user interface. (Text 2)

(8 Hours)

Module – 4

GSM Roaming Scenarios and Handover:

Mobile application part interfaces, Location registration and location update, Connection establishment and termination, Handover. (up to 6.4.1 only in Text2)

Services:

Classical GSM services, Popular GSM services: SMS and MMS.

Improved data services in GSM: GPRS, HSCSD and EDGE

GPRS System architecture of GPRS , Services , Session management, mobility management and routing, Protocol architecture, Signaling plane, Interworking with IP networks, Air interface, Authentication and ciphering, Summary of GPRS . HSCSD: Architecture, Air interface, HSCSD resource allocation and capacity issues. EDGE: The EDGE concept, EDGE physical layer, modulation and coding, EDGE: effects on the GSM system architecture, ECSD and EGPRS. (Text 2)

(8 Hours)

Module – 5

CDMA Technology

Introduction to CDMA, CDMA frequency bands, CDMA Network and System Architecture, CDMA Channel concept, Forward Logical Channels, Reverse logical Channels, CDMA frame format, CDMA System Operations (Initialization/Registration), Call Establishment, CDMA Call handoff1, IS- 95B, CDMA2000, W-CDMA, UMTS, CDMA data networks, Evolution of CDMA to 3G, CDMA 2000 RAN Components, CDMA 2000 Packet Data Service. (Text 3)

(8 Hours)

Course outcomes: At the end of the course, the students will be able to:

CO1	Apply the understanding of statistical characterization of urban mobile channels to compute the performance for simple modulation schemes
CO2	Demonstrate the limitations of GSM, GPRS and CDMA to meet high data rate requirements and limited improvements that are needed.
CO3	Analyze the call process procedure between a calling number and called number for all scenarios in GSM or CDMA based systems.
CO4	Test and validate voice and data call handling for various scenarios in GSM and CDMA systems for national and international interworking situations.

Text Books:

1. Theodore Rapport, —" Wireless Communications – Principles and Practice" , Prentice Hall of India , 2nd Edition, 2007, ISBN 978-8-120-32381-0.
2. Jorg Eberspacher, Hans-Jorg Vogel, Christian Bettstetter, Christian Hartmann, "GSM– Architecture, Protocols and Services, Wiley,3rd Edition, 2009, ISBN-978-0-470-03070-7
3. Gary J Mullet, —Introduction to Wireless Telecommunications Systems and Networks", Cengage Learning.

Comprehensive Continuous Assessments (CCAs) suggested:

- Open Ended Experiments: Students need to explore experiments beyond the syllabus.

Web links/e-resources:

- https://archive.nptel.ac.in/courses/117/102/117102062/
- https://onlinecourses.nptel.ac.in/noc21_ee66/preview

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Automotive Electronics (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC605C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to:

- To understand the concepts of Automotive Electronics and it's evolution and trends
- Automotive systems & subsystems overview.
- To understand sensors and sensor monitoring mechanisms aligned to Automotive
- systems, different signal conditioning techniques, interfacing techniques and actuator
- mechanisms
- To understand, design and model various automotive control systems using Model
- based development technique
- To understand role of Microcontrollers in ECU design and choice of appropriate
- Hardware and Software
- To describe various communication systems, wired and wireless protocols used in
- vehicle networking
- To understand Safety standards, advances in towards autonomous vehicles,
- To understand vehicle on board and off board diagnostics

Preamble:

The undergraduate course in automotive electronics provides students with a comprehensive understanding of the electronic systems that are integral to modern vehicles. The curriculum covers essential topics such as vehicle communication networks, sensors and actuators, power electronics, and embedded systems. Students engage in hands-on projects, learning to design, diagnose, and troubleshoot automotive electronic systems. Emphasizing both theoretical knowledge and practical skills, the course prepares graduates for careers in automotive engineering, focusing on innovations like electric vehicles and advanced driver-assistance systems (ADAS). With the automotive industry increasingly relying on sophisticated electronics, this program equips students to contribute effectively to future advancements in vehicle technology.

Module – 1

Automotive Systems, Design cycle and Automotive industry overview:

Overview of Automotive industry, leading players, automotive supply chain, global challenges. Role of technology in Automotive Electronics and interdisciplinary design. Tools and Processes. Spark and Compression Ignition Engines: Ignition systems, Fuel delivery systems

Automotive transmissions: Transmission fundamentals, Types-MT, AT, CVT and DCT
Vehicle braking fundamentals: Introduction to antilock braking systems.
Steering Control: Steering system basics, Fundamentals of electronically controlled power steering:
Passenger Safety and Convenience occupant protection systems: Tire pressure monitoring systems.
Overview of Hybrid Vehicles
ECU Design Cycle: V-Model development cycle, Components of ECU, Examples of ECU on Chassis, Infotainment, Body Electronics and cluster

(9 Hours)

Module – 2

Automotive Sensors and Actuators: Systems approach to control and instrumentation: Concept of a system, Analog and Digital systems, Basic measurements systems, Analog and digital signal processing, Sensors, Sensor characteristics, Sensor response, Sensor error, Redundancy of sensors in ECUs, Avoiding redundancy, Sensor modelling, Smart Nodes,
Examples of sensors : Accelerometers, wheel speed sensors, brake pressure sensors, Seat occupancy sensor, Engine speed, Steering wheel angle, Vehicle speed sensor, Throttle position sensor, Turbine speed sensor, Temperature sensor, Mass air flow (MAF) rate sensor, Exhaust gas oxygen concentration sensor, Throttle plate angular position sensor, Crankshaft angular position/RPM sensor, Manifold Absolute Pressure (MAP) sensor, Differential exhaust gas pressure sensor, Actuators used : Solenoids, various types of electric motors, and piezoelectric force generators, Examples for actuators: Relays, solenoids and motors. Sensors in Airbag system, Chassis Control systems, Automatic transmission control system,

(8 Hours)

Module – 3

Microcontrollers/Microprocessors in Automotive domain:

a. Overview of development within the automotive context (Architecture of 8/16 bit microcontrollers with emphasis on Ports, Timer/Counters, Interrupts. Watchdog timers, PWM).
b. Automotive grade processors ex: Renesas, Quorivva, Infineon
c. Understanding and working on tool chains for different processors
d. Development of control algorithm for different automotive subsystems Look-up tables and maps, Need of maps, Procedure to generate maps, Fuel maps/tables, Ignition maps/tables, Engine calibration, Torque table, Dynamometer testing.

Introduction to V2X Vehicle to Everything

(8 Hours)

Module – 4

Communication protocols: Overview of Automotive communication protocols: CAN, LIN, Flex Ray, MOST, Ethernet, D2B and DSI

Communication interface with ECUs Interfacing techniques and interfacing with infotainment gadgets, Relevance of Protocols such as TCP/IP for automotive applications

Wireless LANs standards such as Bluetooth, IEE802. 11x communication protocols for automotive applications.

Infotainment Systems: Application of Telematics in Automotive domain, Global Positioning Systems (GPS) and General Packet Radio Service (GPRS) **(8 Hours)**

Module – 5

Safety Systems in Automobiles and Diagnostic Systems:

Active Safety Systems: ABS, TCS, ESP, Brake assist.

Passive Safety Systems: Airbag systems, Advanced Driver Assistance Systems (ADAS): Combining computer vision techniques as pattern recognition, feature extraction. Examples of assistance applications: Lane Departure Warning, Collision Warning, Automatic Cruise Control, Pedestrian Protection, Headlights Control, Connected Cars technology and trends towards Autonomous vehicles.

Diagnostics: Fundamentals of Diagnostics: Basic wiring system and Multiplex wiring system, Preliminary checks and adjustments, Self-diagnostic system. Fault finding and corrective measures, Electronic transmission checks and Diagnosis, Diagnostic procedures and sequence, On board and off board diagnostics in Automobiles, OBDII, Concept of DTCs, DLC, MIL, Freeze Frames, History memory, Diagnostic tools, Diagnostic protocols: KWP2000 and UDS

(7 Hours)

Course outcomes: The students will be able to:

CO1	Analyze the working of various subsystems in an Automobile.
CO2	Analyze the principles and working of automotive sensors and actuators.
CO3	Critical review of microprocessor, microcontroller in Automotive domain.
CO4	Analyze communication protocols used automotive applications.
CO5	Analyze Safety Systems in Automobiles and Diagnostic Systems.

Text Books:

1. Ronald K Jurgen: "Automotive Electronics Handbook, 2nd Edition, McGraw-Hill, 1999
2. James D. Halderman, Curt Ward, Electric and Hybrid Electric Vehicles, Pearson, First Edition 2023

Reference Books:

1. Tom Denton: "Advanced Automotive Diagnosis, 2nd Edition, Elsevier, 2006.
2. Uwe Kieneke and Lars Nielsen: Automotive Control Systems Engine, Driveline and Vehicle, 2nd Edition Springer Verlag, 2005
3. Iqbal Husain: "Electric and Hybrid Vehicles: Design fundamentals" CRC Press, 2003.

Comprehensive Continuous Assessments (CCAs) suggested:

- Poster presentation on state of art technologies and innovations

Web links/e-resources:

- https://www.elprocus.com/automotive-electronics-and-its-innovations/

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER – VI

5G Technology (3:0:0) 3

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC605D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course objectives:

This course will enable students to

- Understand the basics of 5G standardization phases, architecture and specification
- Apply the knowledge of 5G Technologies to different applications
- Analyse the performance of different 5G Technologies

Preamble:

5G technology heralds a new era in mobile connectivity, offering vastly improved speed, reduced latency, and greater network capacity compared to previous generations. This fifth generation of wireless technology is designed to support a burgeoning number of connected devices and enable advanced applications, such as autonomous vehicles and smart cities.

Module – 1

Introduction: The Journey to 5G Wireless Communication, Background and Future of 5G Technology, Applications of 5G

5G: Need for the Hour: Introduction, Mobile Communication Aeon, WISDOM and Its Task Groups Abstract

(8 Hours)

Module – 2

Towards 5G: Requirements and Drivers, Use-cases, How 5G will Change the Society, Rural Connectivity, Challenges faced by LTE and other technologies, Carrier aggregation for rural connectivity, Universal Internet Connectivity and Affordable Broadband, Emerging Technologies in 5G

(8 Hours)

Module – 3

Mm-waves Promises and Challenges in Future Wireless Communication: 5G: Introduction to Millimeter-waves, Channel Propagation of Millimeter-waves, Data Rate and Millimeter-waves, Application of Millimeter-waves .

(8 Hours)

Module – 4

The Fog over the Meadow and the Cloud in the Blue Sky : Introduction, Background and Examples, Uber Fog Network , IFTTT and Google OnHub , Smartgrid , Edge Analytics, Fog Network Architecture and Its Attributes ,Fog Network in the Context of 5G,Fog Network Attributes

Adding a New Dimension to Customer Experience, the Reality of 6th Sense – 5G and

Beyond 55: Introduction , CX Applications .

(8 Hours)

Module – 5

5G for Personalized Health and Ambient Assisted Living : Introduction , Technology to Support Personalized Health and Ambient ,Assisted Living, Exercising at Home ,Movement Analysis and Monitoring, Personal Coaching Systems , The Caring Home; Supportive Home Environments.

(8 Hours)

Course Outcomes: The students will be able to:

CO1	Comprehend the basics of 5G technology and different architecture.
CO2	Apply the concept of 5G to rural challenges.
CO3	Apply the concept of 5G to Mm-waves Promises and Challenges in Future Wireless Communication
CO4	Apply the concept of 5G to cloud application and CX technologies.
CO5	Analyse the concept of 5G towards Health and Ambient Assisted Living

Text Books:

1. 5G Outlook Innovations and Applications, Ramjee Prasad, River Publishers Series in Communications, Volume 48, 2016.

Reference Books:

2. Ramjee Prasad, "5G: 2020 and Beyond", River Publisher, 2014

Comprehensive Continuous Assessments (CCAs) suggested:

Application projects

Web links/e-resources:

https://www.qualcomm.com/5g
https://www.ericsson.com/en/ran/network-performance

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

VLSI Laboratory (0:0:2) 1

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BECL607**	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	3

Course Objectives: This course will enable students to:

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

Preamble:

This course describes the design and model of CMOS circuits. Also highlights the ASIC design flow and RTL-GDSII design flow.

Part – A
Analog Design

1. a) Capture the schematic of CMOS inverter with load capacitance and set the widths of inverter with Wn = Wp, Wn = 2Wp, Wn = Wp/2 and length at selected technology. Carry out the following:
    i. Set the input signal to a pulse with rise time, fall time of 1ns and pulse width of 10ns and time period of 20ns and plot the input voltage and output voltage of designed inverter and also plot the DC characteristics.
    ii. From the simulation results compute tpHL, tpLH and td for all three Geometrical settings of width.
    iii. Tabulate the results of delay and find the best geometry for minimum delay for CMOS inverter.
1. b) Draw layout of inverter, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

2. a) Capture the schematic of 2-input CMOS NAND gate having similar delay as that of CMOS inverter computed in experiment 1. Verify the functionality of NAND gate and also find out the delay td for all four possible combinations of input vectors. Table the results. Increase the drive strength to 2X and 4X and tabulate the results.

2. b) Draw layout of NAND, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

3. a)Capture schematic of Common Source Amplifier with PMOS Current Mirror Load and find its transient response and AC response. Measures the Unity Gain Bandwidth (UGB), amplification factor by varying transistor geometries, study the impact of variation in width to UGB.

3. b) Draw layout of common source amplifier, use optimum layout methods. Verify for DRC and LVS, extract parasitic and perform post layout simulations, compare the results with pre-layout simulations. Record the observations.

4.a) Capture schematic of two-stage operational amplifier and measure the following:

i. UGB
ii. 3dB bandwidth
iii. Gain margin and phase margin with and without coupling capacitance
iv. Use the op-amp in the inverting and non-inverting configuration and verity its functionality

4.b) Draw layout of two-stage operational amplifier choose appropriate transistor geometries as per the results obtained in 4.a. Use optimum layout methods. Verity for DRC and LVS.

Part - B

Digital Design

1.Write Verilog code for 4-bit up/down asynchronous reset counter and carry out the following:

i. Verify the functionality using test bench
ii. Synthesize the design by setting area and timing constraint. Obtain the gate level netlist, find the critical path and maximum frequency of operation. Record the area requirement in terms of number of cells required and properties of each cell in terms of driving strength, power and area requirement.

2.Write Verilog code for 32-bit ALU supporting four logical and four arithmetic operations, use case statement and if statement for ALU behavioural modelling.

i. Perform functional verification using test bench
ii. Synthesize the design targeting suitable library by setting area and timing constraints.
iii. For various constrains set, tabulate the area, power and delay for the synthesized netlist.
iv. Identify the critical path and set the constraints to obtain optimum gate level netlist with suitable constraints. Compare the synthesis results of ALU modelled using IF and CASE statements

3.Write Verilog code for Flip-flop, Synthesize the design and compare the synthesis report (D, SR, JK).

4.For the synthesized netlist carry out the following for any two above experiments:

i. Floor planning (automatic), identify the placement of pads
ii. Placement and Routing, record the parameters such as no. of layers used for routing, flip method for placement of standard cells, placement of standard cells, routes of power and ground, and routing of standard cells
iii. Physical verification and record the LVS and DRC reports
iv. Perform Back annotation and verify the functionality of the design
v. Generate GDSII and record the number of masks and its color composition.

Course outcomes: The students will be able to:

CO1	Design the analog circuits with minimum delay by changing the width of NMOS and PMOS width (Wn and Wp) using EDA tool.
CO2	Design the circuit using optimum layout method and compare the circuit performance with post layout simulation.
CO3	Perform ASIC design flow and understand the process of synthesis, synthesis constraints and evaluating the synthesis reports to obtain optimum gate level net list.
CO4	Perform an experiment and comprehend, write and reproduce the results.

Suggested Self Learning:

Text Books:

1. CMOS Digital Integrated Circuits: Analysis and Design, Sung Mo Kang & Yosuf Leblebici, Tata McGraw-Hill, 2002.
2. CMOS VLSI Design- A Circuits and Systems Perspective, Neil H. E. Weste, and David Money Harris, Pearson Education, 4th edition, 2011.

Comprehensive Continuous Assessments (CCAs) suggested:

- Open Ended Experiment assigned for students

Web links/e-resources:

- https://www.monolithicpower.com/en/learning/mpscholar/automotive-electronics/introduction/basics-of-automotive-electronic-systems

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Unix Shell Programming (1:0:2) 1

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC608A**	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	14	Exam Hours	01

Course objectives:

- Understand the UNIX architecture and shell scripting basics.
- Demonstrate the applications of various shell scripts.
- Apply the shell scripting for networking operations.

Preamble:

Unix shell programming stands as a powerful and versatile tool for automating tasks, managing system operations, and enhancing productivity in a Unix-based environment. This subject contains the core concepts, commands, and scripting techniques that form the foundation of Unix shell programming. By leveraging the capabilities of various UNIX shells. This subject involves both theory as well as hands on sessions.

Module – 1

Introduction to UNIX:

Introduction to UNIX, Architecture of UNIX, Features of UNIX, Introduction to UNIX file system, vi editor, file handling utilities, security by file permissions, Basic UNIX commands (PATH, man, echo, printf, script, passwd, uname, who, date, stty, pwd, cd, mkdir, rmdir, ls, cp, mv, rm, cat, more, wc, lp, od, tar, gzip).

(03 Hours)

Module – 2

Introduction to Shells

what is shell, Types of shells, architecture of shell in LINUX, why we need shell scripting? Examples of shells from real world.

(03 Hours)

Module – 3

Introduction to: automation of configuration, redirection of the command outputs, network configuration, cron-jobs

(03 Hours)

Module – 4

Relation of networking commands and shell scripting, how to access man pages in Linux for any command, Catching user-signals via traps Powerful recursive commands

(03 Hours)

Module – 5

Introduction to frequently used commands: cut, sed, awk, tee, tail, more, grep

(02 Hours)

Course outcomes: The students will be able to:

CO1	Elaborate the structure of UNIX environment and basic commands. Explain the concept of digitization of signals viz; sampling, quantizing and encoding.
CO2	Discuss the use of regular expression in various types of filtering.

CO3	Develop Shell programs with customization of environmental variables.
CO4	Design a shell script for specific tasks using filters and pipes.

Text Book:

1. UNIX and shell Programming- Behrouz A. Forouzan, Richard F. Gilberg. Thomson, 2003.

Reference Book:

1. C Hamacher, Z Vranesic, S Zaky: Computer Organization, Tata McGraw Hill, 5th Edition, 2018.

Comprehensive Continuous Assessments (CCAs) suggested:

- Mini projects to demonstrate shell programming capabilities.

Web links/e-resources:

- https://www.coursera.org/learn/hands-on-introduction-to-linux-commands-and-shell-scripting#about

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Engineering Aptitude (1:0:0) 1

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC608B**	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	01

Course objectives:

This course will enable students to:

- Provide students with a solid understanding of fundamental concepts in circuit analysis, signal processing, analog and digital circuits, and control systems.
- Equip students with the ability to analyze and solve problems related to electrical circuits, signals, and systems using standard methods and techniques.
- Develop practical problem-solving skills using mathematical tools for analyzing electronic systems and circuits.
- Enhance students' readiness for GATE and other competitive exams by strengthening their analytical aptitude and reasoning capabilities in core engineering concepts.

Preamble:

This course is designed to provide a foundational understanding of key concepts in Electronics and Communication Engineering, focusing on circuit analysis, signal processing, analog and digital circuits, and control systems. It equips students with the analytical skills necessary to solve problems commonly encountered in engineering and competitive exams such as GATE, Engineering Services Examination (ESE), and Public Sector Undertakings (PSUs) recruitment tests. Through objective-type assessments, this course aims to develop problem-solving and reasoning abilities that are crucial for success in various technical and competitive fields. The course will guide students to apply theoretical concepts to real-world problems, strengthening their aptitude for academic excellence and professional development in engineering careers.

Module – 1

Circuit Analysis

Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer.

(03 Hours)

Module – 2

Signals and Systems

DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response.

(03 Hours)

Module – 3

Analog Circuits

Diode Circuits: Clipping, clamping and rectifiers.

Op-amp Circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

(03 Hours)

Module – 4

Digital Circuits

Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates, arithmetic circuits, code converters, multiplexers, decoders. Sequential Circuits: Latches and flip-flops, counters, shift-registers.

(03 Hours)

Module – 5

Control Systems

Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response, Routh-Hurwitz, Lag, lead and lag-lead compensation.

(03 Hours)

Course outcomes: The students will be able to:

CO1:	Apply core methods of circuit analysis (such as node and mesh analysis, Thevenin and Norton theorems, and superposition) to solve electrical circuit problems in both DC and AC conditions.
CO2:	Analyze and solve problems involving discrete-time signals and systems using techniques like DTFT, DFT, and z-transforms.
CO3:	Analyze analog circuits (diode-based circuits, op-amp amplifiers, filters, and oscillators) for practical applications in electronics.
CO4:	Solve problems in digital circuits by applying Boolean algebra, Karnaugh maps, and logic gates for combinatorial and sequential circuit design.
CO5:	Apply control system principles, including feedback loops, transfer functions, and compensation techniques, to analyze and model dynamic systems.

Text Books:

1. Allan H. Robbins and Wilhelm C. Miller, "Circuit Analysis: Theory and Practice", 4th Edition, Cengage Learning.2014
2. Alan V. Oppenheim and Alan S. Willsky, "Signals and Systems", 2nd Edition, Pearson. 2012
3. M. Morris Mano , "Digital Design", 6th Edition, Pearson.2014
4. Norman S. Nise, "Control Systems Engineering", 7th Edition, Wiley 2015

References Books:

1. GATE Electronics & Communication Vol 3 (GATE 2015 EC by R. K. Kanodia 10 Volume Set) by R. K. Kanodia and Ashish Murolia, 1st Edition, 2015, Paperback.

Comprehensive Continuous Assessments (CCAs) suggested:

- Quiz, MCQ's, Presentations, etc.

Web links/e-resources:

- https://www.selfstudys.com/gate/electronics-communication-engineering/online/exam#google_vignette
- https://gate.nptel.ac.in/

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Soft Skill Training for Employability (1:0:0) 1

Effective from the academic year 2024-2025 (2022 Scheme)

Course Code	**BEC608C**	CEE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	1

Course Objectives:

- To equip students with Professional soft skills like communication, interviews, group discussion, presentation etc.
- The subject also will enable them to learn interpersonal skills, work culture and effective management of time and stress. .

Preamble:

This course provides students to understand, improve their skills and make them employable.

Module – 1

Communication skills: Process of communication, Flows of Communication in organization, Barriers to communication (Formal Flow – Upward, Downward, lateral and diagonal, Strategies to improve Organizational Communication, Effectiveness in Managerial Communication, and importance of technical communication, Nonverbal communication

(3 Hours)

Module – 2

Interviews and Meetings: Types of interviews, General preparation for interview, gathering information about the company, knowing about the role/job position, Types of interviewing questions, Non-verbal communication to win the interview.

(3 Hours)

Module – 3

Meeting and Conferences: Planning a meeting (Agenda and notice), Conducting a meeting, Post meeting actions (Minutes), Planning & Conducting a Conference (anchoring and Report writing), and Video/web conferences, Identifying Strengths and Weakness

(3 Hours)

Module – 4

Presentation Skills and Letters: Effective Presentation strategies: Purpose, analyzing the audience and locale, organizing the content Oral presentation, Graphic presentation, Presentation aids, Personality Development. Newsletters, technical article and business letters. Technical Reports, characteristics, Importance, objectives, categories of report, format structure of reports, types of reports

(3 Hours)

Module – 5

Group Discussion: Qualities needed for effective group discussion. Email etiquettes, Telephone Etiquettes, Role and responsibility of engineer, Work culture in jobs. Work place, rights and responsibilities

Time and Stress Management: Concept & Importance of Time Management, Techniques of Time Management, and Concept & Importance of Stress Management, Techniques of Stress Management, and Overcoming Stage fear and Interpersonal Relationships

(3 Hours)

Course outcomes: The students will be able to:

CO1	Apprehend the communication process and communicate professionally
CO2	Participate in Group Discussion and evaluate the same
CO3	Develop Interview skills and Write Reports
CO4	Make effective Presentations
CO5	Conduct meetings and conferences
CO6	Effectively manage time and stress

Text Books:

1. Rao, G S R K Babu ," Business communication and soft skills", HPH ,New Delhi , 2nd edition,2009
2. Diane Hacker "Pocket Style Manual", Bedford Publication, New York, 2003. (ISBN 0312406843,2015

Reference Books:

1. Shiv Khera, "You Can Win", Macmillan Books, New York, 2003.,2007
2. Caroline Whit beck, "Ethics in Engineering practice and research," 2nd Edition, Cambridge.
3. Raman Sharma, "Technical Communications", Oxford Publication, London,2004
4. Sharma, R. and Mohan, K, "Business Correspondence and Report Writing", TMH New Delhi,2002

Comprehensive Continuous Assessments (CCAs) suggested:

- Group discussion on any real time situation

Web links/e-resources:

- https://www.udemy.com/course/soft-skills-the-11-essential-career-soft-skills/
- https://nptel.ac.in/courses/109105110

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Cyber Crime and Law (1:0:0) 1

Effective from the Academic Year 2024-2025 (2022 Scheme)

Course Code	**BEC608D**	CIE Marks	50
Teaching Hours/Week (L:T:P)	1:0:0	SEE Marks	50
Total Number of Contact Hours	15	Exam Hours	01

Course objectives:

This course will enable students to:

- Analyze the overview of Cyber law and cyber policies.
- Identify different types of cybercrime and security measures.
- Enhance their knowledge on Cybercrime and prevention of the crime.

Preamble:

Cyber Crime and law course describes the different crimes happening in the cyber space and how common people are becoming the victim of these crimes. Cyber law and Cyber policies are important aspects of the course. It also gives overview of cybercrime and security measures adopted in India.

Module – 1

Cyber Law: introduction to Indian cyberlaw, need for cyber law, jurisprudence of cyber law, Importance of cyber law, UNCITRAL.

IT Act: Objective and scope of The Indian Information Technology Act 2000.

(03 Hours)

Module – 2

Phishing; Spear phishing, protecting from phishing attack, identifying a spear phishing attack, ways to avoid phishing scams, Nigeria 4-1-9 scam, cyber stalking, to prevent cyber stalking.

(03 Hours)

Module – 3

Hacking: different types of Hackers and their operation, Protection of computers from intrusion and types.

Introducing Virus: Virus cases, Pornographic material, Section 32 and 67B of IT Act.

Data theft: IT act related to data theft, Mobile banking fraud, Denial of Access, Incidents of Denial of access, Kinds of attack.

(03 Hours)

Module – 4

Spam E-mail: Incidence of spam e-mail, IT act related to spam mail, Cyber laundering, Cyber Terrorism, WannaCry Ransomware cyber-attack, Cyber Voyeurism, Cyber Murder.

Software piracy: types, Data Diddling, Identity theft, Information Theft, Email Security Destruction, Judy Malware, Font Code Hidden Information, Traditional offense using cyber medium.

(03 Hours)

Module – 5

Electronic Signature: Definition, Types, Characteristics of trustworthy electronic documents. Preserving Trustworthy electronic records, Guidelines for implementation of the electronic signatures.

(03 Hours)

Course outcomes: The students will be able to:

CO1	Interpret the Cyber law and cyber policies.
CO2	Analyze the different types of cybercrime and security measures.
CO3	Apply the suitable IT Acts related to different Cyber crimes.
CO4	Explore the legal and policy developments to Regulate cybercrime.

Text Books:

1. V Appukutty, "Cyber Crime & Law", Coral Publishers, 2022
2. Surya Prakash Tripati, Ritendra Goel, Praveen Kumar Shukla, "Introduction to information Security and Cyber Laws", Dream Tech Press,2021

Reference Books:

1. Prabhuddha Ganguli, "Intellectual Property Rights", Tata Mc-Graw –Hill, 2017.
2. S R Myneni, "Patent Right Creation and Registration", Asia Law House, 2017
3. Marjie T. Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson, 3rd Edition, 2004.
4. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", Cengage Learning, 4th Edition, 2010.

Comprehensive Continuous Assessments (CCAs) suggested:

- Case Study topics on cybercrime, patents, Copy Right, Trade Mark. Activity on drafting the patents.

Web links/e-resources:

- Web resources(https://www.coursera.org/learn/cybersecurity-for-everyone) .
- Use SIFT Workstation (open-source network software)/ Assignment
- https://www.udemy.com/course/cybersecurity-law-policy
- https://academy.apnic.net/en/course/introduction-to-cybersecurity
- https://www.coursera.org/specializations/intro-cyber-security
- https://www.classcentral.com/tag/cybercrime

BMS Institute of Technology and Management

B.E. Electronics & Communication Engg. / Electronics & Telecommunication Engg.

Choice Based Credit System (CBCS)

SEMESTER VI

Generative AI Lab (0:0:1) 1

Effective from the academic year 2024 -25 (2022 scheme)

Course Code	**BEC608E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	20	Exam Hours	3

Course Objectives:

This course will enable students to:

- To learn Python and Tensor Flow skills for Generative AI.
- To study techniques for cleaning and preparing data for Generative AI tasks.
- To implement generative AI models.
- To develop innovative applications using generative AI tools and techniques.

Preamble:

The advancement of artificial intelligence (AI) has resulted in the emergence of a remarkable field known as generative AI. Generative AI is a type of AI technology that allows machines to generate new content, data, or outputs that are like human-created content. It uses large datasets to learn the underlying structure and characteristics of the data, enabling it to produce original and contextually relevant outputs. Generative AI can generate various data types, including signals, text, images, sounds, animations, and 3D models, and it can create entirely new data based on the patterns it has learned.

Program List

Experiments executed using programming languages Python/Pytorch / MATLAB (but not limited to)

Sl. No.	Program List
1	Write Python scripts to implement basic operations and Tensor Flow 2 tensors.
2	Pre-process and clean datasets for Generative AI applications using Python libraries such as Pandas and Num Py. Handle missing data, normalize features, and encode categorical variables.
3	Use Matplotlib or Seaborn to visualized at a distributions and patterns in Generative AI datasets. Plot histograms, scatter plots, and heat maps to analysed at a characteristics
4	Implement a Generative Adversarial Network (GAN) architecture using Tensor Flow 2. Train the GAN model on a dataset such as MNIST or CIFAR-10 for image generation tasks
5	Train a GAN model on a custom dataset for image generation. Experiment with hyper parameters, loss functions, and optimization techniques to optimize GAN training
6	Explore advanced techniques such as Wasserstein GANs, Progressive GANs, or Style GANs for image generation. Implement and compare these techniques using Chat GPT

7	Music Generation: Implement a Long Short-Term Memory (LSTM) network using Tensor Flow 2 for music generation. Train the LSTM model on a data set of music sequences and generate new musical compositions.
8	Text generation: Implement a Long Short-Term Memory (LSTM) network using Tensor Flow 2 for text generation tasks. Train the LSTM model on a dataset of text sequences and generate new text samples
9	Story Writing with ChatGPT: Engage in creative writing by utilizing ChatGPT for generating dialogues, narratives, and even collaborative storytelling.
10	Explore Machine learning and Deep learning algorithms for Fault Prediction in Electronics / Signal Processing.

Course outcomes:

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

CO1	Implement Tensor Flow basics, including data handling and pre-processing techniques using Modern tool.
CO2	Implement Generative AI models such as GANs, LSTM networks, and Transformer models for image, text, and music generation tasks.
CO3	Evaluate model performance and experiment with hyper parameters and optimization techniques to enhance Generative AI outcomes.
CO4	Develop innovative applications in image, text, and music generation, show casing practical skills.

Text Books:

1. Modern Generative AI with ChatGPT and OpenAI Models: Leverage the Capabilities of OpenAI's LLM for Productivity and Innovation with GPT3 and GPT4, by Valentina Alto, Packt Publishing Ltd, 2023.
2. Generative AI for Cloud Solutions: Architect modern AI LLMs in secure, scalable, and ethical cloud environments, by Paul Singh, Anurag Karu Parti ,Packt Publishing Ltd, 2024.

Reference Books:

1. The Artificial Intelligence and Generative AI Bible: [5 in 1] The Most Updated and Complete Guide | From Understanding the Basics to Delving into GANs, NLP, Prompts, Deep Learning, and Ethics of AI ,Kindle Edition by Alger Fraley .
2. "Ripples of Generative AI: How Generative AI Impacts, Informs and Transforms Our Lives" by Jacob Emerson, ISBN-10: 1088221610 Publisher: Artificial Intelligence, 2023
3. 3"Demystifying Prompt Engineering: AI Prompts at Your Fingertips (A Step-By-Step Guide)" ,Kindle Edition ,by Harish Bhat.
4. Generative AI in Practice: 100+ Amazing Ways Generative Artificial Intelligence is Changing Business and Society Bernard Marr, ISBN: 978-1-394-25424-8, March 2024

Alternate Assessment Tools (AATs) suggested:

- Experiential Learning/ MOOC/Certification Courses (Infosys Springboard, Geek for Geeks, IBM, Hacker earth, Math works)

Web links / e – resources:

- https://onlinecourses.swayam2.ac.in/imb24_mg116/preview
- https://www.cloudskillsboost.google/paths/118

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Department of Humanities and Social Sciences

Choice Based Credit System (CBCS)

SEMESTER – VI

National Service Scheme (NSS) (0:0:2)

(Common to all branches)

Effective from the Academic Year 2024-2025) (2022 scheme)

Course Code	**BNSK609**	CIE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

Course Objectives:

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

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

Module – 1

Introduction to NSS

History and growth of NSS, Philosophy of NSS, Objectives of NSS, Meaning of NSS Logo, NSS Programs and activities, administrative structure of NSS, Planning of programs / activities, implementation of NSS programs / activities, National & State Awards for NSS College / Program Officer / Volunteers. **(04 Hours)**

Module – 2

Overview of NSS Programs

Objectives, special camping – Environment enrichment and conservation, Health, Family, Welfare and Nutrition program. Awareness for improvement of the status of women, Social Service program, production-oriented programs, Relief & Rehabilitation work during natural calamities, education and recreations, Selection of the problem to be addressed. (**04 Hours)**

Module – 3

NSS Activities - Group Contributions to Society / community (Activity based Learning)

Organic Farming, Indian agriculture (Past, Present, Future) Connectivity for marketing, Waste management– Public, Private and Govt. organization, 5 R's. Water conservation techniques – role of different stakeholders – implementation, preparing an actionable business proposal for enhancing the village income and approach for implementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. **(06 Hours)**

Module – 4

NSS National Level Activities for Society / Community at large (Activity based Learning)

Developing Sustainable Water management system for rural areas and implementation approaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. **(06 Hours)**

Module – 5

NSS Individual Activities for Local Voice (Activity based learning)

Govt. school Rejuvenation and helping them to achieve good infrastructure, Plantation and adoption of plants. Know your plants. Spreading public awareness under rural outreach programs, National integration and social harmony events. **(06 Hours)**

Course Outcomes (Course Skill Set):

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

CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field.
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

Assessment Details

Weightage	**CIE – 100%**
Presentation -1 Selection of topic, PHASE-1	20 Marks
Commencement of activity and its progress – PHASE – 2	20 Marks
Case Study based Assessment – Individual performance	20 Marks
Sector wise study and its consolidation	20 Marks
Video based seminar for 10 minutes by each student at the end of the course with Report	20 Marks

Suggested Learning Resources:

Books:

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

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Department of Humanities and Social Sciences

Choice Based Credit System (CBCS)

SEMESTER – VI

Physical Education (PE) (Sports and Athletics) (0:0:2)

(Common to all Branches)

Effective from the Academic Year 2024-2025 (2022 scheme)

Course Code	**BPEK609**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	--
Total Number of Contact Hours	26	Exam Hours	--

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

Course Objectives:

The course will enable students to

- Develop a healthy life style.
- Acquire Knowledge about various stages of sports and games.
- Focus on modern technology in sports.

Module – 1

Introduction of the game: Aim of sports and games, Brief history of the game, Nature of the game, Terminology & Modern trends of the game, Fitness & Skill tests along with Game Performance.

(06 Hours)

Module – 2

Offensive and Defensive Techno Tactical Abilities: Fitness, Fundamentals & Techniques of the game with the implementation of Biomechanics, Tactics- Drills for the Techno Tactical abilities, Individual and Group, Miner games- to implement the Techniques, Tactics and Motor abilities.

(05 Hours)

Module – 3

Team tactics and Rules of the Game: Rules and Regulations of the Game: Game rules as well as sequence of officiating, Team tactics: Offensive and Defensive team strategies and scrimmages, Practice Matches: among the group, Analysis of Techno Tactical abilities: Correction and implementation of skills and Sports Injuries and rehabilitation: First aid, PRICE treatment,

(05 Hours)

Module – 4

Sports Training: Introduction of Sports Training, Principles of Sports performance, how to increase and sustain the sports performance, Training Load & Recovery- How to increase the training load (volume/Intensity) and means and methods for Recovery, Periodization: Shorts,

Medium and Long term, Physiological changes: Changes in Lung capacity, heart beats etc…

(05 Hours)

Module – 5

Organization of Sports Event: Tournament system, Planning and preparation for the competition, Ground preparation and Equipment's, Organizing an event among the group.

(05 Hours)

The above 5 modules are common to all the sports events / games, we are offering the following games**: 1. Baseball, 2. Kabaddi, 3. Table Tennis, and 4. Volleyball.**

Course Outcomes (Course Skill Set):

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

CO1	Understand the importance of sports and games, inculcate healthy habits of daily exercise & fitness, Self-hygiene, good food habits, Create awareness of Self-assessment of fitness.
CO2	Develops individual and group techno tactical abilities of the game.
CO3	Increases the team combination and plan the strategies to play against opponents.
CO4	Outline the concept of sports training and how to adopt technology to attain high level performance.
CO5	Summarize the basic principles of organizing sports events and concept of technology implemented to organize competitions in an unbiased manner.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation and video analysing.
- Practical classes in outdoor and indoor as per requirement

CIE: 100 Marks

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student has to give fitness and skill tests and his performance in game will be assessed.

Text Books:

1. Barbara Bushman, "ACSM's complete guide to Fitness & Health", 2011, Human Kinetics USA
2. Pankaj Vinayak Pathak, "*Sports and Games - Rules and Regulation*", 2019, Khel Sahitya Kendra.
3. Hardayal Singh, *"Sports Training, General Theory & Methods"***,** 1984 "Netaji Subhas, National Institute of Sports".
4. Keith A. Brown, "International Handbook of Physical Education and Sports Science", 2018, (5 Volumes) Hardcover.

Reference Books:

1. Tudor O Bompa,*" Periodization Training for Sports*", 1999, Human Kinetics, USA
2. Michael Boyle, "New Functional Training for Sports" 2016, Human Kinetics USA
3. Michael Kjaer, Michael Rogsgaard, Peter Magnusson, Lars Engebretsen & 3 more, "Text book of Sports Medicine: Basic Science and Clinical Aspects of Sports Injury and Physical Activity", 2002, Wiley Blackwell.
4. Scott L. Delp and Thomas K. Uchida, "Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation", 2021, The MIT Press
5. MCARDLE W.D. "Exercise Physiology Nutrition Energy And Human Performance" 2015, LWW IE (50)

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

Choice Based Credit System (CBCS)

SEMESTER – VI

Yoga (0:0:2)

(Common to all Branches)

Effective from the Academic Year 2024-2025) (2022 scheme)

Course Code	**BYOK609**	CIE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Course Objectives:

This course will enable students to:

- Understand the importance of practicing yoga in day-to-day life.
- Be aware of therapeutic and preventive value of Yoga.
- Have a focused, joyful and peaceful life.
- Maintain physical, mental and spiritual fitness.
- Develop self-confidence to take up initiatives in their lives.

Module – 1

Introduction to Yoga: Introduction, classical and scientific aspects of yoga, Importance, Types, Healthy Lifestyle, Food Habits, Brief Rules, Sithalikarana Practical classes.

(04 Hours)

Module – 2

Physical Health: Introduction, Pre-requisites, Asana-Standing, Sitting, Supine and Prone, Practical classes.

(06 Hours)

Module – 3

Psychological Health: Introduction Thought Forms, Kriya (Kapalabhati), Preparation to Meditation, Practical classes.

(06 Hours)

Module – 4

Therapeutic Yoga: Mudra Forms, Acupressure therapy, Relaxation techniques Practical classes.

(06 Hours)

Module – 5

Spirituality & Universal Mantra: Introduction, Being Human, Universal Mantra, Universal LOVE, Benefits of practice of Spirituality in day-to-day life, practical classes. **(04 Hours)**

Course Outcomes (Course Skill Set):

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

CO1	Understand the requirement of practicing yoga in their day-to-day life.
CO2	Apply the yogic postures in therapy of psychosomatic diseases
CO3	Train themselves to have a focused, joyful and peaceful life.
CO4	Demonstrate the fitness of Physical, Mental and Spiritual practices.
CO5	Develops self-confidence to take up initiatives in their lives.

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

CIE: 100 Marks

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student have to perform asanas.

Text Books:

1. George Feuerstein: The yoga Tradition (Its history, literature, philosophy and practice.)
2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind. (Orient paper Backs: vision Books Pvt. Ltd., 1982.
3. B.K.S Iyenkar: Light on the Yoga sutras of patanjali (Haper Collins Publications India Pvt.,Ltd., New Delhi.)
4. Science of Divinity and Realization of Self – Vethathiri Publication, (6-11) WCSC, Erode

Reference Books:

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited, ISBN: 9781909141209, 9781909141209
2. Basavaraddi I V: Yoga in School Health, MDNIY New Delhi, 2009
3. Dr. HR. Nagendra: Yoga Research and applications (Vivekanda Kendra Yoga Prakashana Bangalore)
4. Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga Prakashana Bangalore)

Web resources:

Web links and Video Lectures (e-Resources): Refer links
1. https://youtu.be/KB-TYlgd1wE
2. https://youtu.be/aa-TG0Wg1Ls

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Department of Humanities and Social Sciences

Choice Based Credit System (CBCS)

SEMESTER – VI

National Cadet Corps (NCC) (0:0:2)

(Common to all Branches)

Effective from the Academic Year 2024-25 (2022 scheme)

Course Code	**BNCK609**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

Course Objectives:

This course will enable students to:

- Understand the vision of NCC and its functioning.
- Understand the security set up and management of Border/Coastal areas.
- Acquire knowledge about the Armed forces and general awareness.

Module– 1

Introduction to National Cadet Corp: What is NCC, who can join NCC, benefits, Establishment, history, 3 wings, motto, core values, Aims, flag, song, pledge, cardinals, Organization, Director General NCC, Directorates, Uniform and Cadet ranks, Camps, Certificate exams, Basic aspects of drill.

National Integration: Importance of national integration**,** Factors affecting national integration, Unity in diversity**,** Role of NCC in nation building.

Disaster Management: What is a Disaster**,** Natural and Man-made disasters**,** Earthquake, Floods.

(04 Hours)

Module– 2

Indian Army: Introduction to Indian Army, Command and control, Fighting & supporting arms**,** Rank structure, Major Regiments of the Army**,** Major Wars and Battles**,** Entry to the Indian Army, Renowned leaders and Gallantry Awardees.

(02 Hours)

Module– 3

Indian Air Force: Introduction to Indian Air Force, Command and control**,** Rank structure**,** Major Aircrafts, Entry to the Indian Air Force, Renowned leaders.

Indian Navy: Introduction to Indian Navy, Command and control, Rank structure, Major Ships and Submarines**,** Entry to the Indian Navy, Renowned leaders. **(02 Hours)**

Module 4

Health and Hygiene: First Aid Protocols - CPR, Understanding Types of Bandages, Fire Fighting

Field & Battle Crafts: Field Signals using hands, Judging distance -Types of Judging Distance,

Section formations-types of Section Formation. **(04 Hours)**

Module– 5

Drill Practical's: Savdhan, Vishram, Salute, Turning, Marching. **(14 Hours)**

Course Outcomes (Course Skill Set):

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

CO1	Develop qualities like character, comradeship, discipline, leadership, secular outlook, spirit of adventure, ethics and ideals of selfless service.
CO2	Get motivated and trained to exhibit leadership qualities in all walks of life and be always available for the service of the nation.
CO3	Familiarize on the issues related to social & community development and disaster management and equip themselves to provide solutions.
CO4	Get an insight into the defense forces and further motivate them to join the defense forces.

Teaching Practice:

- Blackboard/Multimedia Assisted Teaching.
- Class Room Discussions, Brainstorming Sessions, Debates.
- Activity: Organizing/Participation in Social Service Programs.
- On Ground: Drill training.

CIE: 100 Marks

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.

  CIE 2 for 60 marks – A practical test conducted at the end of the semester.

Text Books:

1. NCC Cadets Handbook –Common Directorate General of NCC, New Delhi.
2. NCC Cadets Handbook –Special(A), Directorate General of NCC, New Delhi.

Reference Books:

1. Chandra B. Khanduri, "Field Marshal KM Cariappa: a biographical sketch", Dev Publications,2000.
2. Gautam Sharma, "Valour and Sacrifice: Famous Regiments of the Indian Army", Allied Publishers,1990

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Department of Humanities and Social Sciences

Choice Based Credit System (CBCS)

SEMESTER – VI

Music (0:0:2)

(Common to all Branches)

(Effective from the Academic Year 2024-2025) (2022 scheme)

Course Code	**BMUK609**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of the Degree)

Course Objectives:

The course will enable the students to:

- Identify the major traditions of Indian music, both through notations andaurally.
- Analyze the compositions with respect to musical and lyrical content.
- Demonstrate an ability to use music technology appropriately in a variety ofsettings.

Module – 1

Preamble: Contents of the curriculum intend to promote music as a language to develop an analytical, creative, and intuitive understanding. For this the student must experiencemusic through study and direct participation in improvisation and composition.

Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. **(03 Hours)**

Module – 2

Compositions: Introduction to the types of compositions in Carnatic Music - Geethe, JathiSwara, Swarajathi, Varna, Krithi, and Thillana, Notation system.

(03 Hours)

Module – 3

Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysore Vasudevacharya. **(03 Hours)**

Module – 4

Music Instruments: Classification and construction of string instruments, wind instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments

(03 Hours)

Module – 5

Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Notation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethein Malahari, and one Jathi Swara, One Nottu Swara OR One krithi in a Mela raga, a patriotic song

(14 Hours)

Course Outcomes (Course Skill Set):

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

CO1	Discuss the Indian system of music and relate it to other genres (Cognitive Domain)
CO2	Experience the emotions of the composer and develop empathy (Affective Domain)
CO3	Respond to queries on various patterns in a composition (Psycho-Motor

Teaching Practice:

- Classroom teaching
- ICT – PowerPoint Presentation
- Audio & Video Visualization Tools

CIE: 100 Marks

- **CIE 1** for 40 marks – A theory paper which is MCQ / Descriptive conductedduring the semester
- **CIE 2** for 60 marks – A practical test conducted at the end of the semester in which the student has to recite one Sarale Varase mentioned by the examiner inthree speeds. Sing / Play the Geethe in Malahari. Singing / Playing Jathi Swara /Krithi.

Text Books:

1. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
2. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana - Vol. 1 (English), Shreenivaasa Prakaashana, 2018.

Reference Books:

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: APractical Guide", Tranquebar 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
3. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of thePresent and a Record of the Past", Pilgrims Publishing, 2007.
4. Carnatic Music, National Institute of Open Schooling, 2019.

BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER – VI

Indian Knowledge System

(Common to All UG Programs)

Effective from the Academic Year 2024-25 (2022 scheme)

Course Code	**BIKS610**	CIE Marks	100
Teaching Hours/Week (L: T:P)	1:0:0- NCMC	SEE Marks	-
Total Number of Lecture Hours	13	Total marks	100

Course objectives:

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

Module – 1

Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character, scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge. **(5 Hours)**

Module – 2

Traditional Knowledge in Humanities and Sciences: Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology. **(4 Hours)**

Module – 3

Traditional Knowledge in Professional domain: Town planning and architecture-Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals. **(4 Hours)**

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

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

Reference Books:

1. B Mahadevan,Vinayak Rajat Bhat, Nagendra Pavana R N "Introduction to Indian Knowledge System- concepts and applications", PHI Learning Private Ltd, 2022. ISBN-978-93-91818-21-0
2. Amit Jha" Traditional Knowledge System in India", Atlantic Publishers and Distributors(P) Ltd., 2009. ISBN-13: 978-8126912230,
3. Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, DK Print World (P) Ltd.,2005. ISBN: 81-246-0334,

Suggested Web Links:

- https://www.youtube.com/watch?v=LZP1StpYEPM
- http://nptel.ac.in/courses/121106003/
- http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
- https://www.wipo.int/pressroom/en/briefs/tk_ip.html
- https://unctad.org/system/files/official-document/ditcted10_en.pdf
- http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
- https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EAIaIQobChMInpJtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE