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 Telecommunication Engineering

VI Semester Scheme and Syllabus

2022 Scheme - Autonomous

Vision of the Department

To emerge as a premier department developing high quality Electronics and Telecommunication Engineering Professionals with ethics and eco-friendliness for bettermentof the society.

Mission of the Department

Impart quality education in Electronics and Telecommunication Engineering by facilitating:

M1: Conducive learning environment and research activities

M2: Good communication skills, leadership qualities and

ethics**M3:** Strong Industry-Institute interaction

Program Educational Objectives (PEOs)

After three to four years of graduation our graduates will:

PEO 1: Excel as Professionals in Electronics, Telecommunication and IT related fields.

PEO 2: Engage in life-long learning.

PEO 3: Maintain ethical norms, exhibit good communication skills and leadership qualities.

Program Specific Outcomes (PSOs)

PSO 1: Analyze and design communication systems

PSO 2: Analyze and implement signal processing applications

PSO 3: Design and implement embedded syst

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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

VI Semester

Scheme and Syllabus

BMS INSTITUTE OF TECHNOLOGY &MANAGEMENT

(Autonomous Institution Affiliated to VTU, Belagavi)

B. E. in Electronics And Telecommunication Engineering

Scheme of Teaching and Examinations – 2022 Scheme

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

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

VI Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Credits Distribution				CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA					
1	IPCC	BET601	RF Communication	TD: ET PSB:ET	3	0	2		50	50	100	3	4
2	PCC	BEC602	Digital Communication		4	0	0		50	50	100	3	4
3	PCC	BET603	CMOS VLSI Design		3	0	0		50	50	100	3	3
4	PEC	BET604X	Professional Elective Course II		3	0	0		50	50	100	3	3
5	OEC	BET605X	Open Elective Course I		3	0	0		50	50	100	3	3
6	PW	BETP66	Major Project Phase I		0	0	3		100	-	100	-	3
7	PCCL	BECL607	VLSI Laboratory		0	0	2		50	50	100	3	1
8	AEC	BET608X	Ability Enhancement Course/Skill Enhancement Course		For Theory course				50	50	100	1	1
					1	0	0						
					For Practical course								
					0	0	1						
9	NCMC	BNSK609	National Service Scheme (NSS)	NSS Coordinator	0	0	0	0	100	-	100	-	-
		BPEK609	Physical Education (Sports and Athletics)	PED									
		BYOK609	Yoga	Yoga Teacher	0	0	0	0	100	-	100	-	-
		BNCK609	National Cadet Corps (NCC)	NCC officer									
		BMUK609	Music	Music Teacher									
10	NCMC	BIKS610	Indian Knowledge System		0	0	0	0	100	-	100	-	0
TOTAL								**22**	**650**	**350**	**1000**	**-**	**22**

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**
BET604A	Nano Electronics	BEC605A	Sensors and Applications	BET608A	Advanced CCN Lab
BET604B	Image processing	BEC605B	Mobile Communication	BET608B	Embedded system Lab
BET604C	Robotics and Drone Technology	BEC605C	Automotive Electronics	BET608C	Image processing Lab
BET604D	Global Positioning System	BEC605D	5G Technology	BET608D	Robotics Lab using TI Processor
				BEC608E	Gen AI Lab

Integrated Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's 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,

1. The candidate has studied the same course during the previous semesters of the program.
2. The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

RF Communication (3:0:1) 4

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

Course Code	BET602	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	03

Course Objectives:

This course will enable students to:

1) Learn the characteristics of RF communication
2) Understand the basics of Microwave transmission lines, passive devices and antennas
3) Know the parameters required for antenna radiation
4) Acquire the knowledge of different antennas and RF circuits

Preamble:

Importance of RF communication, antennas, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

Module – 1

Transmission Line theory:

Introduction, transmission lines equations and solutions, reflection and transmission coefficients, standing waves and SWR, line impedance. Smith chart, impedance matching using single stubs. (Text2)

(8 Hours)

Module – 2

Microwave Network theory:

Symmetrical Z and Y-Parameters, for reciprocal Networks, S matrix representation of multi-port Networks, Losses in terms of S parameters, Properties of S parameters.(Text1)

Microwave Passive Devices:

Attenuators, Phase shifters, Waveguide Tees, Four port Circulator, Faraday rotation Isolator, Directional Coupler.(Text1)

(8Hours)

Module – 3

Strip Lines:

Introduction, Micro Strip lines, Parallel strip lines, Coplanar strip lines, Shielded strip Lines.

Antenna Basics:

Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Bandwidth, Radio Communication Link, Polarization. **(8 Hours)**

Module – 4

Electric dipole:

Introduction, Radiation resistance of short dipole, Thin linear antenna and Radiation resistance of λ/2 dipoles (Excluding field derivations).

Loop antenna:

Introduction, Small loop, Comparison of Far fields of Small Loop and Short Dipole, The Loop Antenna General Case, Far field Patterns of Circular Loop Antenna with Uniform Current, Radiation Resistance of Loops, Directivity of Circular Loop Antennas with Uniform Current. Horn antenna, Rectangular Horn Antennas

(8 Hours)

Module – 5

Antenna Types:

Helical Antenna, Helical Geometry, Practical Design Considerations of Helical Antenna, Yagi-Uda array, Parabola General Properties, Log Periodic Antenna.

Micro-strip antennas:

Some Salient Features of Microstrip Antennas, Advantages and Limitations, Rectangular Microstrip Antennas, Feed Methods, Characteristics of Microstrip Antennas, Design considerations.

(8 Hours)

Textbooks:

1) Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd , 2010.
2) Microwave Devices and circuits- Liao / Pearson Education.
3) Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4th Special Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.

References:

1) Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008
2) Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015.
3) Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press, 2007

Alternate Assessment Tools (AATs) suggested:

- Design and analysis of patch antenna for 4G/5G/6G communication using HFSS/CST microwave studio.(Student workshop)

Web links / e – resources:

https://www.antennaweb.org
https://www.antenna-theory.com
https://ethw.org/Microwave_Link_Networks

Practical Components of RF Communication (IPCC)

Hardware experiments using Microwave test bench:

1) Determination of the VSWR and Power loss of circulator and isolator
2) Measurement of VSWR and Power loss of E and H plane tees
3) Measurement of VSWR and Power loss of Magic tee
4) Measurement of VSWR and Power loss of directional coupler
5) Measurement of impedance using slotted line assembly
6) Three point method of obtaining equivalent Circuit Parameters
7) Field intensity measurement of a Horn antenna
8) Field intensity measurement of a Parabola antenna

Course outcomes:

The students will be able to:

CO1: Understand the characteristics of different transmission lines, microwave devices and antennas at microwave frequencies

CO2: **Apply** various properties/laws/theorems/knowledge of microwaves to solve problems related to microwave and planar transmission lines.

CO3: **Solve** the problems related to VHF/UHF antennas and microstrip antennas in wireless communication

CO4: **Analyze** the behavior of transmission lines, devices and antennas at microwave frequencies

CO5: **Design** VHF/UHF antennas and microstrip antennas for given configurations

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Digital Communication (4:0:0) 4

(Effective from the academic year 2024-25 - 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	50	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Understand the importance of representation of band-pass signals, systems into its equivalent low pass signals and systems.
2. Learn the concept of signal conversion to symbols and signal processing to symbols in transmitter and receiver functional blocks.'
3. Acquire the knowledge to compute performance issues and parameters for symbol processing and recovery in ideal and corrupted channel conditions.
4. Familiarize with performance parameters and mitigation methods.

Preamble:

Importance of digital communication, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

Module – 1

Band-pass Signal to Equivalent Low-pass:

Hilbert Transform, Pre- envelopes, Complex envelopes, Canonical representation of band-pass signals, Complex low pass representation of band-pass systems, Complex representation of band pass signals and systems.

Line codes:

Unipolar, Polar, Bipolar (AMI) and Manchester code and their power spectral densities, Overview of HDB3, B3ZS, B6ZS.

(10 Hours)

Module – 2

Signalling over AWGN Channels:

Introduction, Geometric representation of signals, Gram-Schmidt Orthogonalization procedure, Conversion of the continuous AWGN channel into a vector channel, Optimum receivers using coherent detection: ML Decoding, Correlation receiver, matched filter receiver.

(10 Hours)

Module – 3

Digital Modulation and Demodulation Techniques:

M-Generation and detection of BPSK, QPSK, DPSK, BFSK, MSK, Derivation of BER of BPSK, QPSK and BFSK. M-ary Modulation Techniques: M-ary PSK, M-ary FSK, QAM Modulation. Comparison of various digital modulation techniques.

(10 Hours)

Module – 4

Communication through Band Limited Channels:

Digital Transmission through Band limited channels: Digital PAM Transmission through Band limited Channels, Signal design for Band limited Channels: Design of band limited signals for zero ISI–The Nyquist Criterion (statement only), Design of band limited signals with controlled ISI-Partial Response signals.

Channel Equalization:

Linear Equalizers (ZFE, MMSE).

(10 Hours)

Module – 5

Principles of Spread Spectrum: Spread Spectrum Communication Systems:

Model of a Spread Spectrum Digital Communication System, Generation of PN Sequences, Direct Sequence Spread Spectrum Systems, Effect of De-spreading on a narrowband Interference, Some applications of DS Spread Spectrum Signals, Frequency Hopped Spread Spectrum, CDMA based on IS-95.

(10 Hours)

Course outcomes:

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.

Textbooks:

1. "Digital Communication Systems" , Simon Haykin, John Wiley & sons, First Edition, 2014, ISBN 9780-471- 64735-5.
2. "Fundamentals of Communication Systems", John G Proakis and Masoud Salehi, Pearson Education, 2014 Edition, ISBN 978-8-131- 70573-5

References:

1. "Modern Digital and Analog Communication Systems", B.P.Lathi and Zhi Ding, Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198- 07380-2.
2. "Digital Communications - Fundamentals and Applications", Bernard Sklar and Ray, Pearson Education, Third Edition, 2014, ISBN:978-81-317-2092-9.
3. "Digital Communications", Ian A Glover and Peter M Grant, Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.

Alternate Assessment Tools (AATs) suggested:

- Simulation of BPSK, QPSK, BFSK, MSK using SIMULINK / GNU Radio

Web links / e – resources:

- https://onlinecourses.nptel.ac.in/noc22_ee10/preview
- https://nptel.ac.in/courses/117101051

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

CMOS VLSI Design (3:0:0) 3

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

Course Code	BET603	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

1. Understand and distinguish different MOS transistor technologies
2. Learn CMOS process technology Realize digital circuits using different MOS and CMOS techniques
3. Acquire the knowledge of different digital subsystems

Preamble:

Introduction to the course:

Need for VLSI, Advancements in VLSI technology, Future Scope and its impact on the economic growth of a country.

Module – 1

Basic MOS technology:

Integrated circuits era. Enhancement and depletion mode MOS transistors. nMOS fabrication. CMOS fabrication. Thermal aspects of processing. Bi-CMOS technology. Production of E-beam masks.

MOS Transistor Theory:

Introduction, MOS Device Design Equations, The Complementary CMOS Inverter – DC Characteristics, Static Load MOS Inverters, The Differential Inverter, The Transmission Gate, Tristate Inverter

(9 Hours)

Module – 2

Circuit Design Processes:

MOS layers. Stick diagrams. Design reues and layout- lambda-based design and other rules. Examples. Layout diagrams. Symbolic diagrams. Basic Physical Design of Simple logic gates

(7 Hours)

Module – 3

CMOS Logic Structures:

CMOS Complementary Logic, Bi CMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic Cascaded Voltage Switch
Logic (CVSL).

(7 Hours)

Module – 4

CMOS Subsystem Design:

Architectural issues. Switch logic. Gate logic. Design examples – combinational logic. Clocked circuits. Other system considerations. Clocking Strategies.

Memory Systems: Timing considerations. Memory elements. Memory cell arrays, Content Addressable Memory (CAM) Cells designs.

(8 Hours)

Module – 5

Designing Arithmetic Building Blocks:
Data path circuits, Architectures for ripple carry adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, and speed and area trade-off.

(8 Hours)

Summary of the course:
Course basically deals with fundamentals of CMOS Technology and its fabrications aspects. Including device performance parameters. The CMOS based Logic structures are analysed highlighting the benefits and limitations of each structure. The CMOS structures are designed for its stick and layouts using standard fab lab rules. Subsystem design and Memory designs are carried out using CMOS logic circuits. Students are familiarized to designs of data path for different Practical applications.

Note: Students are required to complete NPTEL videos lecture on "CMOS Technology and its trends" and list companies working on IC technology and Submit the report**.**

Course Outcomes:
The students will be able to:
CO1**: Understand** different MOS transistor technologies and fabrication process
CO2: **Apply** the fundamentals to realize the logic using different logical techniques
CO3**: Design** stick diagrams and layouts for different digital logic structures
CO4**: Analyze** CMOS based subsystems and memory circuits
CO5**: Design** arithmetic blocks for different applications
CO6**: Evaluate** the performance of digital Systems/subsystems using modern tools.

Textbooks:
1. N.H. Weste and David Harris, "CMOS VLSI Design – A Circuits and Systems Perspective" , 3rd Edition , Wesley, 2005
2. Douglas A. Pucknell & Kamran Eshraghian , Basic VLSI Design , 3rd Edition, PHI, 2005

References:
1. R. Jacob Baker, "CMOS Circuit Design, Layout and Simulation", John Wiley India Pvt.
2. Ltd, 2008
3. Sung- Mo Kang & Yusuf Leblebici , "CMOS Digital Integrated Circuits", Analysis and Design, 3rd Edition, Tata McGrawHill Publishing Company Ltd., New Delhi, 2007
4. A Hodges, H.G Jackson and R.A Saleh. , Analysis and Design of Digital Integrated Circuits, 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi. 2007.

Alternate Assessment Tools (AATs) suggested:
- Use modern tools such as SPICE/LTSPICE for evaluating the performance of VLSI Circuit Designs Or
- Use Tools available at Nanohub.org to explore different memory designs Or
- Design Layout for VLSI Circuits using Cadence/ any open source tools

Web links / e – resources:
Nanohub.org

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Nano Electronics (3:0:0) 3

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

Course Code	BET604A	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

1. Understand and appreciate the role of nanotechnology in our day today life
2. Learn different device characteristics and fabrication techniques
3. Explain concepts behind the device physics of all nano structures
4. Familiarize with present research front in Nano electronics and its applications to industry and society

Preamble:

Need for Nano Technology, Advancements in Nano technology, Future Scope and its impact on the economic growth of a country.

Module – 1

Background to nanotechnology:

Types of nanotechnology and Nano machines, Periodic table, Atomic structure, Molecules and phases, energy, Molecular and atomic size, Surface and dimensional space, Top down and bottom up.

Nano materials:

Preparation, Plasma arcing, Chemical vapor deposition.

(8 Hours)

Module – 2

Fundamentals of Nanoelectronics:

Fundamentals of logic devices, Requirements, Dynamic properties, Threshold gates, physical limits to computations, Concepts of logic devices, Classifications, Two terminal devices, Field effect devices, Coulomb blockade devices, Spintronics, Quantum cellular automata, Quantum computing.

(8Hours)

Module – 3

Quantum Transport Devices Based on Resonant Tunneling:

Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications: - Single electron devices – applications of single electron devices to logic circuits.

(8 Hours)

Module – 4

Carbon Nanotubes:

Carbon Nanotube: Fullerenes types of nanotubes formation of nanotubes assemblies' purification of carbon nanotubes electronic properties synthesis of carbon nanotubes carbon nanotube interconnects carbon nanotube FETs Nanotube for memory applications prospects of an all carbon nanotubes Nano electronics.

(8 Hours)

Module – 5

Molecular Electronics:

Electrodes & contacts, Functions, Molecular electronic devices, First test systems, simulation and circuit design, Fabrication, Future applications, MEMS, NEMS, Robots, Random access memory, Mass storage devices.

Summary of the Course: This course gives insight into nanotechnology and its role in electronics systems and its impact on the performance of systems starting from logic devices to quantum computing. The different structures of Carbon Nanotubes and their applications are covered in the course. Finally, an attempt is made to explore molecular electronics and its fabrications aspects including micro/Nano robot application.

Course Outcomes:

The students will be able to:

CO1: **Understand** the nano technology and its wider applications prospective
CO2: **Apply** the fundamental knowledge of device characteristics to model them
CO3: **Analyse** different nano device structures for practical applications
CO4: **Evaluate** the performance of Nano devices for different applications

Textbooks:

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons," Nanotechnology: Basic Science and Emerging Technologies", Chapman & Hall / CRC, 2002.
2. T. Pradeep, NANO: The Essentials, Understanding Nano Science and Nanotechnology. TMH, 2007.

References:

1. Rainer Waser (Ed.), Nano electronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003
2. Mitin. V. Kochelap V, Stroscio. M —Introduction to Nano electronics||, Cambridge University Press, 2008
3. Karl Goser, Peter Glosekotter, Jan Dienstuhl, —Nano electronics and Nanosystems||, Springer, 2004

Alternate Assessment Tools (AATs) suggested:

● Students will be asked to explore TOOLs like MugFET/Nanowire/Comsol/available at nanohub.org (Purdue University) to evaluate the performance of nano devices (AAT)

Web links / e – resources:

www.Nanohub.org

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Image processing (3:0:0) 3

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

Course Code	BET604B	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:

1. To learn and understand the basics of digital image processing
2. To learn and understand various image transform used in digital image processing
3. To learn and understand various image enhancement technique used in digital image processing
4. To learn and understand various image restoration, image compression and Segmentation techniques used in digital image processing
5. To learn and understand basics of colour image processing

Preamble:

This course is designed to give undergraduate students all the fundamentals in 2-D digital image processing with emphasis in image processing techniques, image filtering design and applications.

Module – 1

Digital image fundamentals:

What is Digital Image Processing. Fundamental Steps in Digital Image Processing, Components of an Image processing system, elements of Visual Perception.

Image sensing and acquisition:

Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

(8 Hours)

Module – 2

Image transforms:

Two-dimensional orthogonal & unitary transforms, properties of unitary transform, two dimensional discrete Fourier transform.

Discrete cosine transform, sine transform, Hadamard transform, Haar transform

(9 Hours)

Module – 3

Image enhancement:

Image Enhancement in Spatial domain, Some Basic Gray Level Trans -formations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations.

Basics of Spatial Filtering Image enhancement in the Frequency Domain filters, Smoothing Frequency Domain filters, Sharpening Frequency Domain filters.

(7 Hours)

Module – 4

Model of image degradation/restoration process, noise models, Restoration in the Presence of Noise, Only-Spatial Filtering Periodic Noise Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, inverse filtering, minimum mean square error (Weiner) Filtering.

(9 Hours)

Module – 5
Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing **Segmentation:** Point, Line and Edge detection, Thresholding, Region based segmentation. **Color fundamentals:** Color Models, Pseudo color Image Processing., processing basics of full color image processing. **(7 Hours)**
Course outcomes: The students will be able to: CO1: Understand the basic operations, analysis techniques of images. CO2: Apply different image transforms, CO3: Apply image processing techniques for image enhancement. CO4: Apply image processing techniques for image restoration. CO5: Understand the basics of morphological image processing and colour models
Textbooks: 1. Digital Image processing: Rafael C.Gonzalez and Richard E.Woods, Pearson Education, 2001, 2nd edition. 2. Fundamentals of Digital Image Processing: Anil K. Jain,Pearson Edun, 2001. **References:** 1. Digital Image Processing and Analysis, B. Chanda and D. Dutta Majumdar, PHI, 2003
Alternate Assessment Tools (AATs) suggested: ● Implementation of image processing applications using Matlab
Web links / e – resources: ● https://onlinecourses.nptel.ac.in/noc22_ee116/preview

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SEMESTER - VI

Robotics and Drone Technology (3:0:0) 3

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

Course Code	BET604C	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:

1. Understand the basics of Robotics and Drone technologies.
2. Understand the different types of Drone systems
3. Analyze the performance of Robotics and UAV Drone based systems
4. Design embedded applications based on Robotics and UAV Drone Technologies.

Preamble:

This course is designed to give undergraduate students all the fundamentals in Drone technology, with emphasis UAV techniques, and usefulness of the same to society.

Module – 1

Introduction:

Introduction to Robotics and UAV Technologies; its significance and scope in the current scenario. Industrial applications, research and innovations related to Robotics and UAV Technologies. Impact of the course on society problems, sustainable solutions and national economy.

(8 Hours)

Module – 2

Specifications of Robots:

Classifications of robots, Work envelope, Flexible automation versus Robotic technology, Applications of Robots.

(8 Hours)

Module – 3

Trajectory Planning:

Trajectory planning, Pick and place operations, Continuous path motion, Interpolated motion, Straight line motion.

(8 Hours)

Module – 4

Introduction to Drones:

Introduction to Unmanned Aircraft Systems, History of UAV drones, classification of drones, System Composition, Applications.

(8 Hours)

Module – 5

Design of UAV Drone Systems:

Introduction to Design and Selection of the System- Aerodynamics and Airframe Configurations-Characteristics of Aircraft Types- Design Standards and Regulatory Aspects-UK, USA and Europe-Design for Stealth–control surfaces specifications.

(8 Hours)

Summary of the Course:

The student will be able to explore the concepts, challenges and requirements of UAV and application of the same in Real time systems.

CO:1: Design, build and program simple autonomous robots.
CO:2. Implement standard signal processing and control algorithms.
CO3. Understand working of different types of engines and its area of applications
CO4: Describe the static and dynamic stability, dynamic instability and control concepts related to UAV drone systems

Textbooks:

1. Robert J. Schilling**, "**Fundamentals of Robotics Analysis and Control"**,** 1st Edition, PHI Learning 2009.
2. Niku S B, "Introduction to Robotics, Analysis, Systems, Applications", 1st Edition, Prentice Hall, 2001.

References:

1. John J Craig**, "**Introduction to Robotics"**,** 1st Edition, Pearson 2009.
2. Deb S R and Deb S**, "**Robotics Technology and Flexible Automation", 1st Edition, Tata McGraw Hill Education Pvt. Ltd, 2010.

Alternate Assessment Tools (AATs) suggested:

- **Design and implementation of simple and drone using any modern simulation tool**

Web links / e – resources:

- **https://www.entsoe.eu/Technopedia/techsheets/drones-and-robotics**
- **https://www.yokogawa.com/in/solutions/featured-topics/robot-and-drone-technology/**

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Choice Based Credit System (CBCS)

SEMESTER - VI

Global Positioning System(3:0:0) 3

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

Course Code	BET604D	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:

1. Understand the basics of GPS and Satellite Constellation.
2. Explain the concept of Earth-Centered, Earth-Fixed Coordinate System.
3. Describe GPS C/A Code Signal Structure.

Preamble:

Importance of GPS, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

Module – 1

Introduction**,** History of GPS Development, A Basic GPS Receiver, Approaches of Presentation, Software Approach, Potential Advantages of the Software Approach.

Basic GPS Concept:

GPS Performance Requirements, Basic GPS Concept, Basic Equations for Finding User Position, Measurement of Pseudorange, Solution of User Position from Pseudoranges, Position Solution with more than Four Satellites, User Position in Spherical Coordinate System, Earth Geometry,Basic Relationships in an Ellipse, Calculation of Altitude, Calculation of Geodetic Latitude, Calculation of a Point on the Surface of the Earth, Satellite Selection, Dilution of Precision.

(8 Hours)

Module – 2

Satellite Constellation:

Introduction, Control Segment of the GPS System, Satellite Constellation, Maximum Differential Power Level from Different Satellites, Sidereal Day, Doppler Frequency Shift, Average Rate of Change of the Doppler Frequency, Maximum Rate of Change of the Doppler Frequency, Rate of Change of the Doppler Frequency Due to User Acceleration, Kepler's Laws, Kepler's Equation, True and Mean Anomaly, Signal Strength at User Location.

(8 Hours)

Module – 3

Earth-Centered, Earth-Fixed Coordinate System:

Introduction, Direction Cosine Matrix, Satellite Orbit Frame to Equator Frame Transform, Vernal Equinox, Earth Rotation, Overall Transform from Orbit Frame to Earth-Centered, Earth-Fixed Frame, Perturbations, Correction of GPS System Time at Time of Transmission, Calculation of Satellite Position, Coordinate Adjustment for Satellites, Ephemeris Data.

(8 Hours)

Module – 4

GPS C/A Code Signal Structure:
Introduction, Transmitting Frequency, Code Division-Multiple Access (CDMA) Signals, P Code, C/A Code and Data Format, Generation of C/A Code, Correlation Properties of C/A Code, Navigation Data Bits, Telemetry (TLM) and Hand Over Word (HOW), GPS Time and the Satellite Z Count, Parity Check Algorithm.

(8 Hours)

Module – 5

Navigation Data:
Navigation Data from Subframe-1, Navigation Data from Subframes- 2 and 3, Navigation Data from Subframes 4 and 5–Support Data, Ionospheric Model, Tropospheric Model, Selectivity Availability (SA) and Typical Position Errors.

(8 Hours)

Course outcomes:
The students will be able to:
CO1: Understand the basic concepts of GPS, Satellite Constellation.
CO2: Apply the concepts of earth-centered and earth-fixed coordinate system to GPS.
CO3: Use the concepts of C/A code signal structure for the operation of GPS
CO4: Describe the role of different subframes in the navigation of data.

Textbooks:
1. Fundamentals of Global Positioning System Receivers: A Software Approach, James Bao-Yen, Tsui, John Wiley, 2nd Edition, 2005, ISBN: 978-0-471-70647-2

Alternate Assessment Tools (AATs) suggested:
- Simulation of GPS concepts using modern tools

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SEMESTER - VI

Sensors and Applications (3:0:0) 3

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

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:

1. **Identify** and **classify** various types of sensors and transducers used in modern technological systems based on the stimuli they detect.
2. **Analyze** the static and dynamic characteristics of sensors, including zero, first, and second-order sensors
3. **Assess** the performance of magnetic and acoustic sensors in detecting magnetic fields, sound intensity, and frequency across different media.
4. **Integrate** concepts of MEMS-based sensors into the understanding of modern sensor technologies and design simple sensor-based systems for specific applications.

Preamble:

This overview explores the essential concepts and applications of sensors and transducers, which convert physical stimuli into measurable electrical signals and its application in MEMS devices.

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 magnetostrictive 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: Explain the fundamental concepts of sensors and transducers, their need in modern applications, and classify sensors based on stimuli and analyze sensor characteristics.

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.

Textbooks

1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. Julian W. Gardner, Vijay K. Varadan, Osama O. Awadelkarim "Microsensors, MEMS and Smart Devices", New York: Wiley, 2001.

References Books

1. Henry Bolte, "Sensors – A Comprehensive Sensors", John Wiley.
2. Jocob Fraden," Handbook of Modern Sensors, Physics, Designs, and Applications", Springer
3. Manabendra Bhuyan," Intelligent Instrumentation Principles and Applications", CRC Press.
4. Randy Frank," Understanding Smart Sensors", Second edition, Artech House

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/

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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:

1. Understand the application of multi user access in a cellular communication scenario.
2. Understand the propagation mechanisms in an urban mobile communications using statistical and empirical models.
3. Understand system architecture, call processing protocols and services of GSM GPRS and EDGE.
4. 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)

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)

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)

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.

Textbooks

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

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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:

1. To understand the concepts of Automotive Electronics and it's evolution and trends
2. Automotive systems & subsystems overview.
3. To understand sensors and sensor monitoring mechanisms aligned to Automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms
4. To understand, design and model various automotive control systems using Model based development technique
5. To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software
6. To describe various communication systems, wired and wireless protocols used in vehicle networking
7. To understand Safety standards, advances in towards autonomous vehicles,
8. 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)

Textbooks

1. Ronald K Jurgen: "Automotive Electronics Handbook, 2nd Edition, McGraw-Hill, 1999
2. James D Halderman: -Automotive electricity and Electronics", PHI Publication

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.
4. Marc Herniter: "Introduction to Model Based System Design – Rose Hulman Institute of Technology

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/

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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: Understand 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:

1. 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

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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:

. Verify the functionality using test bench

. 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.

. Perform functional verification using test bench

. Synthesize the design targeting suitable library by setting area and timing constraints.

. For various constrains set, tabulate the area, power and delay for the synthesized netlist.

. 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:

a) Floor planning (automatic), identify the placement of pads
b) 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
c) Physical verification and record the LVS and DRC reports
d) Perform Back annotation and verify the functionality of the design
e) 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.

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

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Advanced CCN Laboratory (0:0:1) 1

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

Course Code	BET608A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Total Number of Contact Hours	20	Exam Hours	3

Course Objectives:

This course will enable students to:

1. Understand the basic programming of NS2.
2. Develop programs for various Topologies in simulation environment
3. Develop programs for various Routing algorithms in simulation environment.

Sl. No.	Experiments
1	Simulate a Point to Point Network with Four Nodes and Duplex Links between them. Analyze the Network Performance by Setting the Queue Size and Varying the Bandwidth.
2	Simulate Ethernet LAN using n(6-10) Nodes and Assign Multiple traffic to the Nodes to obtain congestion Window for different Sources/ Destinations.
3	Simulate Ethernet LAN using n(6-10) Nodes and Assign Multiple traffic to the Nodes to obtain compare the throughput by changing the Error Rate and Data Rate.
4	Simulate the Transmission of Ping Messages over a Network Topology Consisting of Six Nodes and Find the Number of Packets dropped due to Congestion.
5	Simulate a Simple BSS with Transmitting Nodes in Wireless LAN and Determine the Performance with respect to Transmission of Packets.
6	Build a Four-node Point to Point Network with links n0-n2, n1-n2 and n2-n3. Connect a TCP link between n0-n3 and UDP link between n1-n3.Define BERs for Links. Compare TCP and UDP Protocols when errors occur.
7	Build a Four-node Point to Point Network with links n0-n2, n1-n2 and n2-n3. Connect a TCP link between n0-n3 and UDP link between n1-n3.Modify to Simulate a Link Failure between the Host and the Target Node. Compare TCP and UDP Protocols when the Target Node is not accessible.
8	Simulate a Network with a Star Topology (One Router and several Hosts). Declare Applications (TCP or UDP) to send Packets from Hosts and to Receive(on one Host). Test the Bandwidth and the Delay, when Buffers are of infinite Capacities and Buffers are of Limited Capacities.
9	Simulate Link State Routing Algorithm.
10	Simulate Dynamic Routing distance Vector Routing Algorithm.
	Course outcomes: The students will be able to: CO1: Conduct experiments by writing programs on computer communication network using NS-2. CO2: Write a report for the conducted experiment. CO3: Conduct open ended experiment related to Routing protocols

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Embedded system Lab (0:0:1) 1

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

Course Code	BET608B	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	20	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Understand the basic programming of Microprocessor and microcontroller.
2. Develop microcontroller-based programs for various application in simulation environment
3. Program a microcontroller to control external hardware using suitable I/O ports.

Preamble:

Basic concepts ,architecture and instruction set of 8051 microcontroller and C programming skills is needed. **C**onduct the following experiments by writing C Program using Keil microvision simulator(any 8051 microcontroller can be chosen as the target and LPC1768 for ARM CORTEX M3).

Sl.No	Experiments
1.	Write an ALP to transfer a block of data bytes from source memory to destination memory using 8051 microcontroller.
2.	Write an ALP to exchange two blocks of data using 8051.
3.	Write an ALP to perform 16 bit addition.
4.	Write an ALP to find the largest/smallest element in an array using 8051.
5.	Write anALP to perform 16 bit subtraction.
6.	Write an ALP to perform the basic logical AND,OR and NOT byte operations.
7.	Write ALPs to generate Ramp,Square and Triangular waveforms using DAC interface/Logic Analyzer.
8.	Write ALP to interface a Stepper Motor with 8051 to rotate the motor.
9.	**DEMO Experiment**: Write an Embedded C Program using Arm Cortex M3 to interface a simple switch and display its status through Relay, led and Buzzer.
10.	**DEMO Experiment:** Write an Embedded C Program using ARM Cortex M3 to display the Hex digits 0 to F on a 7-segment LED interface with an appropriate delay in between.

Course outcomes:

The students will be able to:

CO1: Enhance programming skill using Assembly Language & execute programs in 8051 for solving simple problems that manipulate input data using different instructions of 8051, also interface different input and output devices to 8051 and ARM CORTEX M3.

CO2: Write a report for the conducted experiment

CO3: Conduct an open ended experiment to design a simple Calculator / Elevator using 8051 microcontroller.

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Image processing Lab(0:0:1) 1

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

Course Code	BET608C	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To learn and understand the basic operations on images
2. To learn and understand various image transform and enhancement techniques used on images
3. To learn and understand various image restoration, image compression and Segmentation techniques

Preamble:

The lab consists of a diverse set of experiments with objective, theory, assessment, references and interactive examples which are designed to improve the clarity in understanding of the basic concepts.

Sl. No.	Experiments
1	Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2	Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
3	To learn basic image transformation a. Translation b. Rotation c. Scaling
4	To learn the role of interpolation operation a. Bi-linear b. Bi-cubic c. Nearest neighbor
5	Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
6	To learn image enhancement through point transformation i. Linear transformation ii. Non-linear transformation iii. Clipping (piecewise linear) iv. Gray level windowing
7	Display of FFT(1-D & 2-D) of an image
8	Image Compression by DCT,DPCM, HUFFMAN coding
9	Implementation of image restoration techniques
10	Study the thresholding-based segmentation technique

Course outcomes:

The students will be able to:

CO1: Understand the basic concepts of image processing.

CO2: Conduct the experiments related to the concepts of image processing to obtain the desired image processing application.

CO3: Write a report for the conducted experiment

CO4: Perform in a group to execute simple applications of image processing operations using modern tools.

Textbooks :

Digital Image processing– Rafael C.Gonzalez and Richard E.Woods, Pearson Education, 2001, 2nd edition.

Fundamentals of Digital Image Processing– Anil K. Jain,Pearson Edun, 2001.

Web links / e – resources:

- https://www.pcuv.es/en/institutos-de-investigacion/lpi

B.E. ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Robotics Lab using TI Processor (0:0:1) 1

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

Course Code	BET608D	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	25	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To learn and understand the TI processors,
2. To learn and understand implementation using Texas Instruments Robotics System.
3. To learn and various interfacing modules with TI processors.

Preamble:

The lab cover the basic assembly of the parts associated with the TI-RSLK MAX Robot. This also covers how to install the TI MSP432 LaunchPad on the robot and implementation on various modules with TI-RSLK.

Sl.No.	Experiments
1	Interface ultrasonic sensor to calculate the distance of an object
2	Interface Bluetooth module to control devices wirelessly
3	Write a program to move RSLK in forward and backward direction
4	Write a program to move RSLK in circle, right and left directions
5	Configure BUMP switches to avoid the obstacles
6	Interface HM-10 Bluetooth module to control the robot
7	Interface ultrasonic sensor/IR sensor to detect the object
8	Write a program to control Robot via voice speech
9	Write a program to control RSLK using HTTP protocol
10	Write a program to control Robot using IoT Technology

Course outcomes:

The students will be able to:

CO1: Understand the basic concepts of TI Processors.

CO2: Apply the concepts of microcontroller to write code to control robotic system

CO3: Write a report for the conducted experiment

CO4: Perform in a group to execute simple applications for societal needs using modern tools.

Textbooks:

1. Texas Instruments Robotics System: Construction guide

Alternate Assessment Tools (AATs) suggested:

- Perform in a group to execute simple applications for societal needs using modern tools.

Web links / e – resources:

- https://smartsystems.ece.ufl.edu/wp-content/uploads/sites/27/RoboticsProgramDailyContent/Day1/constructionguide.pdfhttps://www.ti.com/lit/ml/sekp166/sekp166.pdfhttps://www.ti.com/video/series/ti-robotics-system-learning-kit-max-ti-rslk-max-curriculum-modules.html

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/BET608E**	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.

Textbooks

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. "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

Department of Humanities and Social Sciences

Choice Based Credit System (CBCS)

SEMESTER –– III to VI

National Service Scheme (NSS)

(Common to all branches)

(Effective from the academic year 2024-25)

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:

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

Module – 1

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 implementationapproaches. 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)**

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

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

Choice Based Credit System (CBCS)

SEMESTER – VI

Physical Education/Sports

(Common to all Branches)

(Effective from the academic year 2024-25)

Course Code	**BPEK609**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:0	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

1. Develop a healthy life style.
2. Acquire Knowledge about various stages of sports and games.
3. 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:

The students will be able to:

1. 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.
2. Develops individual and group techno tactical abilities of the game.
3. Increases the team combination and plan the strategies to play against opponents.
4. Outline the concept of sports training and how to adopt technology to attain high level performance.
5. Summarize the basic principles of organising sports events and concept of technology implemented to organise 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 thestudent has to give fitness and skill tests and his performance in game will be assessed.

Textbooks

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.

References

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, "Textbook 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 ofSports, 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

Department of Humanities and Social Sciences

Choice Based Credit System (CBCS)

SEMESTER – VI

Yoga

(Common to all Branches)

(Effective from the academic year 2024-25)

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

Course Objectives:

This course will enable students to:

1. Understand the importance of practicing yoga in day-to-day life.
2. Be aware of therapeutic and preventive value of Yoga.
3. Have a focussed, joyful and peaceful life.
4. Maintain physical, mental and spiritual fitness.
5. 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, UniversalLOVE, Benefits of practice of Spirituality in day-to-day life, practical classes.

(04 Hours)

Course Outcomes:

Students will be able to:

1. Understand the requirement of practicing yoga in their day-to-day life.
2. Apply the yogic postures in therapy of psychosomatic diseases
3. Train themselves to have a focussed, joyful and peaceful life.
4. Demonstrate the fitness of Physical, Mental and Spiritual practices.
5. 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 thesemester.

CIE 2 for 60 marks – A practical test conducted at the end of the semester in which thestudent have to perform asanas.

Textbooks

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 paperBacks: vision Books Pvt.Ltd., 1982.

3. B.K.S Iyenkar: Light on the Yoga sutras of patanjali (Haper Collins Publications IndiaPvt.,Ltd., New Delhi.)

4. Science of Divinity and Realization of Self – Vethathiri Publication, (6-11) WCSC, Erode

References

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring PublishingLimited, 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 YogaPrakashana Bangalore)

4. Web resources Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga PrakashanaBangalore)

5.

Web links and Video Lectures (e-Resources): Refer links

1. https://youtu.be/KB-TYlgd1wE
https://youtu.be/aa-TG0Wg1Ls

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DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
Choice Based Credit System (CBCS)
SEMESTER – VI

NCC

(Common to all Branches) (Effective for the 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

(10 Hours)

Module– 5

Drill Practicals: Savdhan, Vishram, Salute, Turning, Marching.

(08 Hours)

Course outcomes:

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 of 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.

Textbooks:

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

References:

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

BMS Institute of Technology and Management

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

Choice Based Credit System (CBCS)

SEMESTER – VI

Music

(Common to all Branches) (Effective for the 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:

1. Identify the major traditions of Indian music, both through notations andaurally.
2. Analyze the compositions with respect to musical and lyrical content.
3. 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 experience music through study and direct participation in improvisation and composition.

Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. **(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 GeetheinMalahari, and one Jathi Swara, One Nottu Swara OR One krithi in a Mela raga, a patriotic song

(14 Hours)

Course Outcomes (COs):

The students will be able to:

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

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 whichthe student has to recite one Sarale Varase mentioned by the examiner inthree speeds. Sing / Play the Geethe in Malahari. Singing / Playing Jathi Swara /Krithi.

Textbooks

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.

References

1. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: APractical Guide", Tranquebar 2018.
2. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", VipanciCharitable 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

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
Choice Based Credit System (CBCS)
SEMESTER – VI

INDIAN KNOWLEDGE SYSTEM

(Common to All UG Programs)
Applicable for the Academic Year 2024-25 for 2022 scheme onwards

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

Suggested Web Links:

1. **https://www.youtube.com/watch?v=LZP1StpYEPM**
2. **http://nptel.ac.in/courses/121106003/**
3. http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4. https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5. https://unctad.org/system/files/official-document/ditcted10_en.pdf
6. http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
7. https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EAIaIQobChMInp-Jtb_p8gIVTeN3Ch27LAmPEAAYASAAEgIm1vD_BwE