



## **Vision and Mission of the Department**

### **Vision**

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

### **Mission**

- To nurture students with a strong foundation in theoretical and practical concepts through innovative pedagogy and industry interface.
- To foster interdisciplinary research, entrepreneurship skills and instill professional ethics by providing experiential learning opportunities.

## **Program Educational Objectives (PEOs)**

1. Establish successful careers in electronics, communication, and allied engineering domains.
2. Pursue advanced studies and conduct research to devise innovative solutions, propelling technological advancements.
3. Demonstrate leadership, effective communication, and teamwork while upholding ethical practices through sustainable engineering solutions

## Program Specific Outcomes (PSOs)

1. Design and analyze digital and analog circuits using industry-standard Electronic Design Automation (EDA) tools, applying electronic fundamental principles for VLSI system implementation.
2. Design and develop communication and signal processing systems using fundamental principles of analog and digital communication, effectively utilizing analytical tools and techniques.
3. Integrate, debug, and deploy embedded hardware and software solutions for various real-time applications, demonstrating proficiency in programming, interfacing, and system-level design.

## Program Outcomes (POs)

**PO1: *Engineering Knowledge:*** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems

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

**PO3: *Design/Development of Solutions:*** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

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

**P05: *Engineering Tool Usage:*** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

**P06: *The Engineer and The World:*** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)

**P07: *Ethics:*** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**P08: *Individual and Collaborative Team work:*** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**P09: *Communication:*** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

**P010: *Project Management and Finance:*** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments

**P011: *Life-Long Learning:*** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

## Knowledge and Attitude Profile (WK)

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

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

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

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

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

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

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

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

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



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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:

<b>IPCC COURSES: 4 CREDITS OR 3 CREDITS</b>						
<b>Evaluation Type</b>		<b>Internal Assessments (IAs)</b>	<b>Test/ Exam Marks Conducted for</b>	<b>Marks to be scaled down to</b>	<b>Min. Marks to be Scored</b>	<b>Evaluation Details</b>
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	20	-	The sum of the two internal assessment tests will be <b>80 Marks</b> and the same will be scaled down to <b>20 Marks</b> .
		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.
<b>Total CIE Theory</b>				<b>25</b>	<b>10</b>	
Practical Component	CIE - Practical		30	15	-	Each laboratory experiment is to be evaluated for <b>30 Marks</b> using appropriate rubrics.
	CIE Practical Test		20	10	-	One test after all experiments to be conducted for <b>20 Marks</b>
	<b>Total CIE Practical</b>			<b>25</b>	<b>10</b>	
<b>Total CIE Theory + Practical</b>				<b>50</b>	<b>20</b>	
<b>SEE</b>			100	50	18	SEE exam is a theory exam, conducted for <b>100 Marks</b> , scored marks are scaled down to <b>50 Marks</b> .
<b>CIE + SEE</b>				<b>100</b>	<b>40</b>	

The laboratory component of the IPCC shall be for CIE only.

<b>Professional Core Courses (PCC) / Engineering Science Courses (ESC): 03 and 02 Credit</b>						
<b>Evaluation Type</b>		<b>Internal Assessments (IAs)</b>	<b>Test/ Exam Marks Condu cted for</b>	<b>Marks to be scaled down to</b>	<b>Min. Marks to be Scored</b>	<b>Evaluation Details</b>
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be <b>80 Marks</b> and the same will be scaled down to <b>30 Marks</b> .
		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.
	<b>Total CIE Theory</b>				<b>50</b>	<b>20</b>
<b>SEE</b>			100	50	18	SEE is a theory exam, conducted for <b>100 Marks</b> , scored marks are scaled down to <b>50 Marks</b> .
<b>CIE + SEE</b>				<b>100</b>	<b>40</b>	

**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	
Continu ous Internal Evaluati on Compon ent	CIE – IA Tests (MCQs)	CIE – Test 1 (1 hr)	40	40	-	<p>The question paper pattern for this course shall be an <b>MCQ of 1 or 2 Marks (s)</b>.</p> <p>The questions with 2 Marks can be framed based on a higher Bloom's level.</p> <p>The sum of the two internal assessment tests will be <b>80 Marks</b>, and the same will be scaled down to <b>40 Marks</b>.</p>	
		CIE – Test 2 (1 hr)	40				
	CIE - CCAs	CCA	10	10	-		Any One Assessment method can be used from the list provided below.
	<b>Total CIE</b>				<b>50</b>		<b>20</b>
<b>SEE (MCQ Type)</b>				50	18	<p>The question paper pattern for this course shall be an <b>MCQ of 1 or 2 Marks (s)</b>.</p> <p>The questions with 2 Marks can be framed based on higher Bloom's level.</p> <p>MCQ-type question papers of 50 questions with each question of a <b>01 Mark</b>, examination duration is 01 hour.</p>	
<b>CIE + SEE</b>				<b>100</b>	<b>40</b>		

Professional Core Course Laboratory (PCCL) / Ability Enhancement Course Laboratory (AEC) - 01 Credit					
Evaluation Type	Internal Assessments (IAs)	Test/ Exam Marks Conduct ed 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 <b>30 Marks</b> using appropriate rubrics.
	CIE - Practical Test	50	20		One test after all experiments is to be conducted for <b>50 Marks</b> and to be scaled down to <b>20 Marks</b> .
	<b>Total CIE</b>	-	<b>50</b>	<b>20</b>	
Semester End Examination		100	50	18	SEE to be conducted for <b>100 Marks</b> .
<b>CIE+SEE</b>		<b>100</b>		<b>40</b>	

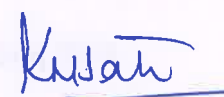
### Learning Activities for CCAs:

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

  
Principal 18/12/24

  
Dean AA 18.12.24

### Copy To:

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



# BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institution Affiliated to VTU, Belagavi)

## B. E. in Electronics & Communication Engineering Scheme of Teaching and Examinations – 2022 Scheme

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

(Effective from the academic year 2025-26 onwards)

### VII Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Credits Distribution				Examination				Contact Hours/sem
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	
1	IPCC	BEC701	Digital Image Processing	TD: ECE PSB: ECE	3	0	1	4	50	50	100	3	5
2	PCC	BEC702	Microwave & Antennas		3	0	0	3	50	50	100	3	3
3	PEC	BEC703X	Professional Elective Course III		3	0	0	3	50	50	100	3	3
4	OEC	BEC704X	Open Elective Course II	TB: PSB offered Dept.	3	0	0	3	50	50	100	3	3
5	PW	BEC705	Major Project Phase II	TD: ECE PSB: ECE	0	0	7	7	100	100	200	3	14
6	PCCL	BECL706	Advanced Communication lab		0	0	1	1	50	50	100	3	2
<b>TOTAL</b>					<b>12</b>	<b>0</b>	<b>9</b>	<b>21</b>	<b>350</b>	<b>350</b>	<b>700</b>	<b>-</b>	<b>30</b>

**IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Courses, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **NMCM:** Non-Credit Mandatory Course, **ESC:** Engineering Science Course **AEC:** Ability Enhancement Course, **SEC:** Skill Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.

**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.

**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 condition shall not be applicable to cases where the admission to the program is less than 10.

Professional Elective Course III		Open Elective Course II	
Course Code	Course Name	Course Code	Course Name
BEC703A	Optical Fiber Communication	BEC704A	Unmanned Aerial Vehicles
BEC703B	Low Power VLSI	BEC704B	Real Time Operating Systems
BEC703C	Satellite Communication	BEC704C	Nano Technology
BEC703D	Network Security and Cryptography	BEC704D	Wireless Sensor Networks
BEC703E	Real Time Systems		

**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), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between 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. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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

**Selection of an open elective shall not be allowed if,**

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

**Major Project Phase II:** The objective of the Project work is (i) To encourage independent learning and the innovative attitude of the students. (ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills. (iii) To impart flexibility and adaptability. (iv) To inspire teamwork. (v) To expand intellectual capacity, credibility, judgment and intuition. (vi) To adhere to punctuality, setting and meeting deadlines. (vii) To instill responsibilities to oneself and others. (viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Digital Image Processing (3:0:1) 4

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC701</b>	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Total Number of Contact Hours	40+ (26 hours of lab slot)	Exam Hours	03

#### Course objectives:

#### Course Objectives:

This course will enable students to:

1. Develop a theoretical foundation on fundamental Digital Image Processing concepts.
2. Understand various image transforms used in digital image processing
3. Recognize the image enhancement techniques in spatial domain and frequency domain in digital image processing.
4. Comprehend the image restoration techniques, segmentation techniques, Morphological Operations and Color Image Processing in digital image processing.

#### Preamble:

Basic knowledge of Mathematics, Signal Processing is highlighted in this course

#### Module - 1

**Introduction to digital image processing:** What is Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, applications.

**Image sampling and Quantization:** Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships Between Pixels.

(8 Hours)

#### Module - 2

#### Image Transforms:

Two-dimensional orthogonal and unitary transforms, properties of unitary transforms, two-dimensional Discrete Fourier Transform, Discrete Cosine transform, Hadamard Transform, Haar Transform.

**Image Enhancement in spatial domain:** Basic Intensity Transformation Functions, Histogram Processing. Enhancement using Arithmetic/logical operations.

(8 Hours)

#### Module - 3

**Spatial Filtering:** Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

#### Image Enhancement in Frequency Domain:

Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters. (Text: Chapter 5.1, 5.2)

(8 Hours)

#### Module - 4

<p><b>Restoration:</b> A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.</p> <p style="text-align: right;">(8 Hours)</p>	
<p><b>Module - 5</b></p>	
<p><b>Morphological Image Processing:</b> Preliminaries, Erosion and Dilation, Opening and Closing</p> <p><b>Segmentation:</b> Point, Line and Edge detection, Thresholding, Region based segmentation.</p> <p><b>Color Image Processing:</b> Color Fundamentals, Color Models, Pseudo color Image Processing.</p> <p style="text-align: right;">(8 Hours)</p>	
<p>PRACTICAL COMPONENT OF IPCC (Experiments can be conducted either using MATLAB tool)</p>	
1	Write a program to learn the basic image processing operations: read an image, resize the image, cropping an image, color conversion from RGB to Gray and vice-versa.
2	Write a program to find the relationship between pixels in an image: distance, neighborhood, adjacency, paths, connectivity, regions and boundaries.
3	Write a program to perform image arithmetic and logical operations.
4	Write a program to perform geometric transformation of an image: Translation, Scaling, Rotation, Shrinking, and Zooming.
5	Write a program to perform histogram equalization of an image.
6	Write a program to perform spatial and frequency filtering of an image.
7	Write a program to perform morphological operations on an image: erosion, dilation, opening and closing.
8	Write a program to perform edge detection of an image using different edge detection mask.
9	Write a program to perform image segmentation operations on an image.
<p><b>Course outcomes:</b> The students will be able to:</p> <p><b>C01:</b> Interpret the basics of human visual system and the basic operations in digital image processing.</p> <p><b>C02:</b> Analyse different image transforms used in digital image processing.</p> <p><b>C03:</b> Apply image processing techniques in both the spatial and frequency domains.</p> <p><b>C04:</b> Analyse image restoration and color image processing techniques</p> <p><b>C05:</b> Apply segmentation and morphological operations on mages.</p>	

**Suggested Learning Resources:****Textbooks:**

1. Digital Image Processing - Rafael C Gonzalez and Richard E. Woods, PHI, 3rd Edition 2010.
2. Digital Image Processing Using MATLAB - Rafael C Gonzalez, Richard E. Woods and Steven E Eddins, TMH, 2nd Edition, 2010.

**Reference Books:**

1. Digital Image Processing- S. Jayaraman, S. Esakkirajan, T. Veerakumar, Tata Mc GrawHill 2014.
2. Digital Image Processing with MATLAB- Vipula Singh

**Continuous Comprehensive Assessments (CCA's):**

Mini project using MATLAB tool for implementing any real time applications.

**Web links/e-resources:**

<https://www.coursera.org/learn/introduction-image-processing>,  
[https://onlinecourses.nptel.ac.in/noc21\\_ee78/preview](https://onlinecourses.nptel.ac.in/noc21_ee78/preview)

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VII

### Microwave and Antennas (3:0:0) 3

(Effective from the academic year 2025-26- 2022 Scheme)

Course Code	<b>BEC702</b>	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.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 radiationz
- 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  $\lambda/2$  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)

**Suggested Learning Resources:****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.

**Reference Books:**

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

**Course outcomes:**

The students will be able to:

**C01:** Apply the knowledge of microwave to **solve** problems related to transmission lines at RF range.

**C02:** Identify various passive components employed to characterize the S-parameters of passive devices.

**C03:** Apply the fundamental concepts of antennas and planar transmission lines to analyze and solve basic engineering problems related to RF and communication systems.

**C04:** Compare the field components of Dipole and Loop antennas

**C05:** Design VHF/UHF antennas and microstrip antennas for given configurations

**Continuous Comprehensive Assessments (CCA's):**

- 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](https://ethw.org/Microwave_Link_Networks)

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Optical Fiber Communication (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC703A</b>	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 working principle and characteristics of optical fibers and connectors.
2. Explain the construction and operation of optical sources, detectors and devices.
3. Describe the concept of optical networking and various optical networks.

#### Preamble:

This course provides students with a comprehensive understanding of the principles, technologies, and applications of optical fiber communications. As the backbone of modern telecommunications and data networks, optical fiber communication plays a crucial role in enabling high-speed, high-capacity, and long-distance transmission of information.

#### Module - 1

##### Overview of Optical Fiber Communication:

Introduction: The general system, Advantages of optical fiber communication, Optical fiber wave guides: Ray theory transmission, Modes in planar guide, Phase and group velocity, cylindrical fiber: Modes, Step index fibers, Graded index fibers (no derivations in article 2.4.4), Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers. (Text 1)

(8 Hours)

#### Module - 2

##### Transmission characteristics of optical fiber:

Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber. (Text 1)

##### Optical Fiber Connectors:

Fiber alignment and joint loss, Fiber splices: Fusion Splices, Mechanical splices, Fiber connectors: cylindrical ferrule connectors, Duplex and Multiple fiber connectors, Fiber couplers: three and four port couplers, star couplers, Optical Isolators and Circulators. (Text 1)(8 Hours)

#### Module - 3

##### Optical sources:

Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation of an LED. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant Frequencies. (Text 2)

**Photodetectors:**

Physical principles of Photodiodes, Photo detector noise, Detector response time. (Text 2)

**Optical Receiver:**

Optical Receiver Operation: Error sources, Front End Amplifiers, Receiver sensitivity, Quantum Limit. (Text 2)

(8 Hours)

### Module – 4

**WDM Concepts and Components:**

Overview of WDM: Operational Principles of WDM, WDM standards, Mach-Zehnder Interferometer Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings. Optical amplifiers: Basic application and Types. Semiconductor optical amplifiers, Erbium Doped Fiber Amplifiers, Raman Amplifiers, Wideband Optical Amplifiers. (Text 2)

(8 Hours)

### Module – 5

**Optical network evolution and concepts:** Optical networking terminology, Optical network node and switching elements, Wavelength division multiplexed networks, public telecommunication network overview. (Text 1)

**Optical network transmission modes, layers and protocols:** Synchronous networks, Asynchronous transfer mode, OSI reference model, Optical transport network, Internet protocol, Wavelength routing networks: Routing and wavelength assignment, Optical switching networks: Optical circuit switched networks, packet switched networks, Multiprotocol Label Switching, Optical burst switching networks. (Text 1)

(8 Hours)

**Course outcomes:** The students will be able to:

**CO1:** Illustrate the fundamental principles of optical fiber communication, including wave propagation, fiber types, dispersion relations, and material aspects.

**CO2:** Analyze the transmission characteristics and losses in optical fiber communication.

**CO3:** Describe the constructional features and working principle of optical active and passive devices.

**CO4:** Apply the concepts of optical networking, including transmission modes, layers, protocols, and switching techniques.

**Suggested Learning Resources:****Textbooks:**

1. John M. Senior, "Optical Fiber Communications Principles and Practice", Third Edition, Pearson Education, 2010, ISBN:978-81-317-3266-3.
2. Gerd Keiser, "Optical Fiber Communication", Fifth Edition, McGraw Hill Education (India) Private Limited, 2015. ISBN:l-25-900687-5.

**Reference Books:**

1. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited.

**Continuous Comprehensive Assessments (CCA's):**

- Technical presentation in a group on Emerging Technologies and Applications in optical fiber communication systems and techniques.

**Web links/e-resources:**

- [https://onlinecourses.nptel.ac.in/noc25\\_ee90/preview](https://onlinecourses.nptel.ac.in/noc25_ee90/preview)
- [https://onlinecourses-archive.nptel.ac.in/noc18\\_ee28/preview](https://onlinecourses-archive.nptel.ac.in/noc18_ee28/preview)
- <https://youtu.be/X7937U2Ben4>

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Low Power VLSI (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC703B</b>	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:

1. To learn various sources of power dissipation in CMOS based circuits.
2. To study concepts of power estimation and analysis
3. To focus on architectural, Behavioural and circuit level low power transforms.
4. To study switched capacitance and leakage minimization techniques
5. To study low energy computing techniques for digital circuits

#### Preamble:

This course aims to equip students with comprehensive knowledge and skills in low-power design methodologies for CMOS-based circuits. Through theoretical study and practical exercises, students will gain proficiency in designing energy-efficient electronic systems suitable for contemporary applications

#### Module - 1

**Power Dissipation in CMOS:** Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits - Dynamic Power Dissipation, Short Circuit Power, Switching Power, Glitching Power, Static Power Dissipation, Degrees of Freedom, Unified Power Format, Voltage islands, power islands.

Emerging Low power approaches, Physics of power dissipation in CMOS devices, Device & Technology Impact on Low Power: Transistor sizing & gate oxide thickness, Leakage current in Deep sub-micron transistors, Impact of technology Scaling, Technology & Device innovation.

(8 hours)

#### Module - 2

**Switched Capacitance Minimization Approaches:** Hardware Software Tradeoff, Bus Encoding, Architectural optimization, Clock Gating, Logic styles.

**Leakage Power minimization Approaches:** Variable-threshold-voltage CMOS (VTCMOS) approach, multi-threshold-voltage CMOS (MTCMOS) approach, Power gating, Transistor stacking, Dual-Vt assignment approach (DTCMOS)., Simulation with spice tools

(8 Hours)

#### Module - 3

**Synthesis for Low Power:** Behavioural, Logic and Circuit level approaches, Algorithm level transforms, Power-constrained Least squares optimization for adaptive and non-adaptive filters, Circuit activity driven architectural transformations, Device feature size scaling, Multi-Vdd Circuits, Architectural level approaches: Parallelism, Pipelining, Voltage scaling using high-level transformations, Dynamic voltage scaling, Power Management, Simulation with Spice tools.  
(8 Hours)

#### Module - 4

**Power estimation, simulation power analysis :** Simulation based techniques, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation, Probabilistic power analysis, statistical methods  
(8 Hours)

#### Module - 5

**Low Energy Computing:** Energy recovery circuit design, designs with reversible and partially reversible logic, energy recovery in adiabatic logic, MOS Memories, Design of peripheral circuits – address decoder, level shifter and I/O Buffer, supply clock generation. Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip& package co design of clock network. Battery driven system design  
(8 Hours)

**Course outcomes:** The students will be able to:

**CO1:** Identify the different sources of power dissipation in CMOS based circuits

**CO2:** Summarize the power analysis using simulation-based approaches and probabilistic analysis.

**CO3:** Apply logic-level and architecture-level techniques in various designs to optimize power consumption of the VLSI circuits.

**CO4:** Utilize logic simulation methods to design Low Power VLSI circuits.

**CO5:** Construct the low energy computing techniques for digital circuits.

#### Suggested Learning Resources:

##### Textbooks:

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002.
2. Rabaey, Pedram, "Low Power Design Methodologies" Kluwer Academic, 1997.

##### Reference Books:

1. Anantha P. Chandrakasan and Robert W. Brodersen, Low Power Digital CMOS Design, Kluwer Academic Publishers, 1995.
2. Kaushik Roy and Sharat C. Prasad, Low-Power CMOS VLSI Design, Wiley-Interscience, 2000.
3. Sung Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata McGraw Hill, 1999.
4. Neil H. E. Weste and K. Eshraghian, Principles of CMOS VLSI Design, 2nd Edition, Addison Wesley (Indian reprint), 1993.
5. A. Bellamour, and M. I. Elmasri, Low Power VLSI CMOS Circuit Design, Kluwer Academic Press, 1995.

#### Continuous Comprehensive Assessments (CCA's):

Simulation of low power circuits using LTSPICE

#### Web links/e-resources:

<https://archive.nptel.ac.in/courses/108/106/108106167/>

**BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT**

**B.E ELECTRONICS AND COMMUNICATION ENGINEERING**

Choice Based Credit System (CBCS)

**SEMESTER - VII****Satellite Communication (3:0:0) 3**

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC703C</b>	CEE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

**Course Objectives:**

This course will enable students to:

1. Study the history of satellites, frequency bands used, basic principle of satellite orbits and trajectories.
2. Analyse the electronic systems associated with a satellite and the earth station.
3. Analyse the various technologies associated with the satellite communication.
4. Summarize on a communication satellite and the national satellite system.
5. Discuss the satellite applications focusing various domains services such as remote sensing, weather forecasting and navigation.

**Preamble:**

This course of satellite communication deals with the concepts and principles of satellite orbits, different modulation adopted in satellite communication. it deals with the architecture involved in constructing the satellites.

**Module – 1**

**Introduction:** History of the scientific developments in this field, significance and scope of the course, impact of the course on sustainable solutions and national economy, career perspective, innovations and state of the art(for 2-3 hours)

**Introduction to Satellite Communication:** Introduction: Overview of Satellite Communications, GEO, MEO and LEO satellite systems, frequency bands.

**Orbital Mechanics:** Orbit Equations, Locating the satellite w.r.t. the earth, Orbital elements, Look Angles, Orbital perturbation, Effects of earth's oblate ness, moon and sun, Satellite eclipse, sun transit outage, Coverage angle, slant range, satellite launching **(Text1)**

(8 Hours)

**Module – 2**

**Satellite subsystems:** Attitude and Orbit Control System (AOCS), Telemetry, Tracking and Command System (TT&C), Power System, Satellite antennas, Communications subsystem, transponders. **(Text1)**

(8 Hours)

### Module - 3

**Modulation and Multiplexing:** FM with multiplexed telephone signals, Analog FM SCPC, PSK, QPSK, Multiple Access Schemes: FDM/FM/FDMA, TDMA, and Frame structure, frame acquisition, synchronization, TDMA in VSAT network, CDMA, Spread spectrum transmission and reception.

**Satellite Link Design:** Basic transmission theory , System noise temperature and G/T ratio, CNR, CIR, ACI, IMI, Down link design, Up link design, System design examples **(Text1)**

(8 Hours)

### Module - 4

**Error Control for Digital Satellite Links:** Error control coding, Block codes, Convolution codes, - Implementation of error detection on satellite links

**Communication Satellites:** Introduction, Related Applications, Frequency Bands, Payloads, Satellite Vs. Terrestrial Networks, Satellite Telephony, Satellite Television, Satellite radio, regional satellite Systems, National Satellite Systems **(Text2)**

(8 Hours)

### Module - 5

**Remote Sensing Satellites:** Classification of remote sensing systems, orbits, Payloads, Types of images: Image Classification, Interpretation, Applications.

**Weather Forecasting Satellites:** Fundamentals, Images, Orbits, Payloads, Applications.

**Navigation Satellites:** Development of Satellite Navigation Systems, GPS system, Applications. **(Text2)**

**Case study:** A case study on educational satellite, commercial satellite, satellite phone working, WCDMA, link to DTH connections and Power level, Direct cables, Satellite connections and CNR. Students can explore Airtel DTH, ATM Banking/VSAT, Satellite radio, Radio Broadcasting.

(8 Hours)

#### Course outcomes:

The students will be able to:

**CO1:** Interpret the fundamentals of satellites with the definitions of parameters.

**CO2:** Apply the concepts of communication systems to interpret the working of a satellite system.

**CO3:** Analyze the various applications of satellites based on the national satellite system.

**CO4:** Apply the technical aspects, safety issues and environmental context of different satellite missions.

**Suggested Learning Resources:****Textbooks:**

1. Timothy Pratt, Charles Bostian Jerney Allnut "Satellite Communications," John Wiley, Singapore, 2013. 2e.
2. Anil K. Maini, Varsha Agrawal. "Satellite Communications", Wiley India Pvt. Ltd, 2015.

**Reference Books:**

1. Wilbur L. Pritchard, Hendri G. Suyderhoud, Robert A. Nelson "Satellite Communication Systems Engineering" Prentice Hall/Pearson, 2007
2. Bruce R. Elbert, the Satellite Communication Applications, Hand Book, Artech House Boston London, 2e.

**Continuous Comprehensive Assessments (CCA's):**

Poster presentation on recent advancements adapted in satellite communication

**Web links/e-resources:**

- <https://www.isro.gov.in/AcademicCourses.html>
- [https://onlinecourses-archive.nptel.ac.in/noc17\\_ec14/](https://onlinecourses-archive.nptel.ac.in/noc17_ec14/)

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Network Security and Cryptography (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC703D</b>	CIE Marks	50
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course objectives:

This course will enable students to;

1. Understand the basics of symmetric key and public key cryptography.
2. Acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
3. Design various key distribution and management schemes and Digital signature, Authentication codes
4. Study intruders, Virus, Malicious software and firewalls.

#### Preamble:

This course of network security and cryptography deals with the concepts of computer network security. It involves basics required to understand network security basics such as encryption algorithms, viruses, firewall etc. The course emphasizes to give a basic understanding of previous attacks on cryptosystems with the aim of preventing future attacks. A wide variety of basic cryptographic primitives will be discussed along with recent developments in topics like encryption, a two-party/multi-party computation. The cryptanalysis part will help us understanding challenges for cybersecurity that includes network security, data security, mobile security, cloud security and endpoint security.

#### Module - 1

**Introduction to network security:** Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. Security services. The OSI security architecture, A model for network security.

(7 Hours)

#### Module - 2

**Symmetric Cipher Model:** Substitution Techniques: Transposition Techniques  
**(Text 1: chapter 1)** Data encryption standard (DES) **(Text 1: chapter 2)**

(9 Hours)

#### Module - 3

**The AES Cipher: (Text 1: chapter 2)**

**Basic concepts of Number theory:** Number theory, Euclidean algorithm, Modular arithmetic, Prime Numbers, Fermat's and Euler's theory.

(9 Hours)

**Module - 4**

**Asymmetric ciphers:** Principles of public key cryptosystems, RSA algorithm, Key Management, Diffie -Hellman Key Exchange

**Pseudo-Random Sequence generators and Stream ciphers:** Linear Congruential generators and Linear Feedback Shift Registers, Design and analysis of stream ciphers: A5, Gifford, PKZIP **(Text 2: chapter 16)**

(7 Hours)

**Module - 5**

**Intruders:** Intruders, intrusion techniques, Intrusion Detection, statistical anomaly detection, Password Management.

**Viruses:** Viruses and Related Threats, The Need for Firewalls

(8 Hours)

**Course outcomes:** The students will be able to:

**CO1:** Illustrate basics of Network security, attacks and services and mechanisms.

**CO2:** Apply the knowledge of network security concepts to various security algorithms.

**CO3:** Analyze the security mechanisms such as RSA and Diffie- Hellman

**CO4:** Apply the Network security algorithms in real time application.

**Suggested Learning Resources:**

**Textbooks:**

1. William Stallings, "Cryptography and Network Security Principles and Practice", 6<sup>th</sup> Edition, Pearson Education Inc, 2014.
2. Bruce Schneier, "Applied Cryptography Protocols, Algorithms, and Source code in C", 2<sup>nd</sup> Edition, Wiley Publications

**Reference Books:**

1. Behrouz A. Forouzan, "Cryptography and Network Security", TMH ,2007.
- Atul Kahate, "Cryptography and Network Security", TMH, 2003.

**Continuous Comprehensive Assessments (CCA's):**

Mini project related to cryptography and network security implemented in a group of 3-4 students which demonstrates the understanding of the course and implementation in any modern tools.

**Web links/e-resources:**

- [https://onlinecourses.nptel.ac.in/noc21\\_cs16](https://onlinecourses.nptel.ac.in/noc21_cs16)
- [https://onlinecourses.nptel.ac.in/noc22\\_cs03/preview](https://onlinecourses.nptel.ac.in/noc22_cs03/preview)

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Real Time System (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC703E</b>	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:

1. To introduce fundamentals, classification, and control aspects of real-time systems.
2. To understand hardware requirements and interfacing for real-time applications.
3. To study real-time operating systems, scheduling, memory, and resource management.
4. To learn design methodologies, modeling techniques, and analyze case studies of real-time systems.

#### Preamble:

This course introduces the fundamentals of Real-Time Systems, covering classifications, hardware and software requirements, operating system concepts, design methodologies, and modeling techniques. Through case studies such as air traffic control and defense systems, students gain practical insights into designing and analyzing reliable real-time applications.

#### Module - 1

##### Introduction to Real-Time Systems:

Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs. Introduction to computer control, Sequence Control, Loop Control, Supervisory Control, Centralized Computer Control, Hierarchical Systems. (Text-1: 1.1to 1.6 and 2.1 to 2.6)

(8 hours)

#### Module - 2

##### Computer Hardware Requirements for Real-Time Applications:

Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface. (Text-1: 3.1 to 3.8)  
(8 Hours)

#### Module - 3

##### Operating Systems:

Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion. (Text-1: 6.1 to 6.11)  
(8 Hours)

#### **Module - 4**

Design of RTS – General Introduction: Introduction, Specification Document, Preliminary Design, Single-Program Approach, Foreground/Background System, Multi-Tasking approach, Mutual Exclusion, Rendezvous. (Text-1: 7.1 to 7.7 and 7.9)

**(8 Hours)**

#### **Module - 5**

Real-Time Modeling and Case Studies: Petri Nets, Analysing Petri Nets, Case Study: Air traffic controller system, Distributed air defense system. (Text-1: 10.2 to 10.3, Text-2: Ch.11 and Ch. 12)

**(8Hours)**

**Course outcomes:** The students will be able to:

**CO1:** Apply the fundamental concepts of real time systems to computer control

**CO2:** Identify the hardware components and interfaces used in real-time applications.

**CO3:** Apply real-time operating system concepts to applications.

**CO4:** Design real-time systems by selecting suitable design approaches to meet timing and resource constraints.

**CO5:** Analyze real-time systems through practical case studies such as air traffic control and distributed air defence systems.

#### **Suggested Learning Resources:**

##### **Textbooks:**

1. Real-Time Computer Control, Stuart Bennet, 2nd Edn. Pearson Education. 2008.

##### **Reference Books:**

1. C.M. Krishna, Kang G. Shin, "Real Time Systems", Tata McGraw - Hil, 2010.
2. Giorgio C. Buttazzo , "Hard real-time computing systems: predictable scheduling algorithms and applications", Springer, 2008.
3. C. Siva Ram Murthy, G. Manimaran, "Resource management in real-time systems and networks", PHI, 2009.
4. Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005.

#### **Continuous Comprehensive Assessments (CCA's):**

- Mini project related to cryptography and network security implemented in a group of 3-4 students which demonstrates the understanding of the course and implementation in any modern tools.

#### **Web links/e-resources:**

<https://www.geeksforgeeks.org/real-time-systems/>

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Unmanned Aerial Vehicles (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC704A</b>	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. Familiarize with the concepts of UAV/drone through their significant learning of
  - a. the Components, Assembly and Calibrations.
2. Impart knowledge of guidance, navigation and control techniques for UAV
  - a. operation.
3. Explore design considerations and software/hardware interface of Drone.
4. Create awareness of emerging Drone technologies and various applications.

#### Preamble:

The syllabus is designed to provide students with a comprehensive understanding of UAV technology, including calibration, operation, and application. Studying Unmanned Aerial Vehicles (UAVs) at the undergraduate (UG) level can be valuable for several reasons, particularly in relation to job opportunities. Studying UAVs can position students at the forefront of a cutting-edge field with significant potential for innovation, making it a strategic choice for enhancing job prospects and career growth.

#### Module - 1

**Introduction:** Evolution of UAV, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

**Introduction of Unmanned Aerial Vehicles:** Introduction, History of drones, Classification of drones based on structure- Fixed wing structure, Lighter than air systems and Rotary-wing aircraft, Application of drones, Parts of Drone system, System design, Mechanical design, hardware design, software architecture, Logistic and Operations Management. (8 Hours)

#### Module - 2

**Dynamics and Stability:** Forces of flight Principal axes and rotation of aerial systems, Longitudinal axis, Lateral(transverse) axis and Perpendicular axis, Equilibrium, Stability - Stable system, Unstable system and Neutrally stable system, Control – Roll, Pitch, Yaw and Throttle (8 Hours)

<b>Module - 3</b>
<b>Sensors in Drone:</b> Sensors – Accelerometer, Barometer, Gyro Sensor, Magnetometer, Distance sensors, Time of Flight (ToF) Sensors, Thermal sensors, Chemical Sensors and Sensor Testing – Test Philosophies and methodologies, Test equipment, Performance testing of sensors (8 Hours)
<b>Module - 4</b>
<b>Gliding Drones:</b> Glider, Lift, Drag, Airfoil and its type, Incident and decalage angle, Three axis motions (roll, pitch, and yaw), Thrust, Aspect ratio and glide ratio, Glide or dive and descent, gliding angle Climb, Center of pressure, Pitching moment, Load factor, Angle of attack, Build our own glider drone (8 Hours)
<b>Module - 5</b>
<b>Drones for Mission Control Application:</b> ESP8266, Downloading and installing APM Planner or Mission Planner, Configuring the quadcopter - Frame type selection, Compass calibration, Access calibration, Radio calibration, Flight mode calibration and Failsafe calibration, Surveying with a drone, tweaks with the Flight Plan screen. Future of Drone Systems (8 Hours)
<b>Course outcomes:</b> The students will be able to:
<p><b>CO1:</b> Interpret the basic principles, classifications, and applications of drones.</p> <p><b>CO2:</b> Analyze UAV subsystems and their functions.</p> <p><b>CO3:</b> Apply the knowledge of aerodynamics and flight mechanics for Drone performance.</p> <p><b>CO4:</b> Evaluate guidance, navigation and control systems.</p> <p><b>CO5:</b> Design a drone for mission control applications.</p>
<b>Suggested Learning Resources:</b>
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Sumit Sharma, Drone Development: From Concept to Flight, Packt, April 2024</li> <li>2. P. K. Garg, Unmanned Aerial Vehicles: A Comprehensive Guide to UAV Technology and Applications, Learning, eBook August 2024</li> <li>3. Handbook of Unmanned Aerial Vehicles, Kruger Brentt Publisher (UK), March 2025</li> <li>4. Sachin Kumar Gupta et al., Unmanned Aircraft Systems, Wiley, 1st edition December 2024.</li> <li>5. T. Hikmet Karakoc, Emre Özbek, Unmanned Aerial Vehicle Design and Technology, Springer, published November 2023 (available in print and eBook).</li> </ol>
<b>Continuous Comprehensive Assessments (CCA's):</b>
Design, simulate and present in a group a Drone for a given specific mission. (Eg:- Agriculture field monitoring ,parcel delivery, disaster surveillance etc.).
<b>Web links/e-resources:</b>
<p><a href="https://onlinecourses.nptel.ac.in/noc21_ae14/preview">https://onlinecourses.nptel.ac.in/noc21_ae14/preview</a></p> <p><a href="https://onlinecourses.nptel.ac.in/noc19_ae06/preview">https://onlinecourses.nptel.ac.in/noc19_ae06/preview</a> <a href="https://nptel.ac.in/courses/105107218">https://nptel.ac.in/courses/105107218</a></p>

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER – VII

#### Real Time Operating System (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC704B</b>	CIE Marks	50
Teaching Hours/Week (L: T:P)	3:0:0	SEE Marks	50
Total Number of Contact Hours	40	Exam Hours	3

#### Course Objectives:

This course will enable students to:

1. Setup and demonstrate the development environment for RTOS
2. Illustrate strategies to interface memory and I/O with RTOS kernels
3. Interpret tasks used in handling multiple activities
4. impart skills necessary to develop software for embedded computer systems using a real-time operating system

#### Preamble:

In today's interconnected and automated world, the demand for systems that can perform tasks within precise time constraints has never been greater. Real-Time Operating Systems (RTOS) play a pivotal role in meeting these demands, enabling critical applications to operate reliably and predictably.

An RTOS is a specialized operating system designed to manage hardware resources, run applications, and process data in real time, ensuring that tasks are completed within a guaranteed time frame. Unlike general-purpose operating systems, RTOS are engineered to provide deterministic responses, which is crucial for applications where timing is paramount.

#### Module – 1

**Introduction:** Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Architecture of OS (Monolithic, Microkernel, Layered, kernel and Hybrid kernel structures), Batch, Multi programming, Multitasking, Multiuser, parallel, distributed & real –time O.S. (8 Hours)

#### Module – 2

**Scheduling algorithms:** FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing techniques. (8 Hours)

#### Module – 3

STM32f4\_RTOS\_BSP, Testing STM32f4\_RTOS\_BSP, Time Management Timer Management, Resource Management Disable/Enable Interrupts, Lock/Unlock

Semaphores, (8 Hours)	Mutex,	Deadlocks,	Synchronization.
<b>Module - 4</b>			
Introduction to Internal Task, Idle Task, Tick Task, Statistics Task, Timer Task, ISR dHandler Task, Scheduling, Preemptive Scheduling, Scheduling points, Round Robin Scheduling Context Switching, coding cooperation. (8 Hours)			
<b>Module - 5</b>			
Interrupt Management, Interrupt Service Routine, Non-Kernel Aware Interrupt Service Routine CPUs with Multiple Interrupt Priorities, All Interrupts Vector to a Common Location, Every Interrupt Vectors to a Unique Location, Direct vs. Deferred Post Methods. Recap/Summary of the Course. (8 Hours)			
<p><b>Course Outcomes:</b> The students will be able to:</p> <p><b>CO1:</b> Apply the concepts of operating systems to manage hardware resources, execute applications, and process data in real time.</p> <p><b>CO2:</b> Apply thread scheduling and multiprocessor scheduling to optimize process execution and system performance</p> <p><b>CO3:</b> Apply operating system Concepts using STM32F4_RTOS_BSP to manage hardware resources, execute applications through testing and validation.</p> <p><b>CO4:</b> Analyze preemptive scheduling techniques and internal task management to evaluate system performance.</p> <p><b>CO5:</b> Analyze interrupt management and multiple interrupt priorities to determine efficient system control</p>			
<p><b>Suggested Learning Resources:</b></p> <p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Jean J Labrosse, "Micro C/OS-II, The Real Time Kernel", CMP, 3rd, 2016.</li> <li>2. Mazidi, "STM32 Arm Programming for Embedded Systems", Mirco digital ED, 1<sup>st</sup> 2018.</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Colin walls, "Building a Real Time Operating System: RTOS from the Ground Up", Newness, 2020.</li> <li>2. Sam, "Real-Time Embedded Components and Systems: With Linipux and RTOS", Mercury Learning, 2015.</li> </ol>			
<p><b>Continuous Comprehensive Assessments (CCA's):</b> Technical seminar in a group on Emerging Trends in RTOS</p>			
<p><b>Web links/e-resources:</b> <a href="https://archive.nptel.ac.in/courses/106/105/106105172/">https://archive.nptel.ac.in/courses/106/105/106105172/</a></p>			

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Nano Technology (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC704C</b>	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 provide a comprehensive overview of synthesis and characterization of nanoparticles.
2. To provide the engineering students with necessary background for understanding various.
3. To develop an understanding of the basis of the choice of material for device applications.
4. To give an insight into complete systems where nanotechnology can be used to improve our everyday life.

#### Preamble:

- Nanoengineering is a multidisciplinary field that merges principles of engineering, physics, chemistry, and biology to manipulate materials at the nanoscale level (one billionth of a meter). At this scale, unique phenomena enable novel applications that are not possible with bulk materials.
- The field of nanoengineering is pivotal in the development of new technologies and solutions across various industries, including medicine, electronics, energy, and environmental science.
- By the end of this course, students will have gained the skills necessary to contribute to the advancement of nanotechnology and its integration into practical solutions.
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#### Module - 1

**Introduction to Nanomaterials:** Nanotechnology, Variation of physical properties from bulk to thin films to nanomaterials, Confinement of electron in 0D, 1D, 2D and 3D systems, Surface to Volume Ratio. Synthesis of Nanomaterials: Bottom-Up approach- Sol-gel, Precipitation, Hydrothermal. Top-Down approach- Ball milling technique, Sputtering, Laser Ablation.  
(9Hours)

#### Module - 2

**Characterization of Nanomaterials:** Basic working principles and instrumentations of Electron Microscopy –Transmission Electron Microscope, Scanning Electron Microscope, Scanning Probes- Atomic Force Microscope. Basic working principle of X-ray diffraction and Debye-Scherrer equation. Optical Spectroscopy- working principle and application of UV/VIS Spectroscopy.  
(8 Hours)

<b>Module – 3</b>
<b>Carbon Based Materials:</b> Introduction, Properties (electrical, Electronic and Mechanical), and Applications of Graphene, SWCNT, MWCNT, Fullerenes and other Carbon Materials: Carbon nanocomposites and nanofibers. (8 Hours)
<b>Module – 4</b>
<b>Nanotechnology in Energy storage and conversion:</b> Solar cells: First generation, second generation and third generation solar cells: Construction and working of Dye sensitized. Batteries: Nanotechnology in Lithium-ion battery- working, Requirements of anodic and cathodic materials, classification based on ion storage mechanisms. Fuel Cells: Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage. (9 Hours)
<b>Module – 5</b>
<b>Applications of Nanotechnology:</b> Introduction, Medicine and Healthcare Applications, Biological and Biochemical Applications, Electronic Applications, Computing Applications, Chemical Applications, Optical Applications, Agriculture and Food Applications. Recent Major Breakthroughs in Nanotechnology. (6 Hours)
<b>Course outcomes:</b> The students will be able to:
<b>CO1:</b> Analyze the variation of physical properties at the nanoscale and compare different approaches for nanomaterial synthesis. <b>CO2:</b> Analyze nanomaterials using suitable characterization techniques to interpret structural and optical properties. <b>CO3:</b> Evaluate the properties and applications of carbon-based for advanced technologies. <b>CO4:</b> Demonstrate the role of nanotechnology in enhancing the performance of solar cells, batteries, and fuel cells for efficient energy storage and conversion. <b>CO5:</b> Apply nanotechnology in healthcare, electronics, agriculture, and other domains.
<b>Suggested Learning Resources:</b>
<b>Textbooks:</b>
<ol style="list-style-type: none"> <li>1. Nano Materials – A.K. Bandyopadhyay/ New Age Publishers.</li> <li>2. Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science.</li> <li>3. Peter J. F. Harris, Carbon nanotube science: synthesis, properties, and applications. Cambridge University Press, 2011.</li> </ol>
<b>Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Nano Essentials- T. Pradeep/TMH</li> <li>2. M.A. Shah, K.A. Shah, “Nanotechnology: The Science of Small”, Wiley India, ISBN 13: 9788126538683</li> </ol>
<b>Continuous Comprehensive Assessments (CCA’s):</b>
Quiz: Students will write the quizzes to enhance the understanding of subject and which will

be further helpful for different standard competitive exams.

**Web links/e-resources:**

- <https://nptel.ac.in/courses/118104008>
- <https://www.digimat.in/nptel/courses/video/118104008/L16.html>
- <https://archive.nptel.ac.in/courses/113/106/113106099/>
- <https://nptel.ac.in/courses/112107283>

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER - VII

#### Wireless Sensor Networks (3:0:0) 3

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BEC704D</b>	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 challenges, technologies, architectures for wireless networks.
2. Describe the communication, energy efficiency, computing, storage and transmission
3. Establish infrastructure and simulations
4. Explain the concept of programming the in WSN environment

#### Preamble:

This Course, Wireless Sensor Networks involves exploring their architecture, communication protocols, power management strategies, and security challenges. This subject delves into highlighting the latest research trends and practical applications. By comprehensively examining WSNs, the challenges associated with their deployment and operation can be addressed.

#### Module - 1

**Introduction:** Evolution of wireless sensor networks, Significance and Scope of the course in economic growth of Nation, Impact of the course on Societal Problems, Career Perspective, Innovations, Research status/trends.

**Overview of wireless sensor networks:** Introduction, Single Node Architecture Hardware Components Network Characteristics unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks Types of wireless sensor networks. (8 Hours)

#### Module - 2

**Architectures:** Network Architecture Sensor Networks Scenarios Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments introduction to Tiny OS and nesC Internet to WSN Communication.

(8 Hours)

#### Module - 3

**Networking sensors:** MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts – SMAC, BMAC Protocol, IEEE 802.15.4 standard and ZigBee, Wakeup Radio Concepts, , Routing Protocols Energy Efficient Routing, Geographical Routing. (8 Hours)

<b>Module – 4</b>
<b>Infrastructure establishment:</b> Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control. <span style="float: right;">(8 Hours)</span>
<b>Module – 5</b>
<b>Sensor Network Platforms and Tools:</b> Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node level software platforms, Node level Simulators, State centric programming. <span style="float: right;">(8 Hours)</span>
<b>Course outcomes:</b> The students will be able to:
<p><b>CO1:</b> Comprehend challenges, technologies, architectures for wireless networks.</p> <p><b>CO2:</b> Apply the knowledge of WSN to establish different routing schemes.</p> <p><b>CO3:</b> Analyse the different types of topologies of WSN.</p> <p><b>CO4:</b> Analyse the routing protocols for WSN using simulators.</p>
<b>Suggested Learning Resources:</b>
<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Holger Karl &amp; Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.</li> <li>2. Feng Zhao &amp; Leonidas J. Guibas, "Wireless Sensor Networks An Information Processing Approach", Elsevier, 2007.</li> <li>3. Waltenege Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley &amp; Sons Publications, 2011</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Kazem Sohraby, Daniel Minoli, &amp; Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley, 2007.</li> <li>2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003</li> <li>3. Ian F. Akyildiz &amp; Mehmet Can Vuran, "Wireless Sensor Networks", John Wiley 2010</li> <li>4. Jun Jheng, Abbas Jamalipour, "Wireless sensor networks A networking Perspective", John Wiley, 2009</li> </ol>
<b>Continuous Comprehensive Assessments (CCA's):</b>
<ul style="list-style-type: none"> <li>• Mini Project: The students have to take up mini projects on WSN protocols or application in a team(not more than 4 students) . The evaluation of AAT is based on project work demonstration and Report submission.</li> </ul>
<b>Web links/e-resources:</b>
<ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/106105160">https://nptel.ac.in/courses/106105160</a>,</li> <li>• <a href="https://archive.nptel.ac.in/courses/106/105/106105160/">https://archive.nptel.ac.in/courses/106/105/106105160/</a></li> </ul>

# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

## B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

### SEMESTER-VII

#### Advanced Communication Laboratory (0:0:2) 1

Effective from the Academic Year 2025-26 (2022 Scheme)

Course Code	<b>BECL706</b>	CIE Marks	50
Teaching Hours/Week L:T:P)	0:0:2	SEE Marks	50
Total Number of Contact Hours	26	Exam Hours	03

#### Course objectives:

This course will enable students to

1. Assess the characteristics of microwave devices and antennas through the analysis and interpretation of experimental results, applying theoretical knowledge to practical scenarios.
2. Use modern tools to evaluate the performance of digital modulation techniques.

#### Preamble:

The Advanced Communication System Laboratory covers design and verification of the concepts of modern communication systems that operates in MHz-THz range. The main focus of the Advanced Communication System (ACS) Laboratory is to design next-generation wireless technologies and mobile computing systems. In particular, ACS Laboratory conducts research in the broad area of communication theory, wireless communications and networks, with focus on the optical communication systems – Optical fiber based.

#### Experiments using Hardware

1. Infer the insertion and isolation characteristics of a circulator, directional coupler, and Magic Tee.
2. Measure the VSWR, frequency, guide wavelength and unknown impedance of a load using a slotted line section assembly.
3. Analyze the radiation pattern characteristics of a horn antenna.
4. Modulate and demodulate digital modulation schemes: BPSK, FSK.
5. Modulate and demodulate digital modulation schemes: QPSK, DPSK.
6. Modulate and demodulate signals using line coding techniques.
7. Interpret the transmission loss, bending loss, and numerical aperture of optical fibers.

#### Experiments using Software (MATLAB, SCILAB, HFSS etc)

1. Design and analyze a microstrip patch antenna using HFSS.
2. Analyze the electric field distribution in Magic Tees using HFSS.
3. Interpret the performance (BER) of BPSK and FSK using MATLAB.

### Open Ended Experiments

1. Demonstrate the application of different digital modulation techniques in next-generation wireless communication systems.
2. Measure the field intensity of a parabolic antenna.
3. Design and analyze a reconfigurable microstrip patch antenna for 5G applications.

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

**CO1:** Assess the characteristics of microwave devices and antennas based on experimental results.

**CO2:** Clarify the principles and mechanisms underlying transmission loss, bending loss, and numerical aperture in optical fibers.

**CO3:** Evaluate the performance of digital modulation techniques by comparing metrics such as Bit Error Rate (BER) in the presence of noise.

**CO4:** Tailor the report for the conducted experiment.

**CO5:** Conduct open ended experiments to measure/check the characteristics of RF devices/components.

### Suggested Learning Resources:

#### Textbooks:

1. John D. Kraus, "Antennas for all practical applications", 4th Edition, McGraw Hill, 2011.
2. Samuel Liao, "Microwave Devices and circuits", 3rd Ed, Pearson Education, 2008.
3. David M Pozar, "Microwave Engineering", 4th Edition, John Wiley, 2011.
4. Simon Haykin, "Digital Communication Systems", John Wiley & sons, First Edition, 2014, ISBN 978-0-471-64735-5.

#### Reference Books:

1. Annapurna Das and Sisir K Das, "Microwave Engineering", TMH Publication, 2nd, 2010.
2. Stutzman & Thiele, "Antenna Theory & Design" 2nd Edition, Wiley, 2010.
3. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.

### Continuous Comprehensive Assessments (CCA's):

Open Ended experiments

### Web links/e-resources:

<https://universe.bits-pilani.ac.in/hyderabad/EEE/AdvancedCommunicationLab>