NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY GREATER NOIDA, GAUTAM BUDDH NAGAR

(An Autonomous Institute)

Affiliated to

Dr. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH LUCKNOW

Evaluation Scheme & Syllabus

For

B. Tech Working Professional in Electronics & Communication Engineering (ECE-WP)

Fourth Year

(Effective from the Session: 2026-27)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute)

B. TECH (ECE-WP)

Evaluation Scheme

SEMESTER VII

S. No.	Subject Codes	Subject Name	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	BEC0701	Optical Communication and Network	Mandatory	3	0	0	30	20	50		100		150	3
2		Departmental Elective-V	Departmental Elective	3	0	0	30	20	50		100		150	3
3		Open Elective – II	Open Elective	2	0	0	30	20	50		100		150	3
4		Open Elective – III	Open Elective	2	0	0	30	20	50		100		150	3
5	BEC0751	Optical Communication & Networking Lab	Mandatory	0	0	2				25		25	50	1
6	BEC0759	Industrial Assessment	Mandatory	0	0	4				100			100	2
7	BEC0758	Capstone Project-I	Mandatory	0	0	8				100		100	200	4
		Massive Open Online Courses (For B.Tech. Hons. Degree)	*MOOCs											
			TOTAL	**10**	**0**	**14**	**120**	**80**	**200**	**225**	**400**	**125**	**950**	**19**

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam, CE: Core Elective, OE: Open Elective, DE: Departmental Elective, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

*** List of MOOCs (Infosys) Based Recommended Courses for Fourth year B. Tech Students**

S. No.	Subject Code	Course Name	University/ Industry Partner Name	No. of Hours	Credits
1.	BMC0110	Fundamentals of Data Networking	Infosys Wingspan (Infosys Springboard)	35h 42m	2.5
2.	BMC0144	Kubernetes Course from a DevOps guru (Kubernetes + Docker)	IIHT	7h 56m	0.5
3.	BMC0145	Mastering Go Programming	IIHT	21h 12m	1.5

List of Department Elective:

S. No.	Subject Code	Subject Name	Bucket Name	Semester
1	BEC0711	Data Analytics	Artificial Intelligence	VII
2	BEC0712	Low Power VLSI Design	Embedded & VLSI	VII
3	BEC0713	Real Time Operating System	Embedded & Robotics	VII

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA

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B. TECH (ECE-WP)

Evaluation Scheme

SEMESTER VIII

S. No	Subject Codes	Subject Name	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1		Open Elective - IV	Open Elective	2	0	0	30	20	50		50		100	2
2	BEC0858 / BEC0859	Capstone Project – II / Industrial Internship	Mandatory	0	0	16				200		200	400	8
		*Massive Open Online Courses (For B.Tech. Hons. Degree)	*MOOCs											
			TOTAL	**2**	**0**	**16**	**30**	**20**	**50**	**200**	**50**	**200**	**500**	**10**

*** List of MOOCs (Infosys) Based Recommended Courses for Fourth year B. Tech Students**

S. No.	Subject Code	Course Name	University/ Industry Partner Name	N. of Hours	Credits
1.	BMC0162	Fundamentals of Routing 101	Infosys Wingspan (Infosys Springboard)	46h 54m	3.5
2.	BMC0027	Network Fundamentals	Infosys Wingspan (Infosys Springboard)	37h 57m	3
3.	BMC0116	Introduction to Generative AI – Artificial intelligence and Machine Learning	NASSCOM	15h	1

Abbreviation Used:

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NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA
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AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Infosys Springboard/NASSCOM/CISCO (as applicable) certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Infosys Springboard/NASSCOM/CISCO (as applicable) registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

i. If he / she secures 7.50 as above CGPA.
ii. Passed each subject of that degree program in the single attempt without any grace.
iii. Successful completion of MOOCs based 20 credits

Course Code: BEC0701	Course Name: Optical Communication and Network	L	T	P	C
Course Offered in: B.Tech. ECE		3	0	0	3

Pre-requisite: Analog and Digital Communication

Course Objectives: To Know

This course introduces the fundamentals of optical communication systems, including optical fibers, sources, and signal transmission characteristics. It covers propagation losses, dispersion mechanisms, multiplexing techniques, optical switching, and modern optical network technologies, enabling students to analyze and design efficient optical communication networks.

Course Outcome: After completion of the course, the student will be able to		**Blooms' Level**
CO1	Explain the basic concepts of optical communication.	K2
CO2	Describe the signal losses and dispersion mechanism occurring inside the optical fiber cable.	K2
CO3	Compare the optical sources used in optical communication with their comparative study.	K2
CO4	Explain different multiplexing techniques, second generation optical networks, optical layer, and optical packet switching.	K2
CO5	Analyze the working of Different types of optical network technologies.	K4

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	2

Course Contents / Syllabus

Unit 1	**Introduction to Optical Communication**	**9 hours**

Optical Spectral Band with Operating Windows, General Communication System, Optical Communication System with its advantages. Optical Fiber Waveguides: Ray Theory of Transmission with TIR, Acceptance Angle, Numerical Aperture and Skew Rays, Electromagnetic Mode Theory for Optical Propagation, Modes in a Planar Guide, Phase and Group Velocity, Phase Shift with Total Internal Reflection, Evanescent Field, Goos-Haenchen Shift, Cylindrical Fiber Modes, Mode Coupling, Step Index fibers Vs Graded Index fibers, Single Mode Fibers- Cut off wavelength, MFD & Spot Size.

Unit 2	**Decision Control and Looping Statements**	**9 hours**

Attenuation, Material Absorption Losses (Intrinsic and Extrinsic absorption), types of Linear and Non-Linear Scattering Losses, Fiber Bending Losses, Kerr Effect. Dispersion: Introduction with its types: Chromatic / Intramodal Dispersion (Material and Waveguide Dispersion), Intermodal dispersion (for MSI and MGI fibers), Overall (Total) Fiber Dispersion in Multimode and Singe Mode Fiber, Dispersion Modified Single Mode Fibers, Polarization & Fiber Birefringence.

Unit 3	**Optical Sources**	**9 hours**

LEDs-Introduction to LEDs & Materials used for fabrication, LED Power and Efficiency, LED Structures, LED Characteristics, Modulation Bandwidth, Laser Diodes and Photo Detector-Introduction, Optical Feedback & Laser Oscillations, Resonant Frequencies, Physical Principles of Photodiodes: The PIN Photo Detector, Avalanche Photodiodes, Temperature Effect on Avalanche Gain, Detector Response Time.

Unit 4	**Introduction to Optical Network**	**9 hours**

Optical Networks: multiplexing techniques, second generation optical networks. The optical layer, optical packet switching. Transmission Basics: wavelength, frequencies and channel spacing, wavelength standards. Nonlinear Effects: Effective length and area, stimulated Brillouin scattering, stimulated Raman scattering, Propagation in a nonlinear medium, self-phase modulation, cross phase modulation Four wave mixing.

Unit 5	Optical Networks Technologies	9 hours
SONET/SDH: Multiplexing, SONET/SDH layers, SONET Frame structure, SONET/SDH physical layer, Elements of a SONET/SDH infrastructure. ATM: Function of ATM, Adaptation layers, Quality of service. IP: Routing and forwarding, QOS, WDM Network elements: Optical line terminals, Optical line amplifiers, Optical add/Drop multiplexers: Architecture, reconfigurable OADMS, Optical cross connects: All optical OXC configuration.		
	Total Lecture Hours	**45 hours**

Textbook:

1. John M. Senior, "Optical Fiber Communications", PEARSON, 3rd edition.
2. R. Ramaswami, & K. N. Siva rajan,"Optical Networks a Practical perspective", Morgan Kaufmann Publishers, 3Ed.
3. U. Black,"Optical Networks: Third Generation Transport Systems", Pearson Educations.

Reference Books:

1. Biswanath Mukherjee, "Optical WDM Networks", Springer Pub 2006.
2. Govind P. Agrawal, "Fiber Optic Communication Systems", John Wiley, 3rd Edition, 2004.

Self-Study Content Links:		**Duration (in Hrs)**
MOOCs		
Video Lectures	https://www.youtube.com/watch?v=PnBxq0-FisA&list=PLbMVogVj5nJQxs7jmzJkGENCYYL-WnP_F&index=5 https://www.youtube.com/watch?v=BGUhTDWkwx8&list=PLbMVogVj5nJQxs7jmzJk GENCYYLWnP_F&index=9 https://www.youtube.com/watch?v=wwdtDcu5yAE&list=PLbMVogVj5nJQxs7jmzJkGE NCYYLWnP_F&index=12 https://www.youtube.com/watch?v=4W7hieXDAmc&list=PLHj96QRJ0kOhH8xoXXrOg kMf9ZOvjh qYl&index=114 https://www.youtube.com/watch?v=f5EmFoXlYyQ&list=PLHj96QRJ0kOhH8xoXXrOg kMf9ZOvjhq Yl&index=115	
Web References		

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

Course Code: BEC0711	Course Name: Data Analytics	L	T	P	C
Course Offered in: B.Tech. EE (VLSI)		3	0	0	3

Pre-requisite: Basic Programming, Basics of digital electronics

Course Objectives:

To equip students with the principles of data analytics, data preprocessing, exploratory analysis, and visualization tools for interpreting and deriving insights from diverse application-oriented datasets.

Course Outcome: After completion of the course, the student will be able to		**Blooms' Level**
CO1	Describe the fundamental concepts of data analytics in the areas that plays major role within the realm of data science	**K2**
CO2	Explain and exemplify the most common forms of data and its representations.	**K2**
CO3	Apply data pre-processing techniques on heterogeneous datasets.	**K3**
CO4	Analyze data using exploratory data analysis	**K4**
CO5	Apply visualization tool to analyze and draw inference from different types of data sets w.r.t different application scenarios.	**K3**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	-	-	-	-	2	2	2	2
CO2	3	2	2	-	3	-	-	-	-	-	2	2	3	2
CO3	3	3	2	-	3	-	-	-	-	-	2	3	3	2
CO4	3	3	3	-	3	-	-	-	-	-	2	2	3	2
CO5	3	2	3	-	3	-	-	-	-	-	2	2	2	2

Course Contents / Syllabus

Unit 1	**Foundations of Data Science: Concepts, Tools, and Applications**	**9 hours**

Introduction to Data Science, Evolution of Data Science, Skillsets needed, Lifecycle, Need for Data Science, Datafication, Types of Data Analysis, Data Science Tools and technologies, Analysis Vs Analytics Vs Reporting, Applications of Data Science in various fields, Use cases of Data science-Facebook, Netflix, Amazon, Uber, AirBnB.

Unit 2	**Data Types and Statistical Foundations**	**9 hours**

Types of Data: structured, semi-structured, unstructured data, Numeric, Categorical, Graphical, High Dimensional Data, Transactional Data, Spatial Data, Social Network Data, standard datasets, Sources of Data, Data manipulation in various formats, for example, CSV file, import and export data in R/Python. Measure of central tendency (Mean, Median, Mode), Central limit theorem, Skewness, Variance, SD, Covariance, Correlation, Normal distribution, Margin of Error.

Unit 3	**Data Preprocessing and Visualization**	**9 hours**

Form of Data Pre-processing, data Attribute and its types, KDD process, Inconsistent Data, Data Cleaning: Missing Values, Noisy Data, Discretization and Concept hierarchy generation (Binning, Clustering, Histogram), Data Integration and Transformation. Data Reduction: Data Cube, Data Compression, Numerosity Reduction, R-Square, Adjusted R-Square, Significance of p-value.

Unit 4	**Data Cleaning, Transformation, and Exploration**	**9 hours**

Variable Selection, Removing Redundant variables, identifying outliers, Removing Outliers, Time series Analysis, Data transformation and dimensionality reduction techniques such as Principal Component Analysis (PCA), Factor Analysis (FA) and Linear Discriminant Analysis (LDA), Univariate and Multivariate Exploratory Data Analysis. Data Wrangling using R/Python.

Unit 5	**Data Visualization with Tableau**	**9 hours**

Introduction to Tableau, Installation and configuration of Tableau. Creating Your First visualization: Getting started with Tableau Software, Using Data file formats, connecting your Data to Tableau, creating basic charts using the Show me panel. Tableau Calculations: Overview of SUM, AVR, and Aggregate Features, creating custom calculations and fields, Manipulating Data in Tableau: Cleaning-up the data with the Data Interpreter, structuring your data, Sorting, and filtering Tableau data, Pivoting Tableau data. Advanced Visualization Tools: Using Filters, Using the Detail panel, Using the Size panels, customizing filters, Using and Customizing tooltips, formatting your data with colors, Creating Dashboards & Stories, Distributing & Publishing Your Visualization

Total Lecture Hours	**45 hours**

Textbook:

1. John Wiley & Sons, Data Analysis and Data Mining, 2nd Edition, John Wiley & Sons Publication, 2014.
2. Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007

Reference Books:

1. John Wiley & Sons, The Data Science Handbook, Field Cady, John Wiley & Sons, Inc, 2017.
2. Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann, Data Mining Concepts and Techniques, Third Edition, 2012.

Self-Study Content Links:		**Duration (in Hrs)**
MOOCs		
Video Lectures	https://www.youtube.com/playlist?list=PLEiEAq2VkUUKgEFXH1tBbHwq38oWYDScU https://www.youtube.com/watch?v=dcXqhMqhZUo https://www.youtube.com/watch?v=VaSjiJMrq24 https://www.youtube.com/watch?v=tDu_KIlXaB0 https://www.youtube.com/watch?v=ZX8vmcSTCrc https://www.youtube.com/watch?v=I3450sh1eDo	
Web References		

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

Course Code: BECVL0712	Course Name: Low Power VLSI Design	L	T	P	C
Course Offered in: B.Tech. EE (VLSI)		3	0	0	3

Pre-requisite: Basic knowledge of Digital Electronics, CMOS circuits, MOSFET operation, and VLSI Design fundamentals.

Course Objectives:

This course provides an understanding of power dissipation in digital integrated circuits and introduces low-power VLSI design techniques for energy-efficient system design. It covers the design and analysis of low-power, high-speed arithmetic circuits such as adders and multipliers, along with low-voltage memory architectures. The course enables students to evaluate and apply power optimization strategies while maintaining system performance and reliability.

Course Outcome: After completion of the course, the student will be able to		**Bloom's Level**
CO1	Demonstrate the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.	**K3**
CO2	Illustrate the different low-power design approaches and optimization of switched capacitance.	**K3**
CO3	Discuss the different low-power high speed adders.	**K2**
CO4	Apply the concepts of low voltage and low power to different multipliers.	**K3**
CO5	Apply the concepts of low voltage and low power to different memories.	**K3**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2

Course Contents / Syllabus

Unit 1	**Fundamentals of Low Power VLSI Design**	**9 hours**

Need for Low Power Circuit Design, Sources of Power Dissipation — Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation-Reverse diode leakage current, Sub threshold leakage current, Glitching Power Dissipation.

Unit 2	**Low Voltage Process Technology**	**9 hours**

Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach — Pipelining and Parallel Processing Approaches. Estimation and Optimization of Switching Activity: The Concept of Switching Activity, Reduction of Switching Activity, Reduction of Switched Capacitance-System Level Measures, Circuit Level Measures, and Mask level Measures.

Unit 3	**Low-Voltage Low-Power Adders**	**9 hours**

Introduction, Standard Adder Cells, CMOS Adder's Architectures — Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Carry Skip Adders.

Unit 4	**Low-Voltage Low-Power Multipliers**	**9 hours**

Overview of Multiplication, Booth Multiplier-Booth's algorithm, modified Booth algorithm, Introduction to Tree Multiplier (Wallace and Dada multipliers) and 4:2 Compressors.

Unit 5	**Low Power Random Access Memory Circuits**	**9 hours**

Sources of power dissipation in SRAMs, Low power SRAM circuit techniques, Sources of power dissipation in DRAMs, Low power DRAM circuit techniques.

	Total Lecture Hours	**45 hours**

Textbook:

	Authors Name
1.CMOS Digital Integrated Circuits — Analysis and Design, TMH, 2011	Sung-Mo Kang, Yusuf Leblebici
2.Low-Voltage, Low-Power VLSI Subsystems, TMH Professional Engineering., 7th Edition, 2004,	Kiat-Seng Yeo, Kaushik Roy

Reference Books:		
		Authors Name
1. Principles of CMOS VLSI Design, 2nd Edition, Addison Wesley (Indian reprint),		Neil H. E. Weste and K. Eshraghian.
2. Low Power VLSI CMOS Circuit Design, Kluwer Academic Press, 1995,		Bellamour, and M. I. Elmasri.
3. Low Power Digital CMOS Design, Kluwer Academic Publishers, 1995,		Anantha P. Chandrakasan and Robert W. Brodersen.
4. Low-Power CMOS VLSI Design, Wiley-Interscience, 2000.		Kaushik Roy and Sharat C. Prasad
Self-Study Content Links:		Duration (in Hrs)
MOOCs		
Video Lectures	https://www.youtube.com/watch?v=C8kiblD2riw&list=PL1wj50dotxPPsCrF16rHnkfID1TP2LJ5Z	00Hrs 25Min
	https://www.youtube.com/watch?v=0ykJeTGqv6M&list=PLB3F0FC99B5D89571&index=27	01Hrs 51Min
	https://www.youtube.com/watch?v=K2kL7pMnL_0&list=PLVDb88QIgXkeeUo6I2oudLvc76GbLGrTi	03Hrs 48Min
	https://www.youtube.com/watch?v=ORtlxpW_LMU&t=10s	10Hrs 17Min
	https://www.youtube.com/watch?v=EMcW9EggY0s	01Hrs 25Min
	https://www.youtube.com/watch?v=jK6xr4r06tU&list=PLB3F0FC99B5D89571&index=16	00Hrs 55Min
Web References		

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

Course Code: BEC0713	Course Name: Real Time Operating System	L	T	P	C
Course Offered in: B. Tech ECE		3	0	0	3

Pre-requisite: Basic fundamental of microprocessor, microcontroller & Embedded System

Course Objectives:

This course develops problem-solving skills through programming by enabling students to analyze computational problems, design algorithms, and write effective pseudocode. It emphasizes the selection of appropriate data representations and programming constructs while building a strong foundation that facilitates learning advanced programming languages and real-time operating system concepts.

Course Outcome: After completion of the course, the student will be able to		**Bloom's Level**
CO1	Explain the basics Embedded Operating System internals.	**K2**
CO2	Describe the basic concepts of RTOS.	**K2**
CO3	Apply the concepts of Process and Task Scheduling.	**K3**
CO4	Implement strategies to interface memory and I/O with RTOS kernel.	**K3**
CO5	Analyze the architecture of CMSIS-RTOS & process of RTX task management.	**K4**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	-	-	-	-	-	2	2	3
CO2	2	2	2	-	-	-	-	-	-	-	-	2	2	3
CO3	2	2	2	-	-	-	-	-	-	-	-	2	2	3
CO4	2	2	2	-	-	-	-	-	-	-	-	2	2	3
CO5	2	2	2	-	-	-	-	-	-	-	-	2	2	3

Course Contents / Syllabus

Unit 1	**Linux Internals**	**9 hours**

Linux internals: Process Management, File Management, Memory Management, I/O Management. Overview of POSIX APIs, Threads – Creation, Cancellation, POSIX Threads Inter Process Communication – Semaphore, Pipes, FIFO, Shared Memory Kernel: Structure, Kernel Module Programming, Interfacing: Serial, Parallel Interrupt Handling Linux Device Drivers: Character, USB, Block & Network.

Unit 2	**OS Overview**	**9 hours**

OS overview: OS components, OS structure, Types of Operating Systems, Basics of RTOS: Real-time concepts, Characteristics of RTOS, Architecture of RTOS, Classification of RTOS: Hard Real time and Soft Real-time, Firm real time system, Advantage and disadvantage of RTOS.

Unit 3	**Process Management**	**9 hours**

Process: Introduction, Memory lay out of an executing program, Process types, Schedulers and Types of scheduling, Scheduling Process control block, Process creation, Process Termination, Context Switching and States.

Unit 4	**Concurrency & Memory Management**	**9 hours**

Concurrency: Concurrency Scheduling, Multiprocessing environment, Read-write by multiple CPUs and consistency problem, Solutions with Mutual Exclusion, Hardware Mutex, Software Mutex, Example: Dekker's algorithm, Semaphore, Deadlock, Banker's algorithm. Memory Management: Processes Need Memory, Address Binding & its types, Memory Hierarchy, Virtual Memory, Memory Partitioning, Paging, Segmentation with Paging, File System, File Structure, Directory Structure, Disk, Interrupt & DMA.

Unit 5	**Introduction to RTX**	**9 hours**

RTX: RTX structure, RTX files, RTX task and time management, Simple Time Management APIs, Task Priority Scheme in RTX, Inter-Task Communication, Event, Interrupt, Mutex, Semaphore, Mailboxes and Messages in RTX, RTX control functions, Architecture of CMSIS-RTOS.

	Total Lecture Hours	**45 hours**

Textbook:

	Authors Name
1. Real-Time Operating Systems for ARM Cortex-M Microcontrollers, 4th Edition.2017.	Jonathan W. Valvano.
2.Real-Time Concepts for Embedded Systems, CMP Books, Elsevier, 2003.	Qing Li and Carolyn Yao.

3. The Real-Time Kernel, CMP Books 2002.		Jean J. Labrosse.
Reference Books:		
		Authors Name
1. Embedded Systems: Architecture, Programming and Design, McGraw Hill, 2017.		Raj Kamal.
2. Building Embedded Linux Systems, O'Reilly Publications.2008.		Karim Yaghmour.
Self-Study Content Links:		**Duration (in Hrs)**
MOOCs		
Video Lectures	1.https://nptel.ac.in/courses/106106144 2.https://nptel.ac.in/courses/106105159 3. https://nptel.ac.in/courses/106105159 4.https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs78 5. https://www.youtube.com/watch?v=OrM7nZcxXZU 6. https://www.youtube.com/watch?v=eESIFJz7mJw 7. https://www.youtube.com/watch?v=Rtewg5tbjqY	00Hrs 25Min 01Hrs 51Min 03Hrs 48Min 10Hrs 17Min 00Hrs 25Min 01Hrs 30Min 01Hrs 45Min 00Hrs 53Min
Web References		

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

Course Code: XXXXXX	Course Name: Sensor Technology	L	T	P	C
Course Offered in: B. Tech ECE		2	0	0	3

Pre-requisite: Knowledge of basic semiconductor devices and principle

Course Objectives:

To provide students with the fundamental concepts of smart sensors and IoT technologies, enabling them to understand sensor principles, industrial sensing applications, and IoT device architectures. The course also aims to develop the ability to apply IoT-based solutions for real-world societal and industrial challenges.

Course Outcome: After completion of the course, the student will be able to		**Bloom's level**
CO1	Explain various real time products using smart sensors.	**K2**
CO2	Use the sensors for measurement of displacement, force, and pressure.	**K3**
CO3	Employ and analyze commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, and level.	**K4**
CO4	Explain the key elements of an IoT device.	**K2**
CO5	Analyze challenges, and issues related to IoT and apply IoT on social society problems.	**K4**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	2	2	2	2
CO2	3	3	2	-	-	-	-	-	-	-	2	3	3	2
CO3	3	3	2	-	-	-	-	-	-	-	2	3	3	2
CO4	3	2	2	-	-	-	-	-	-	-	2	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	2	3	3	2

Course Contents / Syllabus

Unit 1	**Sensors & Transducers**	**9 hours**

Sensors, Actuators & Transducers: Definition, Classification of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT-based diaphragm & piezoelectric sensor, Introduction to sensors most widely used in computer and mobile phones: Temperature, Pressure, Humidity, Toxic Gas, pH sensor, sound sensor, magnetic field sensor, Motion (Infra-red) sensor, barometer, and Gyroscope.

Unit 2	**Measurement of physical parameters**	**9 hours**

Measurement of temperature using Thermistors, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Working Principles of Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.

Unit 3	**Hardware and Advanced Sensors**	**9 hours**

RFID Principles and components, Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Selection of Sensors for Practical Applications, Application of smart sensors: Automatic robot control & automobile engine control.

Unit 4	**Introduction to IoT and its basic fundamentals**	**9 hours**

Basics of Computer Networking and its Topologies, OSI Model, TCP/IP Protocol Introduction to IoT and its Characteristics, IoT Architectures and its Physical & Logical Design, Enabling Technologies in IoT, M2M Communication, Suite.

Unit 5	**IoT Development Boards and Use Cases**	**9 hours**

IoT Development Boards: Arduino IDE and Board Types, Arduino IDE coding, Libraries, Raspberry Pi, Node MCU, Communication Technologies: Zigbee, BLE, Use Cases: Smart Cities, Home Automation, Smart Street Light, Smart Hospitals

	Total Lecture Hours	**45 hours**

Textbook:

1. "Sensors Handbook", Second Edition Jan 2010, Sabrie Soloman.
2. "Sensors and Instrumentation" Dhanpat Rai & Co. 2014, A.K. Sawhney.
3. "The Internet of Things" Pearson. 1st Edition March 2015, Michael Miller.

Reference Books:

1. "Raspberry Pi Cookbook", O'Reilly, Fourth Edition 2022, Simon Monk
2. "Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects" O'Reilly, Third Edition 2020. Projects" O'Reilly, Third Edition 2020. Brian Jepson, Michael Margolis, Nicholas Robert Weldin
3. "Intelligent Technologies for Sensors-Applications, Design, and Optimization for a Smart World" 2023, S. Kannadhasan, R. Nagarajan, Alagar Karthick.

Self-Study Content Links:		**Duration (in Hrs)**
MOOCs		
Video Lectures	1. https://www.arduino.cc/en/software. 2. https://www.raspberrypi.com/ 3. https://nptel.ac.in/courses/108108147 4. https://www.youtube.com/watch?v=wn1UCt9Z6NQ&t=56s 5. https://www.youtube.com/watch?v=GfaHdjApnhU.	10 hours
Web References		

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

Course Code: XXXXXX	Course Name: Wireless Communication	L	T	P	C
Course Offered in: B.Tech. ECE		2	0	0	3

Pre-requisite: Basic Knowledge of Digital Communication

Course Objectives: To Know

To provide students with the fundamental concepts of wireless and cellular communication systems, including mobile communication generations, wireless propagation, and multiple access techniques. The course also aims to develop an understanding of modern wireless technologies and their applications in contemporary communication networks.

Course Outcome: After completion of the course, the student will be able to		**Blooms Level**
CO1	Explain various generations of mobile communications.	K2
CO2	Explain the concept of cellular communication.	K2
CO3	Describe the basics of wireless communication.	K2
CO4	Explain and differentiate contention free and contention based multiple access techniques.	K2
CO5	Explain Various modern wireless technologies.	K2

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	2

Course Contents / Syllabus

Unit 1	**Introduction of Wireless Communication**	**9 hours**

History and evolution of mobile radio systems. General Model of Wireless Communication Link Types of mobile wireless services/systems-Cellular, WLL, Paging, Satellite Systems, Future trends in personal wireless systems.

Unit 2	**Cellular Concepts and System Design Fundamentals**	**9 hours**

Cellular Infrastructure, Cellular System Components, Antennas for Cellular Systems, Operation of Cellular Systems, frequency reuse, channel assignment, handoff strategies, Interference and system capacity.

Unit 3	**Mobile Radio Propagation Models**	**9 hours**

Radio wave propagation issues in personal wireless systems, Propagation models, Channel Noise and Losses, Fading in Land Mobile Systems, Multipath Fading, Fading Effects on Signal and Frequency, Shadowing; Wireless Channel Modeling: AWGN Channel, Rayleigh Channel.

Unit 4	**Equalization, Diversity Techniques & Multiple Access Techniques**	**9 hours**

Equalization, Rake receiver concepts, Diversity Techniques, Linear predictive coders and channel coding. Multiplexing and Multiple Access: FDMA, TDMA, CDMA, OFDMA, Multiple Access for Radio Packet Systems: Pure ALOHA, Slotted ALOHA, CSMA and their versions; Packet and Pooling Reservation Based Multiple Access Schemes.

Unit 5	**Wireless Systems & Standards**	**9 hours**

GSM system for mobile Telecommunication, General Packet Radio Service, Edge Technology; CDMA 2000, IMT 2000 and UMTS, Long Term Evolution (LTE), Introduction to Mobile Adhoc Networks, Li-Fi Communication, Ultra-Wideband Communication, Mobile data networks, Introduction to 4G, 5G and concept of NGN.

	Total Lecture Hours	**45 hours**

Textbook:

1.T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson Publications, Second Edition.

2. Upena Dalal, “Wireless Communication and Networks”, Oxford Press Publications.

3. T L Singal, “Wireless Communications”, McGraw Hill Publications.

Reference Books:

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press.

2. S. Haykin & M. Moher, “Modern wireless communication”, Pearson, 2005.

Self-Study Content Links:		**Duration (in Hrs)**
MOOCs		
Video Lectures	https://www.youtube.com/watch?v=JCGMP37-2EA https://www.youtube.com/watch?v=f2wlHL1Sok8 https://www.youtube.com/watch?v=0PWILK-hqbQ https://www.youtube.com/watch?v=SFcRtZ30rqs https://www.youtube.com/watch?v=tePZhxRLsjE&feature=youtu.be https://www.youtube.com/watch?v=GLmF3YB0pQU&feature=youtu.beyoutube.com/watch?v=QHqZwBoTJRY&feature=youtu.be https://www.youtube.com/watch?v=t3FVP5wuG4g https://www.youtube.com/watch?v=ixY0Cau4mBM	
Web References		

Note: Self-study material may include assignments, seminars, micro projects, industrial visits, any other student activities, etc.

Course Code: BEC0751	Course Name: Optical Communication & Networking Lab	L	T	P	C
Course Offered in: B. Tech ECE		0	0	2	1

Pre-requisite: Basics of Communication Lab & Networking

Course Objectives:

To provide hands-on experience in optical communication and networking by exploring multiplexing techniques, electromagnetic interference, and network protocol configuration. The course also aims to develop the practical skills required to design, implement, and analyze optical communication systems.

Course Outcome: After completion of the course, the student will be able to		**Blooms Level**
CO1	Perform Multiplexing in optical fiber communication.	K3
CO2	Demonstrates the concept of Electromagnetic Interference on an optical fiber. medium.	K4
CO3	Implement File transfer protocol Configuration in optical networking.	K4
CO4	Design optical communication system.	K6

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	3	2		2	-	-				2	2	2	1
CO2	3	3	3		2	-	-				2	3	3	2
CO3	3	3	3		2	-	-				2	3	3	2
CO4	3	3	3		2	-	-				2	3	3	2

List Of Practical's (Indicative & Not Limited To)

S. No.	List of Experiments	COs
1	Setting up fiber optic analog link using ST-2502 Fiber Optics Trainer and Digital Multimeter.	CO1
2	Study of a 650nm fiber optic analog link in this experiment and establish the relation between the input signal and received signal.	CO1
3	Study and perform time division multiplexing (digital) through optical fiber link with help of ST-2502 Fiber	CO2
4	Manchester coding and decoding by using ST-2502 Fiber Optics Trainer and CRO/DSO	CO2
5	Measure the characteristics of fiber optic LED's and photodetector. Study and draw I-V Characteristics of Fiber optic LED and Photodetector.	CO2
6	To compare the effect of Electromagnetic Interference on a copper medium and on an optical fiber medium and Measurement of bending loss and propagation loss in the fiber.	CO3
7	Identify Cat5 cable, RJ 45 Connector, Crimping Tool, Wire Stripper.	CO3
8	Use Wire Stripper for Cutting wire shield and Understanding of Internal Structure of Cat 5 Cable	CO4
9	Finding Pin No-1 on RJ 45 Connector and Inserting Wires in connector	CO4
10	Working of a router & method to access the router via console or using telnet, different types of cables used for connectivity	CO4
11	Internet Information Services tool and its installation	CO4
12	To implement a simple file transfer protocol (FTP) using connection-oriented and connectionless sockets	CO4

Total Hours: 15 hrs.