Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
(Deemed to be University)
Maduravoyal, Chennai - 600 095. Tamilnadu. India.
(An ISO 9001 : 2015 Certified Institution)
Department of Electronics and Communication Engineering

BACHELOR OF TECHNOLOGY
ELECTRONICS AND COMMUNICATION ENGINEERING (PART TIME)
CURRICULUM & SYLLABUS - 2018-REGULATION

Semester : 1

S.NO	Course Code	Course Title	T / L/ ETL	L	T/SLr	P/R	C
1	BEC18002	CIRCUITS AND NETWORKS	Ty	3	1/0	0/0	4
2	BCS18I01	C PROGRAMMING WITH LINUX	Ty	3	0/0	0/0	3
3	BEC18003	DIGITAL ELECTRONICS	Ty	3	1/0	0/0	4
4	BEC18ET1	ELECTRICAL MACHINES AND PCB DESIGN	ETL	1	0/1	3/0	3
5	BEC18L02	DIGITAL SYSTEM DESIGN LAB	Lb	0	0/0	3/0	1

Credits Sub Total: 15

Semester: 2

S.NO	Course Code	Course Title	T / L/ ETL	L	T/SLr	P/R	C
1	BMA18007	PROBABILITY AND RANDOM PROCESS	Ty	3	1/0	0/0	4
2	BCS18I02	COMPUTER COMMUNICATION	Ty	3	0/0	0/0	3
3	BEC18004	SOLID STATE DEVICES	Ty	3	0/0	0/0	3
4	BEC18ET2	ELECTROMAGNETIC WAVES AND TRANSMISSION LINES	ETL	1	0/1	3/0	3
5	BEC18001	SIGNALS AND SYSTEMS	Ty	3	1/0	0/0	4

Credits Sub Total: 17

Semester: 3

S.NO	Course Code	Course Title	T / L/ ETL	L	T/SLr	P/R	C
1	BEC18007	COMMUNICATION THEORY	Ty	3	0/0	0/0	3
2	BEC18005	CONTROL SYSTEM FOR ELECTRONICS	Ty	3	1/0	0/0	4
3	BEC18006	ELECTRONIC CIRCUITS	Ty	3	0/0	0/0	3
4	BEC18ET3	DESIGN AND IMPLEMENTATION OF LINEAR INTEGRATED CIRCUITS	ETL	1	0/1	3/0	3
5	BEC18L20	ELECTRONIC CIRCUITS AND DEVICES LAB	Lb	0	0/0	3/0	1

Credits Sub Total: 14

Semester: 4

S.NO	Course Code	Course Title	T / L/ ETL	L	T/SLr	P/R	C
1	BEC18008	DIGITAL SIGNAL PROCESSING	Ty	3	1/0	0/0	4
2	BEC18009	DIGITAL COMMUNICATION	Ty	3	1/0	0/0	4
3	BMG18003	PRINCIPLES OF MANAGEMENT	Ty	3	0/0	0/0	3
4	BXX18EXX	ELECTIVE 1	Ty	3	0/0	0/0	3
5	BEC18L14	MICROPROCESSOR AND MICROCONTROLLER LAB	Lb	0	0/0	3/0	1

Credits Sub Total: 15

Semester: 5

S.NO	Course Code	Course Title	T / L/ ETL	L	T/SLr	P/R	C
1	BEC18014	FIBER OPTIC COMMUNICATION	Ty	3	0/0	0/0	3
2	BEC18015	RF AND MICROWAVE ENGINEERING	Ty	3	0/0	0/0	3
3	BEC18010	INTRODUCTION TO VLSI AND EMBEDDED SYSTEM DESIGN	Ty	3	0/0	0/0	3
4	BXX18EXX	ELECTIVE II	Ty	3	0/0	0/0	3
5	BEC18L21	COMMUNICATION ENGINEERING LAB	Lb	0	0/0	3/0	1

Credits Sub Total:13

Semester: 6

S.NO	Course Code	Course Title	T / L/ ETL	L	T/SLr	P/R	C
1	BEC18012	WIRELESS NETWORKS	Ty	3	1/0	0/0	4
2	BEC18ET4	INTERNET OF THINGS	ETL	1	0/1	3/0	3
3	BEC18013	COGNITIVE RADIO	Ty	3	0/0	0/0	3
4	BXX18EX	ELECTIVE III	Ty	3	0/0	0/0	3
5	BEC18L12	PROJECT PHASE - I	Lb	0	0/0	3/3	2

Credits SubTotal: 15

Semester: 7

S.NO	Course Code	Course Title	T / L/ ETL	L	T/SLr	P/R	C
1	BXX18EXX	ELECTIVE IV	Ty	3	0/0	0/0	3
2	BEC18L13	PROJECT PHASE - II	Lb	0	0/0	12/12	8

Credits SubTotal: 11

Semester 1: 15
Semester 2: 17
Semester 3: 14
Semester 4: 15
Semester 5: 13
Semester 6: 15
Semester 7: 11

Total Credits: 100

C : Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research
T/L/ETL: Theory/Lab/Embedded Theory and Lab

Subject Code:	Subject Name :CIRCUITS AND NETWORKS	T / L/ ETL	L	T / S.Lr	P/ R	C

S.No	Sub. Code	Title of the Subject	T/ L/ ETL	T/SLr	P/R	L
ELECTIVE 1 – Electronics stream						
1.	BEC18E01	Microprocessor and Microcontroller	Ty	0/0	0/0	3
2.	BEC18E02	Semiconductor devices and its applications	Ty	0/0	0/0	3
3.	BEC18E03	Basics of Robotics	Ty	0/0	0/0	3
ELECTIVE 1 –Communication stream						
4.	BEC18E05	Antenna and Wave Propagation	Ty	0/0	0/0	3
5.	BEC18E06	Telecommunication Switching Systems	Ty	0/0	0/0	3
6.	BEC18E07	Real Time Operating Systems	Ty	0/0	0/0	3
LECTIVE 2 – Electronics stream						
7.	BEC18E09	Intelligent Instrumentation	Ty	0/0	0/0	3
8.	BEC18E10	Advanced Microprocessors	Ty	0/0	0/0	3
9.	BEC18E11	Nano Electronics	Ty	0/0	0/0	3
ELECTIVE 2 –Communication stream						
10.	BEC18E13	Next Generation IP Networks	Ty	0/0	0/0	3
11.	BEC18E14	Neural networks and its Applications	Ty	0/0	0/0	3
12.	BEC18E16	Radar and navigational aids	Ty	0/0	0/0	3
ELECTIVE 3 - Electronics stream						
13.	BEC18E17	Advanced Digital System	Ty	0/0	0/0	3
14.	BEC18E19	Quantum computing	Ty	0/0	0/0	3
15.	BEC18E20	Power electronics	Ty	0/0	0/0	3
ELECTIVE 3 –Communication stream						
16.	BEC18E21	High speed Switching Architecture	Ty	0/0	0/0	3
17.	BEC18E22	Information coding techniques	Ty	0/0	0/0	3
18.	BEC18E24	Optical network and switching Techniques	Ty	0/0	0/0	3
ELECTIVE 4 - Electronics stream						
19.	BEC18E25	Device modeling	Ty	0/0	0/0	3
20.	BEC18E26	VLSI Technology	Ty	0/0	0/0	3
21.	BEC18E27	Bio medical Instrumentation	Ty	0/0	0/0	3
22.	BEC18E28	Embedded software design	Ty	0/0	0/0	3
ELECTIVE 4 –Communication stream						
23.	BEC18E29	Spread spectrum communication	Ty	0/0	0/0	3
24.	BEC18E30	Network management	Ty	0/0	0/0	3
25.	BEC18E31	Satellite Communication	Ty	0/0	0/0	3
26.	BEC18E32	Operating Mobile Communication	Ty	0/0	0/0	3

	Prerequisite: Mathematical Knowledge, Basic Electrical Concepts	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To understand the concept of circuit elements lumped circuits, waveforms, circuit laws and network reduction
- To solve the electrical network using mesh and nodal analysis by applying network theorems
- To learn methods of circuits analysis in time domain and frequency domain
- To understand the concept of resonance in Series and parallel circuits and to know the concepts of coupled circuits.
- Obtaining equations to solve circuits in steady state and transient state

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Understand the concept of circuits, network theorems and various circuit laws
CO2	Analyze and solve a given electrical networks using mesh and nodal analysis
CO3	Done their inferences to analyze circuits analysis in time domain and frequency domain
CO4	Demonstrate their skills in understanding the concept of various resonance and coupled circuits
CO5	Apply their understanding to derive the analyze the equations with respect to solving circuit transients.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**3**

COs / PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

UNIT I BASIC CIRCUIT CONCEPTS12 Hrs

V-I Relationships Of R, L And C – Independent Sources – Dependent Sources – Kirchhoff's Laws - Simple Resistive Circuits – Network Reduction – Voltage Division – Current Division – Source Transformation. Formation of Matrix Equations and Analysis Using Mesh-Current and Node-Voltage Methods.

UNIT IIAC FUNDAMENTALS12 Hrs

AC Quantity, Phasor Representation – Analysis Of Simple Series And Parallel Circuits – Power And Power Factor – Analysis Mesh Current And Node Voltage Methods – Series Resonance And Parallel Resonance

UNIT IIINETWORK THEOREM AND DUALITY 12Hrs

Useful Circuit Analysis techniques - Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Super position theorem –principle of duality.

UNIT IV TRANSIENT ANALYSIS12 Hrs

Transient Concepts-Behavior Of Circuit Elements Under Switching Conditions and Their Representation-Forced and Free Response of RL, RC And RLC Circuits with D.C. And Sinusoidal Excitations Using Laplace Transform Method – Natural Frequency and Damping Factor.

UNIT VCOUPLED CIRCUITS12 Hrs

Mutual Inductance – Coefficient Of Coupling – Ideal Transformer – Analysis Of Multi Winding Couple Circuits – Single & Double Tuned Circuits – Critical Coupling.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

Textbooks :

1. A.Sudhakar&ShyanmugamS.Palli*"Circuits & Network Analysis & Synthesis*", 4th Edition, Tata McGraw Hill, 2010
2. Bruce Carlson, "*Circuits: Engineering Concepts and Analysis of Linear Electric Circuits*", Thomson Learning, 1st Edition, 2002
3. M.L Soni& J.C. Gupta, "*Electric Circuit Analysis"*, DhanpatRai& Sons , New Delhi, 1999.

Reference Books:

1. *Hyatt, W.H. Jr and Kimmerly, J.E., "Engineering Circuits Analysis", McGraw Hill International Editions,1993.*
2. *Edminister, J.A., "Theory and Problems of Electric Circuits", Schaum's Outline Series McGraw Hill Book Company, 2nd Edition, 1983.*
3. *Paranjothi S.R., "Electric Circuit Analysis", New Age International Ltd., Delhi, 2nd Edition, 2000.*
4. *Artice.M. Davis, "Linear Circuits Analysis", Thomson Learning 2002*
5. *Roy Choudhury, "Networks and Systems", New Age International Ltd, 1992*

Subject Code: BCS18I01	Subject Name : C PROGRAMMING WITH LINUX	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Programming and Multimedia lab	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand and develop well-structured programs using C language
- Problem solving through computer programming
- Familiarity of programming environment in Linux operating system
- Comfortably use basic UNIX/Linux commands from the command line.
- Be knowledgeable enough about basic UNIX/Linux shell scripting to be able to successfully read and write bash shell script.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze the structure of C program, declaration of variables and usage of iterative and conditional statements.
CO2	Write C programs using arrays, strings and structures.
CO3	Apply Pointers to access arrays and Functions to process files.
CO4	Interpret basic hardware components and installation of Linux operating system
CO5	Design and implement basic Linux commands and Shell Programming

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	2	2	1	2	2	2	3
CO2	3	2	3	3	2	2	3	2	3	3	3	3
CO3	3	3	2	3	2	2	3	2	3	2	3	3
CO4	3	2	2	2	1	1	2	1	3	2	3	3
CO5	3	2	2	3	3	2	2	1	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3
CO2	1	2	3	3
CO3	2	3	3	3
CO4	2	3	3	2
CO5	2	2	3	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓										

BCS18I01 C PROGRAMMING WITH LINUX 3 0/0 0/0 3

UNIT I BASICS OF C PROGRAMMING 9Hrs

Introduction to programming paradigms – Structure of C program – C programming: Data Types – Storage classes – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Pre-processor directives – Compilation process

UNIT II ARRAYS, STRINGS AND STRUCTURES

9Hrs Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays– String operations: length, compare, concatenate, copy – Selection sort, linear and binary search - Structure – Nested structures – Pointer and Structures – Array of structures.

UNIT III FUNCTIONS AND POINTERS

9Hrs Introduction to functions: Function prototype, function definition, function call, Built-in functions– Recursion– Pointers – Pointer operators –Array of pointers - Files – Types of file processing: Sequential access, Random access - Command line arguments

UNIT IV INTRODUCTION TO LINUX 9Hrs

Introduction : Comparison of various operating systems, Advantages of Linux, Flavors of Linux, Installation notes, Linux Loader - file system concept, Concepts of devices, various kinds of hardware: Hard disk, floppy disk drivers , CD – ROM drives, Mouse, Memory devices, Printer devices.

UNIT V LINUX COMMANDSAND SHELL PROGRAMMING 9Hrs

Linux commands and Utilities - Backup and Restore: Back up Strategies and Operations, Restoring files Introduction to Shell Programming: Basics, Control Statements, shell variables, filters, Interrupt, parsing options, file generation

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

Textbooks:

1. Balaguruswamy, E(1990) Programming in C(3rd ed.), Tata McGraw-Hill Publishing Company Limited.
2. ReemaThareja, “programming in C”, Oxford university press, second edition, 2016.
3. BillBall&DavidPittsRedHat “Linux7Unleashed”, TechmediaSAMSPublication.

Reference Books:

1. *Kernighan, B.W and Ritchie, D.M, “ The C programming language”, second edition, Pearson Education, 2006.*
2. *Byron Gottfried &JitenderChhabra(2010), Programming with C (Schaum's Outlines Series), McGraw Hill Education.*
3. *K N King(2008), C Programming(2nd ed.), W. Norton & Company.*
4. *EviNemeth,GarthSnyder,ScottSeebass,TrentR.HeinUNIXSystemAdministrationHandbook (3rd. ed), PersonEducationAsia(LPE).*
5. *Mark G. Sobell(2013), Practical Guide to Linux Commands Editor, Pearson.*
6. *Goodlife(2006) , Running Linux(5th ed.), Om Books Publisher*

Subject Code: BEC18003	Subject Name : DIGITAL ELECTRONICS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Basic electronics and computer concepts	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To give an conceptual understanding about Boolean algebra, demorgans theorem, simplification of Boolean expression, Karnaugh map and QuineMcklusky methodology.
- To Design and implement logic gates, combinational logic circuits, PAL, PLA and FPGA.
- To Design and implement sequential logic circuits like Flip flops, counters and shift registers.
- To analyzer state diagram, state tables and its reduction and design and implement synchronous and asynchronous sequential circuits.
- To study different logic families and classify different types of memories.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply Karnaugh map and QuineMcCluskey methodology to simplify Boolean expressions.
CO2	Design and implement combinational logic circuits.
CO3	Explain the basic building blocks of sequential circuits and its applications.
CO4	Demonstrate the ability to design and implement synchronous and asynchronous sequential circuits
CO5	Compare the digital logic families and Classify different types of semiconductor memories.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	3	2	2	3	1	3	2
CO2	3	3	3	2	3	3	2	2	3	1	3	2
CO3	3	3	3	2	3	3	2	2	3	2	3	2
CO4	3	3	3	2	3	3	2	2	3	2	3	2
CO5	3	2	3	2	2	3	2	2	2	1	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	3	2	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	2	2	2	2

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓		✓			✓	✓				

BEC18003 DIGITAL ELECTRONICS3 1/0 0/0 4

UNIT I BOOLEAN ALGEBRA 12Hrs

Boolean Algebra – De Morgan's Law - Simplifications of Boolean Expression – Sum of Products and Product of Sums – Karnaugh Map(up to 5 variables) – Quince McClusky Method of Simplification (Including Don't care conditions)

UNIT II COMBINATIONAL LOGIC 12Hrs

Logic gates – AND, OR, NOT, NOR, NAND and EX-OR – Combinational Logic- Arithmetic Circuits – Half adder – Full adder, Half Subtractor - Decimal Adder – Excess 3 Adder – Code Converters – Multiplexer – Demultiplexer- Encoder – Decoder – Design of General Combinational Logic Circuit. PAL, PLA and FPGA.

UNIT III SEQUENTIAL LOGIC DESIGN 12Hrs

Building Blocks Of Sequential Logic-Rs, JK, Master-Slave, D And T Flip-Flop, Design of Asynchronous and Synchronous Counters - Binary and BCD Counters - Shift Registers.

UNIT IV SEQUENTIAL MACHINES 12Hrs

Basic Models Of Sequential Machines – Concept of State Diagram - State Table – State Reduction - Design and Implementation of Synchronous Sequential Circuits .Design and Implementation of Asynchronous Sequential Circuits.

UNIT V LOGIC FAMILIES AND MEMORY DEVICE 12Hrs

Characteristics of RTL, DTL, TTL, Families – Schottky, Clamped TTL, ECL, IIL –Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

TEXT BOOKS:

1. Charles H. Roth, "*Fundamentals of Logic Design*", cengageLearning, 5th Edition
2. FLOYD:" *Digital Fundamentals*", 10th Edition Universal Book Stall, New Delhi.1993
3. Morris Mano, "*Digital Electronics and Design*", Prentice Hall of India, 2000

REFERENCE BOOKS:

1. *John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008*
2. *Jayadeepchakravarthy "Digital electronics and logic design", Universities press.(2012)*
3. *John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.*
4. *Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.*
5. *Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.*
6. *Donald D.Givone, "Digital Principles and Design", TMH, 2003*

Subject Code:	Subject Name : ELECTRICAL MACHINES AND PCB DESIGN	T / L/ ETL	L	T / S.Lr	P/ R	C
BEC18ET1	Prerequisite: Basic Electrical and Electronic Circuits	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study the working principles of different types of AC machines.
- To understand and analyze the working of various special machines.
- To give an introduction to different types of electronic components and instruments.
- To give an understanding of different stages in PCB design process.
- To analyze how components are assembled and tested in PCB.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze the principle and working of different types of AC machines.
CO2	Interpret the working and applications of various special machines
CO3	Identify the need for different types of electronic components and instruments.
CO4	Formulate the process of designing PCB layout
CO5	Assemble and test different components in PCB's

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	2	1	2	2	2	1
CO2	3	3	3	3	2	2	2	1	2	2	2	1
CO3	3	3	2	3	3	3	2	2	2	2	3	2
CO4	3	2	3	3	3	3	2	2	3	2	3	3
CO5	3	3	3	3	3	3	2	3	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	2	3	2	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18ET1 ELECTRICAL MACHINES AND PCB DESIGN 1 0/1 3/0 3

UNIT I ACMACHINES 9 Hrs

Transformers - Principle of Operation of single phase Transformer – EMF Equation- Auto Transformers – Three Phase Transformers – Constructional Details. Induction motors- Construction Details - Types – Principle of Operation – Torque Equation. Synchronous machines -Construction of Synchronous machines – Classification - Induced EMF Equation

UNIT II SPECIAL MACHINES 9Hrs

Principle of operation-Universal Motor – Switched Reluctance Motor – Permanent magnet Stepper Motor and Variable Reluctance stepper motor – DC and AC Servo Motor – Tachogenerator - Linear Induction Motor.

UNIT IIIINTRODUCTION TO BASICS OF ELECTRONIC

COMPONENTS AND INSTRUMENTS 9Hrs

Study of electronic components: passive: -R,L,C –Types of R,L,C-Analysis of Colour code in R,C :Active: –Diode, BJT, FET,MOSFET :Electronic Instruments: CRO : -Measurements of Voltage &Frequency, Function generator:- Frequency Measurements in Various Range and Wave Form : Power Supply: -Fixed and Variable :Multi-meter:-Measurement of Voltage ,Current, Frequency, R,L,C : IC tester:-Linear ICs and Non Linear ICs: Solder practice.

UNIT IVPCB DESIGN PROCESS 9Hrs

Conception Level Introduction: Specifying Parts, Packages and Pin Names, Libraries and Checking foot prints of the components, Partlist, Netlist, Making Netlist Files, Placing Parts, Routing Traces, Modifying Traces, Mounting Holes, Adding Text, PCB Layout, DRC, Pattern Transfer.

UNIT V ASSEMBLING AND TESTING 9Hrs

Identifying the components and its location on the PCB, soldering of active and passive components, Testing the assembled circuit for correct functionality.

Practical component P : Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS :

1. S. K. Bhattacharya, "*Electrical Machines"*, TMH Publications N. Delhi.
2. Kothari.D.P and Nagrath.I.J., "*Electrical Machines*", Tata McGraw Hill Publishing Co.Ltd, New Delhi, 5th edition 2002

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REFERENCES:

1. *Orcad User manual.*
2. *Raghbir Singh Khandpur, "Printed Circuit Boards: Design, Fabrication, and Assembly", (McGraw-Hill Electronic Engineering-2006)*
3. *Dr. MurugeshKumar.K. "DC Machines & Transformers", Vikas Publishing House Pvt Ltd.,2nd edition 2003.*
4. *Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.*
5. *Department Laboratory Manual.*

Subject Code: BEC18L02	Subject Name : DIGITAL SYSTEM DESIGN LAB	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Electronics	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To implement of various laws of Boolean algebra in SOP and POS forms.
- To implement various combinational logic and sequential logic circuits.
- To implement standard IC's in implementing digital circuits.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Practically implement of various laws of Boolean algebra in SOP and POS forms.
CO2	Implement various combinational logic circuits and code converters.
CO3	Design and implement different types of multiplexer and demultiplexers.
CO4	Design and implement various sequential circuits like flip-flops, counters and registers.
CO5	Use the standard IC's in implementing combinational and sequential logic circuits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	1	2
CO2	3	3	3	3	3	2	2	2	2	1	2	2
CO3	3	3	3	3	3	2	2	2	2	2	1	2
CO4	3	3	3	3	3	2	2	2	2	1	2	2
CO5	3	3	3	3	3	2	2	2	2	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	2	2				
CO2	3	3	3	3				
CO3	3	3	3	3				
CO4	2	2	3	3				
CO5	2	2	2	2				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L02 DIGITAL SYSTEM DESIGN LAB 0 0/0 3/0 1

LIST OF EXPERIMENTS:

1. Implementation of BOOLEAN FUNCTIONS using logic gates –POS &SOP form.
2. Implementation of MULTIBIT ADDERS & SUBTRACTORS (2 & 3 BITS).
3. Design and implementation of code converters using logic gates
   i) BCD to excess-3 code and vice versa
   ii) Binary to gray and vice-versa
4. Design and implementation of Magnitude Comparator (2-Bit).
5. Multiplexer & De multiplexer logic circuit design
6. Design and implementation of FLIP FLOPS
7 .Implementation of STUDY OF REGISTERS
8. Construction and verification of COUNTERS.
9. Implementation of combinational logic functions using standard ICs
10. Implementation of sequential logic functions using standard ICs

REFERENCE BOOKS:

1. *Lab manual, Department of ECE, DR.MGR UNIVERSITY.*
2. *Maheswari.L.K and Anand.M.M.S, "Laboratory Manual for Introductory Electronic Experiments", New Age,2010*
3. *PoornachandraRao.S and Sasikala.B, "Handbook of Experiments in Electronics and Communication".*

Subject Code: BMA18007	Subject Name: PROBABILITY AND RANDOM PROCESS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Mathematics – I, Mathematics - II	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand the basic concepts in probability and random process and its application in signal processing.

COURSE OUTCOMES (Cos) : (3- 5)

The student will be able to

CO1	Understand the Basic concepts in Probability
CO2	Understand the Basic concepts in Distribution
CO3	Understand the Basic concepts in Random process
CO4	Understand the Basic concepts in Correlation
CO5	Understand the Basic concepts in Spectral Density

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	1	1	1	1	1	1	1	2
CO2	3	3	2	3	1	1	1	1	1	1	1	2
CO3	3	3	2	3	1	1	1	1	1	1	1	2
CO4	3	3	2	3	1	1	1	1	1	1	1	2
CO5	3	3	2	3	1	1	1	1	1	1	1	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2
CO2	2	3	2	2
CO3	2	3	2	2
CO4	2	3	2	2
CO5	2	3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
	✓											

BMA18007 PROBABILITY AND RANDOM PROCESS 3 1/0 0/0 4

UNIT I RANDOM VARIABLES 12 Hrs

Baye's Theorem – Applications - Random Variables – Distribution functions – Moments – Moment Generating functions –Chebychev's Inequality (statement and application only) – Function of Random Variables.

UNIT II STANDARD DISTRIBUTIONS 12 Hrs

Marginal and Conditional Distributions – Applications of Discrete Distributions: Binomial – Poisson – Geometric – Applications of Continuous distributions: Uniform – Exponential– Normal distributions – Central Limit theorem (statement applications only).

UNIT III RANDOM PROCESS 12 Hrs

Stationary Process – Ergodic Process – Poisson Process –Applications: Birth and Death Process – Markov Process – Markov Chains.

UNIT IV CORRELATION 12 Hrs

Auto Correlation – Auto Covariance – Cross Correlation – Cross Covariance.

UNIT V LINEAR SYSTEMS-APPLICATIONS 12 Hrs

Spectral Density – Cross Spectral Density – Applications to Linear Systems with Random Inputs and Outputs.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

Text Books:

1) Veerarajan T., "*Probability, Statistics and, Random Processes"*, Tata McGraw Hill Publishing Co., (2008).
2) Gupta S.C., Kapoor V.K., "*Fundamentals of Mathematical Statistics"*, S.Chand& Co., (2007).

Reference Books:

1. *Singaravelu, "Probability and Random Processes", Meenakshi Agency, (2017).*
2. *Richard Johnson A., "Miller & Freund's Probability and statistics for Engineers"(9^{th}ed), Prentice Hall of India, (2016).*

Subject Code: BCS18I02	Subject Name : COMPUTER COMMUNICATION	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Communication System	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To understand different storage media and OSI layers
- To introduce the features of different I/O peripheral devices and protocols.
- To introduce the students the functions and standards of LAN.
- To introduce IEEE standard employed in computer networking.
- To make students to get familiarized with different protocols and network components.

COURSE OUTCOMES (COs) : (3- 5)

The Students will able to

CO1	Describe the basic concepts of data communication and OSI layers.
CO2	Analyze data link control protocol.
CO3	Explain different standards and protocols used in LAN
CO4	Express the duties of network support layer and WAN protocols
CO5	Define the functions of upper OSI layer

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	1	1	1	3	3	2	1	2
CO2	3	3	1	1	2	1	1	1	1	1	2	1
CO3	2	2	2	1	3	2	2	2	1	1	1	3
CO4	3	1	2	2	2	2	2	2	2	1	1	3
CO5	3	2	1	2	1	3	2	1	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3
CO2	3	2	3	1
CO3	1	3	2	2
CO4	1	1	1	1
CO5	2	2	3	1

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Inter disciplinary		
										✓		

BCS18I02 COMPUTER COMMUNICATION 3 0/0 0/0 3

UNIT I DATA COMMUNICATION 9 Hrs

Introduction, Basic concepts, OSI Reference Model, Transmission of Digital Data –Electrical Interface, Modems-Transmission rate-modem standards-Guided Media-Twisted –pair Cable-Coaxial cable-Performance- Error Detection and Correction (CRC) - Time and Frequency domains Signals

UNIT II DATA LINK CONTROL AND PROTOCOLS 9 Hrs

Flow Control and Error Control, Stop And Wait - Sliding Windows- Automatic Repeat (ARQ), Asynchronous Protocols - X Modem, Y Modem, Synchronous Protocols – Character Oriented and Bit Oriented Protocols (HDLC).

UNIT III LOCAL AREA NETWORKS9 Hrs

IEEE 802 Standards, LLC, MAC Layer Protocols –CSMA/CD Ethernet, Token Bus, Token Ring, FDDI, Distributed Queue Dual Bus, Switched Multimegabit Data Service

UNIT IV WIDE AREA NETWORKS 9 Hrs

Switching, Duties of the Transport Layer, ATM Protocol –Architecture Header Structure, Function of AAL Layer,Internetworking Devices, Repeater,Bridge, Routers and Gateways, Routing Algorithms- Link Stateand Distance Vector routing.

UNIT V UPPER OSI LAYERS 9 Hrs

Session Layer - Presentation Layer –Translation, Brief Introduction to Encryption / Decryption, Authentication -Data Compression, Application Layer Protocols, MHS, File Transfer , Virtual Terminal, Common Management Information Protocol.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

Textbooks :

1. Behrouz A. Forouzan , "*Data Communication and Networking*", Tata McGraw Hill, 5th Edition, 2013.
2. William A, Shay, "*Understanding Data Communications and Networks*", Thomson Learning, 3rd Edition 2003.
3. Gallo, "*Computer Communications and Networking Technologies*", Thomson Learning, 1st edition 2001.

Reference Books:

1. *William Stallings, "Data and Computer Communication", Prentice Hall of India, Fifth Edition 1997.*
2. *Andrew S. Tanenbaum, "Computer Networks", prentice hall of India, Third Edition 1996.*
3. *Fred Hallsall, "Data Communication Computer Networks and Open System", Addison – Wesley, 1992*

Subject Code: BEC18004	Subject Name : SOLID STATE DEVICES	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Basics of electrical and electronics.	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn crystal structures of elements used for fabrication of semiconductor devices.
- To study energy band structure of semiconductor devices.
- To understand Fermi levels, movement of charge carriers, Diffusion current and Drift current.
- To study behavior of semiconductor junction under different biasing conditions and Power devices. Varactor diode, Zener diode, Schottky diode, etc.
- To study VI Characteristics of devices and limitations in factors like current, power frequency.

COURSE OUTCOMES (COs) : (3- 5)

The students will be

CO1	Learnsemiconductordeviceslike diodes and zener diode
CO2	Know working and biasing of bipolar junction transistors.
CO3	Understand the construction and operation of FET and MOSFET
CO4	Study the behavior of power electronic and photo electronic devices.
CO5	Analyze transistors and FET using small signal model

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	2	2	1	3	3	2	2	2
CO2	3	1	1	2	1	3	2	2	2	2	1	1
CO3	3	3	1	1	1	2	2	3	2	1	3	2
CO4	3	2	1	1	1	3	3	3	2	2	2	1
CO5	3	3	2	2	2	2	1	1	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	1	1				
CO2	3	2	2	2				
CO3	3	2	1	3				
CO4	3	2	2	3				
C05	3	3	2	3				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓		✓								

BEC18004SOLID STATE DEVICES 3 0/00/03

UNIT I SEMICONDUCTOR DIODES 9 Hrs

Theory of PN Junction Diode – VI characteristics – Static and Dynamic Resistance – Effect of Temperature on Diodes – Space Charge and Diffusion Capacitance - Zener Diode – Avalanche and Zener Break Down Mechanisms – Zener Diode as a Voltage Regulator.

UNIT II BJT &BIASING9 Hrs

Principles of Transistor Action – Current Components – Cut Off, Active & Saturation Region – I/P & O/P characteristics CE, CB and CC. Small Signal Large Signal 'β', Break Down & Switching Characteristics – Transistor Biasing – Bias Stabilization – Bias Compensation – Thermal Runaway – Design with Heat Sink.

UNIT IIIFET & MOSFET9 Hrs

Construction Feature & Working Principles of JFET, MOSFET Depletion and Enhancement Mode, Biasing of FET, and MOSFETS, Transmission Gate using CMOS.

UNIT IVPOWER DEVICES 9 Hrs

Charge Transfer Device, UJT, SCR, Diac, Triac, GTO, MCT and Introduction to Gallium Arsenide Devices, FinFET, LDR, Photo Voltaic cell, Varactor diode.

UNIT VSMALL SIGNAL MODEL 9 Hrs

Small Signal Model of Transistor- Analysis of Amplifiers using Small Signal Model. Common Emitter, Common Base, Common Collector, Common Source, Common Drain, Common Gate, Multistage Amplifiers.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS:

1. Nandita Das Gupta, Amitava Das Gupta, "*Semiconductor Devices*", Prentice Hall of India, 2005
2. Sedra and Smith, "*Microelectronic Circuits*" Oxford University Press, 2004
3. Mohammed Gausi and Spencer, "*Introduction to Electronics Circuit Design*", Pearson Education, 2004

REFERENCE BOOKS:

1. *Boylestad, Robert. L and Nashelsky Louis ," Electronic Devices and Circuit theory" Prentice Hall of India,6th Edition, 2001*
2. *William & Harris, "Electronic Devices and Circuits", Tata McGraw Hill International Editions, 2000*
3. *MillmanHalkias, "Electron Devices", Tata McGraw Hill, 2000.*
4. *Donald neamam, " Micro electronics" , Tata McGraw Hill, 2007.*
5. *Sedra smith, " Micro Electronic Circuits" Fifth edition,2013.*

Subject Code: BEC18ET2	Subject Name : ELECTROMAGNETIC WAVES AND TRANSMISSION LINES	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Physics, Vector Calculus	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the basic concepts in vector calculus and fundamental ideas in electrostatics and magneto statics.
- To understand the concepts of current density and to learn how to solve the electrostatic problems
- To learn the behavior of time varying fields and flow of electromagnetic power.

COURSE OUTCOMES (COs) :

CO1	Analyze the behavior of electric field and magnetic field and determine its parameters
CO2	solve complex electrostatic and magneto static problems using behavioral study
CO3	Familiarize with transmission lines concept and various losses associated with it.
CO4	Identify different impedance matching for guided wave transmission
CO5	Interpret the different types of waveguides and the behavior of TE & TM waves

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	3	2	1	2	2	2
CO2	3	3	3	3	2	2	3	1	1	2	2	1
CO3	3	3	3	3	2	3	3	2	2	2	2	3
CO4	3	3	3	3	2	2	3	1	1	2	2	3
CO5	3	2	1	2	2	2	3	1	3	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	1	3
CO3	3	3	2	3
CO4	3	3	1	3
CO5	1	1	2	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
	✓	✓		✓								

BEC18ET2ELECTROMAGNETIC WAVES AND TRANSMISSIONLINES 1 0/1 3/0 3

UNIT IELECTROSTATICS AND MAGNETOSTATICS 9Hrs

Fundamental Postulates of Electrostatics in free space, Coulomb's law, Determination of Electric field, Gauss's law and its applications, Electric potential, Electric Flux Density and Dielectric constant, Boundary Conditions for Electrostatic fields, Determination of Capacitance and Electrostatic Energy,
Fundamental Postulates of Magneto statics in free space, Vector Magnetic Potential, Biot-Savart's law and its applications, Scalar Magnetic Potential, Magnetic Field Intensity and Relative Permeability, Boundary Conditions for Magneto static fields, Determination of Inductance and Magneto static Energy, Determination of magnetic Force and Torque.

Lab Experiments

- Electrical Field and Potential inside the Parallel Plate Capacitor
- Capacitance and Inductance of Transmission Lines
- Simulation of Electric Field and Potential Inside Capacitors
- Magnetic Field outside a Straight Conductor
- Magnetic Field of Coils
- Magnetic Force on a Current Carrying Conductor
- Inductance of Transmission Lines

UNIT IITIME-VARYING FIELDS AND ELECTROMAGNETIC POWER 9 Hrs

Faraday's Law of Electromagnetic Induction, Maxwell's Equations (Integral and Differential Form), Wave Equations for a source-free region, Poynting vector and Poynting theorem.

Lab Experiments

- Electromagnetic Induction
- E.M Wave Radiation and Propagation

UNIT III TRANSMISSION LINE THEORY9 Hrs

General Theory of Transmission Lines –The transmission line, A General Solution – The Infinite Line – Wavelength, Velocity of propagation – Waveform Distortion – The Distortion-less line – Loading and– Input and transfer Impedance – Open and short circuited lines – Reflection loss .
Transmission lines equations at radio frequencies – Line of Zero dissipation – Voltage and Current on the dissipation-less line – Standing waves, Nodes, Standing wave ratio – Input impedance of the dissipation-less line – Power and impedance measurement on lines.

Lab Experiments

- Study of Open and Short Circuited Lines
- Measurement of SWR, Impedance and Power

UNIT IVIMPEDANCE MATCHING AND GUIDED WAVES 9 Hrs

Impedance matching: Quarter Wave Transformer – Impedance matching by Single and Double Stub – Smith chart-Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – Characteristics of TE and TM Waves – Transverse Electromagnetic waves – Velocities of propagation – Component uniform plane waves between parallel planes – Attenuation of TE and TM waves in parallel plane guides

Lab Experiments

- Impedance Matching by Quarter Wave Transformer and Smith Chart
- Study of Characteristics of TE and TM waves

UNIT V RECTANGULAR AND CIRCULAR WAVEGUIDES 9Hrs

Transverse Magnetic Waves in Rectangular Wave guides – Transverse Electric Waves in Rectangular Waveguides-Impossibility of TEM waves in waveguides - Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides

Lab Experiments

- Study of Rectangular waveguides
- Study of Circular Waveguides

Total Number of Hours: 45 Hrs

Textbooks

1. David K.Cheng, "*Field and Wave Electromagnetics*", McGraw Hill Inc., Third Edition, Malaysia, 1995
2. William H. Hayt& John A.Buck, "*Engineering Electromagnetics*",TataMc-Graw-Hill 7th Edition 2005.
3. Y.Mallikarjunareddy, "Eletromagnetic waves and transmission lines", Universities press, Edition 2015.
4. J.D. Ryder "*Networks, Lines and Fields*", PHI, New Delhi, 2003.
5. E.C. Jordan and K.G. Balmain "*Electro Magnetic Waves and Radiating System*", PHI, New Delhi, 2003.
6. UmeshSinha " *Transmission lines and networks*", Sathyaprakashan ,2010

Reference Books:

1. *John D Kraus, "Electromagnetics", Tata McGraw Hill Book Co., New York, Third Edition, 1989.*
2. *Joseph A Edminister, "Theory and Problems of Electro Magnetics", Schaum's Outline Series Tata McGraw Hill, New York, 1986*
3. *Mathew N. O. Sadiku, "Elements of Electromagnetics", Oxford International Student Edition, Fourth Edition*
4. *David J.Griffiths, "Introduction to Electrodynamics", Pearson Education Limited 2014.*
5. *S.P.Seth, "Elements of Electromagnetic Fields", DhanpatRai& Co. David K. Cheng,"Field and Waves in Electromagnetism", Pearson Education, 1989.*
6. *Ramo, Whineery and Van Duzer: "Fields and Waves in Communication Electronics", John Wiley, 2003.*
7. *David M. Pozar: "Microwave Engineering", 2nd Edition – John Wiley.*
8. *G.S.N Raju: "Electromagnetic Field Theory and Transmission Lines", Pearson Education, First edition 2005.*

Subject Code: BEC18001	Subject Name:SIGNALS AND SYSTEMS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Mathematics	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the representation of discrete and continuous signals and systems.
- To study the analysis of continuous time systems using Laplace and Fourier transforms.
- To study the analysis of discrete time systems using DFT and Z transforms.

COURSE OUTCOMES (COs) : (3- 5)
The student will be able to

CO1	Classify continuous and discrete time signals and systems.
CO2	Analyze continuous signals and its spectrum with transforms.
CO3	Determine the response of continuous time systems with transforms and state variable approach.
CO4	Analyze discrete signals and its spectrum with transforms.
CO5	Determine the response of discrete time systems with transforms and state variable approach.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	2	1	1	2	2	2
CO2	3	3	3	3	3	1	2	1	1	2	2	2
CO3	3	3	3	3	3	1	2	1	1	2	2	2
CO4	3	3	3	3	3	1	2	1	1	2	2	2
CO5	3	3	3	3	3	1	2	1	1	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	3	2
CO5	3	3	3	2

3/2/1 indicates strength of correlation 3 – High, 2 – Medium, 1 – Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18001 SIGNALS AND SYSTEMS 3 1/0 0/0 4

UNIT ICLASSIFICATION OF SIGNALS AND SYSTEMS 10 Hrs

Continuous Time Signals (CT signals), Discrete Time Signals (DT Signals) – Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals – Periodic and aperiodic, Random Signals, CT Systems and DT Systems, Classification of Systems – Linear Time Invariant Systems(LTI).

UNIT IIANALYSIS OF C.T SIGNALS 12 Hrs

Fourier Series Analysis, Spectrum of C.T. Signals, Fourier Transform and Laplace Transform – Properties of Fourier Transform - Applications in Signal Analysis.

UNIT IIILTI – CT SYSTEMS 12 Hrs

Differential Equation, Block Diagram Representation, Impulse Response, Step Response, Convolution Integral, Frequency Response, Fourier and Laplace Transforms in Signal Analysis, State Equations and Matrix.

UNIT IVANALYSIS OF D.T. SIGNALS13 Hrs

Spectrum of D.T. Signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of DFT, Properties of Z – Transform in Signal Analysis, Inverse Z-Transform.

UNIT V LTI – DT SYSTEMS `13 Hrs

Difference Equations, Block Diagram Representation, Impulse Response, Convolution, Frequency Response, Z – Transform Analysis, Realization of Digital Filters – Direct Form-I, Direct Form-II, Transposed, Parallel, Cascade Structure, State Variable Equation and Matrix.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

Textbooks:

1. Alan V Oppenheim, "*Signals and Systems*", Prentice Hall of India Pvt. Ltd, 2nd Edition, 1997.
2. Roger E. Zeimer et al, "*Signals and Systems*": Continuous and Discrete, McMillan, 2nd Edition, 1990
3. Hwei P. Hsu, Schaum's Outline Series, "*Signals and Systems*", McGraw Hill Companies, 2nd Edition.

Reference Books:

1. *Douglas K Lindner, "Signals and Systems", McGraw Hill International, 1999.*
2. *Simon Haykin and Barry Van Veen ," Signals and Systems", John Wiley and Sons, Inc., 1999.*
3. *Robert A. Gabel and Richard A. Roberts,"Signals and Linear Systems", John Wiley, 3rd Edition, 1987.*

Subject Code: BEC18007	Subject Name : COMMUNICATION THEORY	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Probability and random process	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study various Amplitude modulation and demodulation systems.
- To provide some depth analysis in noise performance of various receiver.
- To study some basic information theory with some channel coding theorem.

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Identify the types of Noise and express the need for modulation.
CO2	Illustrate the concepts of amplitude modulation and its transmission technique.
CO3	Articulate the generation & demodulation of FM systems.
CO4	Analyze the analog to digital conversion methods.
CO5	Implement the coding techniques and calculate the channel capacity.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	2	3	1	2	3	1	2
CO2	3	3	3	3	3	2	2	2	2	2	3	3
CO3	3	3	3	3	3	2	2	1	2	2	3	3
CO4	3	3	3	3	3	1	2	1	2	2	3	3
CO5	3	3	3	3	3	1	2	3	1	2	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3
CO2	3	3	3	3
CO3	3	3	3	3
CO4	3	2	2	3
CO5	3	2	3	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18007 COMMUNICATION THEORY 3 0/0 0/0 3

UNIT I INTRODUCTION TO COMMUNICATION SYSTEMS AND NOISE 9 Hrs

Basic Communication Systems – Need for Modulation in Communication Systems - Noise - Sources of Noise – Types of Noise - External Noise – Thermal Agitation – Shot Noise – Noise Figure – Signal to Noise Ratio – Equivalent Noise Resistance, Amplitude Modulation and demodulation- Frequency Spectrum – power relations in Amplitude Modulation.

UNIT IICONTINUOUS MODULATION SYSTEMS 9 Hrs

Balanced Modulator, DSB – SC, SSB and VSB – Modulation and Demodulation - AM Transmitter, Receiver- Types, AM receivers.

UNIT III ANGLE MODULATION9 Hrs

Frequency modulation – Mathematical representation of FM – Frequency Spectrum – Phase Modulation – Noise triangle – Pre-emphasis, de- emphasis- Comparison of Wide band and Narrow band FM, AFC - Stereophonic FM multiplex system – Generation of FM - FM receivers - Communication receivers.

UNIT IV ANALOG TO DIGITAL CONVERSION 9 Hrs

Sampling Theorem - PAM - Quantization of signal - Quantization Error – PWM , PPM – Introduction to digital modulation systems – ASK, FSK, PSK – Transmitter and receiver.

UNIT VINFORMATION THEORY AND CODING 9 Hrs

Introduction –Information - Entropy - Information rate, Classification of codes, Kraft McMillan inequality –-Source coding theorem - Shannon , Fano coding - Huffman coding, Joint and conditional entropies– Channel capacity -Shannon limit - BSC -Discrete memory less channels - Mutual information.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

Textbooks :

1. Roy Blake, "*Electronic Communication Systems*", Thomson Learning 2nd Edition, 2002.
2. George Kennedy: "*Electronic Communication Systems*", Tata McGraw Hill publications, 1992.
3. R Bose, "*Information theory, Coding and Cryptography*", TMH 2007.

Reference Books:

1.K.C.Raveendranath,"Communication system modeling and simulation using matlab& Simulink" universities press, 2011.
2.Taub& Schilling," Principles of Communication", Tata McGraw Hill,1986
3.Simon Haykins, "Principles of Communications", Prentice Hall of India. 2001

Subject Code: BEC18005	Subject Name : CONTROL SYSTEMS FOR ELECTRONICS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the basic elements of control system with mathematical model.
- To understand the time response of first and second order system feedback.
- To learn the frequency response of systems using bode plot and polar plot.
- To check the stability of Control system using various techniques.
- To study different compensators and advance control system concepts using state variables.

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Model physical systems using block diagram and signal flow graph.
CO2	Analyze the system in time for standard input functions
CO3	Perform analysis on margin for stability of the control systems
CO4	Explain the nature of stability for the given system using Characteristics equations.
CO5	Design compensators to obtain the required dynamic response of the system and understand the state variable analysis of systems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	1	2	1	2	2	2	
CO2	3	3	3	3	3	1	2	1	2	2	2	
CO3	3	3	3	3	3	2	2	3	2	2	2	
CO4	3	3	3	3	3	3	3	1	2	2	2	
CO5	3	3	3	3	3	1	3	3	3	2	2	

COs PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	2				
CO2	3	3	2	2				
CO3	3	3	2	2				
CO4	3	3	2	2				
CO5	3	3	2	2				

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓		✓								

BEC18005 CONTROL SYSTEMS FOR ELECTRONICS3 1/00/04

UNIT I SYSTEM REPRESENTATION12 Hrs

Control Systems – Basic elements in control systems –Open and Closed loop systems – Mathematical models of physical systems – Transfer function – Block diagram reduction techniques – Signal flow graph.

UNIT II TIME RESPONSE 12 Hrs

Standard Test Signals-Time Domain study of first order and second order feedback control systems -Time domain Specifications - I and II order System Response - Error Coefficients - Generalized Error Series - Steady State Error - P, PI, PID Controllers.

UNIT III FREQUENCY RESPONSE 12 Hrs

Frequency Response - Bode plot - Polar plot - Constant M and N circles - Determination of Closed Loop Response from Open Loop Response - Correlation between Frequency Domain and Time Domain Specifications.

UNIT IV STABILITY OF CONTROL SYSTEM 12Hrs

Characteristics Equation - Location of Roots in S plane for stability - Routh Hurwitz Criterion - Root Locus Construction - Effect of Pole, Zero Addition - Gain Margin and Phase Margin - Nyquist Stability Criterion.

UNIT V COMPENSATORS AND STATE SPACE ANALYSIS 12 Hrs

Lag, Lead, Lag Lead Compensators- State Space Analysis - State Space Formulation -State Variables - Phase variables and Canonical Variables –Concept of Controllability &Observabliity

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

TEXT BOOKS:

1. K. Ogata, 'Modern Control Engineering', 4th edition, Pearson Education, New Delhi, 2003 / PHI.
2. I.J. Nagrath& M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2003.
3. B.C. Kuo, 'Automatic Control Systems', Prentice Hall of India Ltd., New Delhi,7th edition, 1995.

REFERENCE BOOKS:

1. *M. Gopal, 'Control Systems, Principles & Design', Tata McGraw Hill, New Delhi, 2002.*
2. *M.N. Bandyopadhyay, 'Control Engineering Theory and Practice', Prentice Hall of India, 2003.*
3. *A.Nagoorkani , "Control System Engineering" RBA Publications.*
4. *Stefani ,Shanian, Savant, Hostetter, " Design of Feedback Control Systems"4th edition, Oxford university press 2002.*

Subject Code: BEC18006	Subject Name: ELECTRONIC CIRCUITS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Solid State devices	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- On completion of this course the student will understand
- The methods of biasing transistors and Design of simple amplifier circuits
- Method of calculating cutoff frequencies and to determine bandwidth
- Design of power amplifiers and heat sinks

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Discuss various types of rectifiers.
CO2	Design different amplifiers with required gain independently
CO3	Construct the feedback amplifiers and oscillators for desired frequency.
CO4	Calculate the delay and design multivibrator circuits
CO5	Design and construct power amplifiers for different applications.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	1	2	3	2	3	3
CO2	3	3	3	3	3	2	2	3	2	2	3	3
CO3	3	3	3	3	3	1	1	2	3	3	3	2
CO4	3	3	3	3	3	1	1	1	3	3	2	2
CO5	3	3	2	3	3	1	2	1	3	2	1	3

COs PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	2	3	3				
CO3	3	2	3	2				
CO4	3	3	2	1				
CO5	3	3	3	3				

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18006 ELECTRONIC CIRCUITS 3 0/0 0/0 3

UNIT IRECTIFIER & POWER SUPPLY9 Hrs

Half & Full Wave Rectifies – Filters – Shunt, Inductor, LC Section & Ripple Factor, πfilters Calculation for C, L and LC Filters – Voltage Regulators – Zener – Series Voltage Regulator – Shunt Voltage Regulator – SMPS- IC Voltage Regulators.

UNIT II AMPLIFIERS 9 Hrs

Amplifiers – Frequency Response of RC Coupled Amplifiers – Frequency Response ofEmitter follower, Gain BandWidth Product – FET - Amplifier at Low and High Frequency Cascaded Amplifiers

UNIT IIIFEED BACK AMPLIFIER & OSCILLATORS 9 Hrs

Four Basic Type of Feedback – Effect of Feedback on Amplifier Performance-Examples of Different types of Feedback Amplifiers-Voltage Series & Shunt Feedback, Current Series & Shunt Feedback – Condition for Oscillation Barkhaushen Criteria – LC Oscillators – Hartley &Colpitts – RC Oscillators – Wein Bridge, RC Phase Shift CrystalOscillator.

UNIT IVMULTIVIBRATORS9 Hrs

Collector Coupled & Emitter Coupled AstableMultivibrator, – Mono Stable, BistableMultivibrator – TriggeringMethods – Storage Delay and Calculation of Switching Time - Schmitt Trigger Circuits, Speed up Capacitor in Switching – UJT based Relaxation Oscillator.

UNIT VPOWER AMPLIFIER9 Hrs

Classification – Class A, B, C & AB, Class B-push pull – Class B Complementary Symmetry, Class S, and Power sections Classifications, Efficiency, Distortion in Amplifiers-Tuned Amplifiers.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS :

1. Mohammed. H. Rashid, "*Micro Electronic Circuits, Analysis and Design*", Thomson Learning
2. David. A. Bell, "*Solid state Pulse Circuits*", Prentice Hall India, 4th Edition, 2000.
3. Angsumansarkar, “Solid State Microelectroni and Optoelectronic Devices” University press,2012.
4. Mohammed. H. Rashid, "*Micro Electronic Circuits, Analysis and Design*", Thomson Learning
5. David. A. Bell, "*Solid state Pulse Circuits*", Prentice Hall India, 4th Edition, 2000.
6. Angsumansarkar, “Solid State Microelectroni and Optoelectronic Devices” University press,2012.

REFERNCE BOOKS:

1. *MillmanTaub ,"H Pulse Digital & Switching waveform ", Tata McGraw Hill International, 2001*
2. *Jacob Millman, Cristas C. Halkias," Integrated Electronics", Tata McGraw Hill., Edition 199*
3. *MillmanTaub ,"H Pulse Digital & Switching waveform ", Tata McGraw Hill International, 2001*
4. *Jacob Millman, Cristas C. Halkias," Integrated Electronics", Tata McGraw Hill., Edition 1991.*

Subject Code: BEC18ET3	Subject Name : DESIGN AND IMPLEMENTATION OF LINEAR INTEGRATED CIRCUITS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Electronic Circuits	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce the basics of linear integrated circuits.
- To understand the applications of operational amplifiers.
- To learn the design of comparators, signal generators and timers.
- To design active filters and PLL.
- To learn the concepts of IC regulators and Data converters.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Recall and express the basics of linear IC's.
CO2	Analyze and experiment various applications of diode and rectifier using op-amp.
CO3	Demonstrate comparators and signal generators using op-amp.
CO4	Design and illustrate the characteristics of active filters and PLL.
CO5	Experiment IC regulators and implement data convertors for real time application.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	1	2	2	2	2
CO2	3	3	3	3	3	3	3	2	2	2	2	1
CO3	3	3	3	3	3	2	2	2	2	2	1	2
CO4	3	3	3	3	3	3	2	2	1	2	2	1
CO5	3	3	3	3	3	2	2	1	1	2	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	2				
CO2	3	3	3	2				
CO3	3	3	2	2				
CO4	3	3	2	2				
CO5	3	3	2	2				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18ET3 **1 0/1 3/0 3**

DESIGN AND IMPLEMENTATION OF LINEAR INTEGRATED CIRCUITS

UNIT IINTRODUCTION TO INTEGRATED CIRCUITS **9Hrs**

Integrated circuit and its classification, Introduction to Operational amplifier, Ideal Op-Amp , DC & AC Characteristics, Slew rate and methods of improving slew rate, CMRR, PSRR, Frequency Response and Compensation techniques.

Lab Experiments:

- Measure input bias current, input offset current, input offset voltage of the given op-amp
- Design voltage follower to measure slew rate.
- Measure CMRR for a given circuit and Compare measured value with calculated value

UNIT II APPLICATIONS OF OPAMP IC741 **9Hrs**

Inverter and Non-Inverter - Summer and Subtractor – Multiplier and Divider – Differentiator and Integrator – Instrumentation Amplifier – AC Amplifier – Op- Amp Circuits using Diodes, Precision Rectifier – Clipper and Clamper – Sample and Hold Circuit – Log and Antilog Amplifiers.

Lab Experiments:

- Design an Inverting and Non Inverting amplifier for required gain using IC741
- Design and realize adder and subtractor using IC741.
- Design Integrator and Differentiator using IC741.
- Design Clipper and Clamper Circuit using IC741.

UNIT IIICOMPARATORS AND SIGNAL GENERATORS **9Hrs**

Applications of Comparators – Regenerative Comparators (Schmitt Trigger) – Square Wave Generator (AstableMultivibrator) – MonostableMultivibrator –Triangular Wave Generator – Saw Tooth Wave Generator – Sine Wave Generators.

Lab Experiments:

- Design Schmitt trigger using IC741 for given values of UTP & LTP
- Design Monostablemultivibrator for required pulse width using IC741.
- Design Astablemultivibrator for required frequency and duty cycle using IC741

UNIT IVACTIVE FILTERSAND PLL **9Hrs**

RC Active Filters: Low pass – High pass – Band pass – Band reject – Notch – First order , Second order Filters– Switched Capacitor Filters – Counter Timers.

PLL Basic Principles – Phase Detector and Comparator: Analog and Digital Voltage Controlled Oscillator – Low pass Filter - PLL – Applications of PLL

Lab Experiments: (PSPICE)

- Design & Obtain frequency response of First order HPF & LPF filters
- Design & Obtain frequency response of Notch, BPF & BRF filters

UNIT VIC REGULATORS AND DATA CONVERTERS: 9Hrs

IC voltage regulators: Introduction, Fixed voltage regulators, SMPS, current limiting and current foldback techniques using IC723.

DAC/ADC Techniques – Integrating DAC /ADC Specifications, High Speed A/D Converters

Lab Experiments: (PSPICE)Total Number of Hours: 45 Hrs

- Design a voltage regulator for a given voltage.
- Calculate line, load regulation for a voltage regulator using IC723
- Construct a 4-bit R-2R ladder type DAC
- Set up a 4-bit successive approximation type ADC and study its performance

TEXT BOOKS:

1. James. M. Fiore, "Operational Amplifiers and Linear Integrated Circuits", First Edition , Thomson Learning.
2. Roy Choudhury and Shail Jain, “Linear Integrated Circuits” , Wiley Eastern Ltd., 1991.
3. Coughlin and Dirscol, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall of India Pvt., Ltd., 1992

REFERENCE BOOKS:

1. *Millman and Halkias, “Integrated Electronics", McGraw Hill, 1992.*
2. *Sergio Franco, “ Design with Operational Amplifiers and Analog Integrated Circuits”, Third Edition, T MH, 2002 .*
3. *Ramakant A. Gayakwad, “ Op – amp and Linear Integrated Circuits”, Fourth edition, PHI.*

Subject Code: BEC18L20	Subject Name :ELECTRONIC CIRCUITS AND DEVICES LAB	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Electronic Circuits	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To be able to design, implement different types of rectifier circuits.
- To be able to design different types of voltage regulators.
- To be able to design different amplifiers and oscillatory circuits.
- To be able to design power amplifier and study its characteristics.
- To be able to design tuned amplifier and analyze its behavior.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Design and implement different types of rectifier circuits.
CO2	Testing and Verification of circuit theorems
CO3	Perform hands on design on different amplifier circuits.
CO4	Testing and verification of Resonant Circuits
CO5	Perform hands on designing oscillator circuits and analyze its behavior.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	2	2	1
CO2	3	3	3	3	3	2	2	2	2	2	1	2
CO3	3	3	3	3	3	2	2	2	2	1	2	1
CO4	3	3	3	3	3	2	2	2	2	1	1	2
CO5	3	3	3	3	3	2	2	2	1	2	2	1

COs /PSOs	PSO1	PSO2	PSO3	Pso4
CO1	3	3	2	2
CO2	3	3	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	3	3	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L20ELECTRONICCIRCUITS & DEVICES LAB 0 0/0 3/0 1

1. VERIFICATION OF SUPERPOSITION THEOREM, MPT, THEVENIN & NORTON THEOREM
2. CHARACTERISTICS OF P-N JUNCTION & ZENER DIODE
3. I/P & O/P OF CHARACTERISTICS OF BJT & FINDING β OF THE TRANSISTOR
4. CHARACTERISTICS OF JFET
5. HALF WAVE AND FULL WAVE RECTIFIERS
6. MOSFET CHARACTERISTICS
7. STUDY OF RESONANT CIRCUITS
8. FREQUENCY RESPONSE OF CE AMPLIFIER
9. HARTLEY AND COLPITTS OSCILLATOR
10. WIEN BRIDGE AND RC PHASE SHIFT OSCILLATOR

Subject Code: BEC18008	Subject Name : DIGITAL SIGNAL PROCESSING	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Signals and System	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the concepts of Fourier transform and its Applications.
- To understand the design techniques of digital IIR filters
- To learn the concepts and design techniques of digital FIR filters.
- To understand the concepts and applications of Multi – rate sampling.
- To introduce the architecture of Digital Signal Processors.

COURSE OUTCOMES (COs) : (3- 5)

The students will

CO1	Illustrate Fourier transform concepts.
CO2	Interpret the knowledge of designing IIR filters.
CO3	Learn to design FIR filters.
CO4	Evaluate Multi rate samplings techniques for system design.
CO5	Describe the modules in the architecture of digital signal processor.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	1	1	1	1	2	2
CO2	3	3	3	3	3	2	2	1	2	2	1	2
CO3	3	3	3	3	3	2	1	1	1	1	2	1
CO4	3	3	3	3	3	1	2	1	2	1	2	2
CO5	3	3	3	2	2	2	1	1	2	2	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	2	2
CO3	3	3	1	3
CO4	3	3	1	2
CO5	2	2	3	1

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
		✓		✓			✓					

BEC18008DIGITAL SIGNAL PROCESSING 3 1/0 0/0 4

UNIT I DFT AND FFT 12 Hrs

Discrete Fourier Transform (DFT) - Properties-Convolution of Sequences - Linear Convolution - Circular Convolution - Introduction to Radix-2 FFT- Properties - DIT (FFT)-DIF (FFT) - Algorithms of Radix-2FFT-Computing Inverse DFT by doing a direct DFT.

UNIT II DESIGN OF IIR FILTER 12 Hrs

IIR Filters- Properties of IIR Filters -Analog Low pass Filter Design - Butterworth Filter - Chebyshev Filter - Design of IIR Filters from Analog filters - Approximation of Derivatives – Impulse Invariance - Bilinear Transformation – The Matched z- Transformation - Frequency Transformation.

UNIT III DESIGN OF FIR FILTER 12Hrs

FIR Filters - Characteristics of FIR Filters with Linear Phase-Properties of FIR Filters-Design of FIR Filters using Windows-Fourier Series Method-Frequency sampling Method – Limit cycle oscillations-Zero- Input Limit cycle oscillations- Overflow Limit cycle oscillations- Signal Scaling.

UNIT IVMULTIRATE SIGNAL PROCESSING12 Hrs

Multirate Signal Processing- Interpolation - Decimation - Single and Multistage Realization - Filter Bank Implementation - Applications-Sub Band Coding.

UNIT V OVERVIEW OF DIGITAL SIGNAL PROCESSOR12Hrs

Overview of Digital Signal Processors – Application of Digital Signal Processor – Memory Architecture of DSP Processor – Von Neumann Architecture – Harvard Architecture - Architecture of TMS32C5X Processor – Addressing modes – Pipelining .

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

TEXT BOOKS :

1. John . G. Proakis and DimitrisC.Manolakis, " *Digital Signal Processing Principles, Algorithms and Applications*, " Pearson Education, Third edition 2006.
2. Sanjitk.Mitra "*Digital signal processing*",A Computer Based Approach,Tata McGraw Hill,New delhi,2001.
3. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "*Discrete – Time Signal Processing*", 8th Indian reprint, Pearson 2004.

REFERENCE BOOKS:

1. *Ashok Ambardar,"Analog and Digital Signal Processing",2nd Edition,Thomson Learning 2000.*
2. *Ashok Ambardar,"Analog and Digital Signal Processing A Modern Introduction",I st edition Thomson Learning 2006*
3. *Johnny R.Johnson,"Introduction to Digital Signal Processing",Minthprinting,September 2001.*
4. *M.D.Srinath,P.K.Rajasekaran,R.Vishwanathan "Introduction to Statistical Signal ProcessingWithApplication",Prentice-Hall of India Pvt.Ltd.,New Delhi,1999.*
5. *B.Venkataramani, M.Bhaskar, "Digital Signal Processors, Architecture, Programming and Application", Tata McGraw Hill, New Delhi, 2003.*

Subject Code: BEC18009	Subject Name : DIGITAL COMMUNICATION	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Communication System, Probability and Random Process, Mathematics-I	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study detection, estimation and discuss the process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals.
- To understand the concepts of different digital modulation techniques and their applications in our day to day life
- To learn error control coding which encompasses techniques for the encoding and decoding of digital data streams for their reliable transmission over noisy channels.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Interpret the sampling process in real-time systems and reconstruct the signal with the estimation of noise
CO2	Design a system without distortion and interference
CO3	Hone their inferences to develop various modulation technologies for the state of the art communication.
CO4	Demonstrate their skills in generating a unique code for detecting the error in digital communication
CO5	Apply their understanding to improve the digital communication efficiency in a multipath environment.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	3	1	1	1	2	2	1
CO2	3	3	3	3	2	3	1	1	1	2	2	1
CO3	3	2	2	3	3	3	2	3	2	2	3	3
CO4	3	3	3	3	3	2	2	3	1	2	1	3
CO5	3	2	1	2	2	2	3	1	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	1
CO2	3	1	1	2
CO3	3	3	1	2
CO4	3	3	1	1
CO5	3	3	1	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18009	DIGITAL COMMUNICATION	3 1/0 0/0 4

UNIT I DETECTION, ESTIMATION AND SAMPLING PROCESS 12 hrs

Model of Digital Communication System, Gram Schmidt Orthogonalization Procedure, Matched Filters, Correlation Receivers, Error Probability, Maximum Likelihood Estimation, Linear Prediction and Prediction Filters, Sampling Theorem, Quadrature Sampling of Band-Pass Signals, Reconstruction of a message from its samples

UNIT IIWAVEFORM CODING TECHNIQUES AND BASEBAND SHAPING 12 hrs

PCM and TDMA Principles, Channel Noise and Error Probability, Quantization Noise and SNR, Differential Pulse Code Modulation and Delta Modulation, Speech Coding at Low Bit Rates, Power Spectra of PAM Signals, Inter Symbol Interference, Nyquist Criterion for distortionless baseband transmission, Correlative Coding and Precoding, Eye Patterns and Equalization Techniques.

UNIT IIIDIGITAL MODULATION TECHNIQUES12 hrs

Coherent Binary Modulation Techniques, Coherent Quadrature Modulation Techniques, NonCoherent Binary Modulation Techniques, Power Spectra, Bandwidth Efficiency, Bit versus Symbol Error Probabilities

UNIT IVERROR CONTROL CODING 12 hrs

Need for Coding, Types of Codes, Linear Block Codes, Cyclic Codes, Convolution Codes, Maximum Likelihood Decoding of convolutional Codes, Distance Properties and Sequential Decoding of convolutional Codes, Trellis coding, Viterbi coding.

UNIT VSPREAD SPECTRUM SYSTEMS 12 hrs

Generation of Pseudo Noise Sequences, Correlation Properties, Direct Sequence Spread Spectrum Systems, Frequency Hop System, Signal Space Dimension and Processing Gain , Probability of Error, Antijam and Multipath Performance.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

Textbooks:

1. Simon Haykin, "Digital *communications*", John Wiley & Sons, 1988.
2. John. G. Proakis, "*Digital Communication*", McGraw Hill Inc., Third Edition, Malaysia, 1995.
3. B.P. Lathi, "*Modern Digital and Analog communication system*", Oxford publications, Third edition.

Reference Books:

1. *Roy Blake, "Electronic Communication systems",Thomson Learning, 2nd edition 2002.*
2. *M.K. Simen, "Digital Communication Techniques Signal Design & Detection", Prentice Hall of India, 1999.*
3. *Bernard Sklar, "Digital Communication: Fundamentals and Applications",Prentice Hall, 2011 Edition.*
4. *UpamanyuMadhow, "Fundamentals of Digital Communication",Cambridge University Press, 2008*
5. *Robert G. Gallager, "Principles of Digital Communication",Cambridge University Press 2008.*

Subject Code: BMG18003	Subject Name: **PRINCIPLES OF MANAGEMENT**	Ty/Lb/ETL	L	T / S.Lr	P/R	C
	Prerequisite: NONE	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To enable the students to study the evolution of Management and types of business organization.
- To enable the students to understand the nature of planning and its process and decision making steps and process.
- To enable the students to understand the nature and purpose of organizing types of organization authority and its types and Human Resource Management and its concepts.
- To understand the foundation of individual and group behaviour and various motivational theories, techniques, job satisfaction concepts and communication theories.
- To understand the concept of controlling its system and processes..

COURSE OUTCOMES (COs) : (3- 5)

CO1	To know the evolution of management, types of business organization, Organizational culture and environment and trends and issues in management.
CO2	Ilustrate the planning and processes associates with tools and decision making steps.
CO3	Examine the concept of organizing, HR and its concepts.
CO4	Analyze individual, group behavior and related concepts.
CO5	Evaluate system and process of controlling techniques.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	2	3	3	3	3	3	3	3
CO2	2	3	2	3	1	3	3	3	3	3	3	3
CO3	2	2	2	3	2	3	3	2	3	2	2	3
CO4	1	2	2	3	1	2	2	2	3	3	3	3
CO5	2	2	2	3	2	2	2	2	3	3	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	3
CO2	2	3	2	2
CO3	2	3	3	1
CO4	2	3	3	2
CO5	3	3	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical	Soft Skills	Management Science		
										√		

BMG18003PRINCIPLES OF MANAGEMENT	**3**	**0/0**	**0/0**	**3**

OBJECTIVES:

- To increasing organizational effectiveness, To achieve optimum utilization of various resources.
- To have co-ordination between various department in the organization.

UNIT-I **9HRS**

Management: Importance – Definition – Nature and Scope of Management Process – Role and Functions of a Manager – Levels of Management – Development of Scientific Management and other Schools of thought and approaches.

UNIT-II **9HRS**

Planning: Nature – Importance – Forms – Types – Steps in Planning – Objectives – Policies – Procedures and Methods – Natures and Types of Policies – Decision –making – Process of Decision – making – Types of Decision.

UNIT-III **9HRS**

Organisation: Types of Organisations – Organisation Structure – Span of Control and Committees – Departmentalisation – Informal Organisation.

UNIT-IV **9HRS**

Authority – Delegation – Decentralisation – Difference between Authority and Power – Responsibility – Recruitment – Sources, Selection, Training – Direction – Nature and Purpose.

UNIT-V **9HRS**

Co-ordination – Need, Type and Techniques and requisites for excellent Co-ordination – Controlling – Meaning and Importance – Control Process.

Total No of Hours :45

Reference Books

1.C.B.Gupta, Management Theory & Practice -Sultan Chand & Sons - New Delhi.
2. L.M.Prasad, Principles & Practice of Management - Sultan Chand & Sons - New Delhi.
3. P.C. Tripathi& P.N Reddy, Principles of Managements - Tata Mc.Graw Hill - New Delhi.
4. Weihrich and Koontz, Management – A Global Perspective.
5. N.Premavathy, Principles of Management - Sri Vishnu Publication - Chennai.
6. J.Jayasankar, Business Management - Margham Publication - Chennai.

Subject Code: BEC18L14	Subject Name : MICROPROCESSOR AND MICROCONTROLLER LAB	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital Electronics, Digital System Design lab	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the assembly language programs in 8085,8086
- To study the various interfacing techniques with microprocessor.

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Write assembly language programming in 8085 and 8086 microprocessor
CO2	Interface peripherals with 8086 microprocessor
CO3	Understand the 8051 ALP and implement stepper motor control using the concepts.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	2	2	3	3	3
CO2	3	3	3	3	3	2	2	2	2	3	3	3
CO3	3	3	3	3	3	2	2	2	2	3	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	3	3	3	3			
CO2	3	3	2	3			
CO3	3	3	3	3			

3/2/1 indicates Strength of Correlation 3- High,2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L14MICROPROCESSOR AND MICROCONTROLLER LAB 00/0 3/01

8085 MICROPROCESSOR:

1. ASSEMBLY LANGUAGE PROGRAMMING FOR SINGLE BYTE, MULTIBYTE, ADDITION, SUBTRACTION, MULTIPLICATION, DIVISION

2. AVERAGE OF N NUMBERS, BLOCK MOVEMENT OF DATA, MAXIMUM OF GIVEN SERIES, SQUARE OF A GIVEN NUMBER

INTERFACING:

3. WAVE FORM GENERATION USING 8255 PPI

4. TRAFFIC LIGHT CONTROLLER

5. STEPPER MOTOR CONTROLLER

6. KEYBOARD INTERFACING

7. MATRIX DISPLAY

8. A/D INTERFACE USING ADC 0809

9. DAC INTERFACE USING DAC 0808.

Subject Code: BEC18014	Subject Name : FIBER OPTIC COMMUNICATION	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn the basic elements of optical fiber transmission link, types of fibers, Slicing and connectors.
- To understand the different kind of loss and system design consideration.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.
- To learn the fiber optical receivers such as PIN, APD diodes, noise performance in photo detector, receiver operation and configuration.
- To learn different types of optical networks.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Design any types of fibers.
CO2	Design lossless fibers.
CO3	Include newer technique for designing optical sources.
CO4	Design efficient optical detectors using innovative idea.
CO5	Implement modern technology for designing optical networks.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	1	3	2	1	3	2	3
CO2	3	3	3	2	2	1	2	3	1	3	3	3
CO3	3	3	3	3	2	1	2	1	1	3	2	2
CO4	3	3	3	3	2	1	2	1	1	3	2	2
CO5	3	3	3	3	3	1	2	3	3	3	3	3

COs / PSOs	PSO1	PSO2	PSO3
CO1	3	3	2	1
CO2	3	3	3	1
CO3	3	3	1	2
CO4	3	3	1	2
CO5	3	3	2	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18014 FIBER OPTIC COMMUNICATION 3 0/0 0/0 3

UNIT I INTRODUCTION TO OPTICAL FIBERS 9Hrs

The General System – Evolution of Fiber Optical System – Elements of an Optical Fiber Transmission Link – Cylindrical Fiber – Single Mode Fibers and Multimode Fibers -Fiber Splicing and Connectors.

UNIT II OPTICAL LOSSES AND DESIGN 9Hrs

Absorption Losses, Scattering Losses – Bending Losses – Core and Cladding Losses – Signal Distortion in SM Fibers - Point to Point Links – System Design Consideration — Line Power Budget – Rise Time Budget.

UNIT III OPTICAL SOURCES 9Hrs

Direct and Indirect Band Gap Material – LED Structures - LED Power and Efficiency – Modulation – Laser Diodes Structures and Radiation Pattern – Single Mode Lasers – Modulation of Laser Diodes.

UNIT IV OPTICAL DETECTORS 9Hrs

PIN and APD Diodes – Photo Detector Noise, SNR, Detector Response Time, Avalanche Multiplication Noise – Comparison of Photo Detectors – Fundamentals Receiver Operation – FET Pre-amplifiers

UNIT V OPTICAL NETWORKS 9Hrs

Operational Principles of WDM – Introduction to Optical Networks - Principles of SONET/SDH, OFDM, OTDM – Multiplexing and De multiplexing techniques - Synchronization.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS :

1. Gerd Keiser, "*Optical Fiber Communication System*", McGraw Hill, International, Singapore 3rd ed., 2000.
2. John M. Senior, "*Optical Fiber Communication principles and practice*" – Prentice Hall of India private limited, 1996.
3. Rajiv Ramaswami and Kumar N. Sivarajan, "*A Practical Perspective*‖," Harcourt Asia Ptv Ltd., Second Edition, 2004.

REFERENCE BOOKS:

1. *J. Gower, "Optical communication system", Prentice Hall of India, 2001.*
2. *Govind P. Agrawal "Fiber-Optic Communication Systems", Wiley India 3rd Edition*
3. *C. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002. 54*
4. *P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.*
5. *Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.*

Subject Code: BEC18015	Subject Name : RF AND MICROWAVE ENGINEERING	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Transmission Lines and Waveguides, Antenna and Wave Propagation	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To study Microwave sources and amplifiers.
- To study passive microwave components and their S- Parameter analysis.
- To study Microwave semiconductor devices & applications.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Understand the characteristics of microwave passive devices and their scattering parameter analysis.
CO2	Understand the concept of microwave generators and amplifiers.
CO3	Understand the concepts of microwave solid state devices and their characteristics.
CO4	Understand the concepts of microwave transistors in RF circuits.
CO5	Measure different parameters like frequency, wavelength, power, VSWR in RF circuits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	1	1	2	1	2	1
CO2	3	3	3	3	3	2	1	1	2	1	2	1
CO3	3	3	3	3	3	2	1	1	2	1	2	1
CO4	3	3	3	3	3	2	1	1	2	1	2	1
CO5	3	3	3	3	3	2	1	1	2	1	2	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	2
CO2	3	2	1	1
CO3	3	2	1	2
CO4	3	2	1	1
CO5	3	2	1	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18015RF ANDMICROWAVE ENGINEERING 30/0 0/0 3

UNIT I MICROWAVE PASSIVE DEVICES 9 Hrs

Transmission Lines for use at Microwave Frequencies – Attenuators, Directional Couplers, Terminators, Phase Shifters, Faraday Rotation Isolators and Circulators, Field Displacement Isolators, Microwave Filters, Frequency Meters, Hybrid Junctions – Scattering Analysis.

UNIT II MICROWAVE GENERATORS10Hrs

Limitations of Conventional Tubes at Very High Frequencies – Velocity – Modulated Tubes, Two – Cavity Klystron Amplifiers, Reflex Klystron Oscillators – Periodic Slow Wave Structures and their Use in Travelling Wave Tube Amplifiers, Focusing Techniques, TWTA Performance Characteristics – Electron Motion in Crossed Electric and Magnetic Fields - Magnetron Oscillators, Hartree Equation Rieke Diagram and Performance Charts .

UNIT III MICROWAVE SOLID-STATE DEVICES9 Hrs

Varactor Diodes, Manley – Rowe Relations, Low Noise Parametric Amplifiers – Transferred – Electron Devices and Their Operation, Cavity – Controlled Modes, LSA Mode-Avalanche – Transit Time Devices and Their Operation, TRAPATT Mode, BARITT mode, PIN Diodes and Their use as Attenuators and Switches.

UNIT IV MICROWAVE CIRCUITS8 Hrs

Small – Signal Equivalent Circuits, High-Frequency Applications, Performance Criteria and Limitations of BJTs and FETs – HEMTs – Fabrication Techniques.

UNIT V MICROWAVE MEASUREMENTS9 Hrs

Slotted - Line Techniques – Measurements of Wavelength – Measurement of Low and High VSWR – Measurement of Frequency and Frequency Meters – Measurement of Insertion Loss and Attenuation by Substitution Methods – Measurement of Low and High Powers at Microwave Frequencies – Modern Measurement Techniques using Automatic Network Analyzer and Spectrum Analyzer.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS:

1. Annapurna Das, Sisir. K. Das, "*Microwave Engineering*", Tata McGraw Hill Co., Ltd., 1999. Reprint 2001.
2. Samuel Y. Liao: "*Microwave Devices and Circuits*" , Prentice Hall of India – 3rd Edition (2003)
3. SubalKar , "*Microwave Engineering*" , Universities press(India) private limited – 1st Edition (2016)

REFERENCE BOOKS:

1. *D.M. Pozer, "Microwave Engineering", Addison – Wesley, 1998.*
2. *R.E. Collins: "Foundations for Microwave Engineering", IEEE Press Second Edition (2002)*
3. *David K. Cheng," Field and Waves in Electromagnetism", Pearson Education, 1989.*

Subject Code: BEC18010	Subject Name : INTRODUCTION TO VLSI AND EMBEDDED SYSTEM DESIGN	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital Electronics and Data structures	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the basics of MOS Transistors.
- To study the design of combinational logic circuit using CMOS.
- To learn CMOS sequential logic circuits design.
- To learn the concepts of modeling a digital system using HDL.
- To study the basics of PIC microcontroller.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Gain sound knowledge in the basics CMOS Circuits.
CO2	Analysis and design of different combinational circuits.
CO3	Identify the techniques involved in the analysis and synthesis of sequential circuits.
CO4	Expertise in digital system design using VHDL & Verilog.
CO5	Understand the basics of 16F877 PIC Microcontroller.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	2	1	1	1	1	1	1	1	
CO2	3	3	3	3	1	1	1	1	1	1	1	
CO3	3	3	3	3	1	1	1	1	1	1	1	
CO4	3	2	3	2	1	1	1	1	1	1	1	
CO5	3		3	2	1	1	1	1	1	1	1	
COs / PSOs	PSO1		PSO2		PSO3		PSO4					
CO1	3		3		2		1					
CO2	3		3		2		2					
CO3	3		3		2		2					
CO4	3		3		2		2					
CO5	3		3		1		1					

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18010 INTRODUCTION TO VLSI AND EMBEDDED SYSTEM DESIGN3 0/0 0/03

UNIT I MOS TRANSISTOR THEORY 12Hrs

Introduction – NMOS and PMOS transistor, Threshold voltage, Body effect, MOS device – Basic DC equations ,Second order effects, MOS models, Small signal AC characteristics, Complementary CMOS Inverter, Power dissipation and scaling of MOS transistors.

UNIT II DESIGNING COMBINATIONAL LOGIC CIRCUITS 12Hrs

Static CMOS design – Complementary CMOS, Propagation Delay and Power Consumption in static CMOS, Pseudo NMOS Logic, Pass Transistor Logic, Transmission gates, Dynamic CMOS Design – Basic principle, Speed and Power dissipation of Dynamic logic, Signal integrity issues in dynamic design,CMOS Domino logic, np CMOS logic.

UNIT III DESIGNING SEQUENTIAL LOGIC CIRCUITS 12Hrs

Introduction – Timing metrics for sequential circuits, Classification of memory elements, Static latches and registers – The bi-stability principle, Multiplexer based latch, Master slave edge triggered register, Static SR flip flop, Dynamic latches and registers – Dynamic transmission gate edge triggered registers, clocked CMOS register.

UNIT IV VHDL & VERILOG PROGRAMMING 12Hrs

VHDL background – VHDL requirement, Elements of VHDL, operators, Basic concepts in VHDL, Structural modeling, Behavioral modeling and Dataflow modeling in VHDL and Simple programs, Verilog HDL – Basic concepts – Gate Level modeling, Dataflow modeling and Behavioral modeling – Simple programs.

UNIT V PIC MICROCONTROLLER 12Hrs

Introduction - PIC16F877 Micro controller overview, Special Function Registers, I/O Ports, Timers, Oscillators, Capture/ Compare and PWM module, Serial communication module, Analog module and Instruction set.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60 Hrs

TEXT BOOKS :

1. Neil H.E. Weste, Kamran Eshraghian, "*Principles of CMOS VLSI Design – A system perspective*", second edition,Addison Wesley,1997.
2. Jan M.Rabaey, AnanthChandrakasan, BorivojeNikolic, " *Digital Integrated Circuits : A Design perspective*", second edition, Prentice Hall of India, 2003.
3. ZainalabedinNavabi, " *VHDL – Analysis and modeling of Digital Systems*" , Second edition, Mcgraw – Hill International Editions, 1998.

REFERNCE BOOKS:

1. *A. Pucknell, Kamran Eshraghian, " Basic VLSI Design", Third Edition, Prentice Hall of India,2007.*
2. *R.Jacob Baker, Harry W.Li, David E. Boyce, "CMOS circuit design, Layout and Simulation", Prentice Hall of india, 2005*
3. *J.Baskar, "A VHDL Primer", Third edition, Pearson Education,2004.*
4. *Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis", second edition, Pearson Education,2003.*
5. *pic-microcontroller.com / free- ebook- pic-microcontrolers.*

Subject Code: BEC18L21	Subject Name : COMMUNICATION ENGINRRRING LAB	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital Communication, Communication Systems	Lb	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To learn the concepts of analog pulse modulation techniques.
- To study the working of digital modulation system.
- To study the different types of information coding.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand and apply the concept of analog pulse modulation.
CO2	Generate codes for transmission of data.
CO3	Apply digital modulation techniques.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	2	2	1	2	2	1	2
CO2	3	3	3	3	1	2	2	2	2	2	1	2
CO3	3	3	3	3	2	2	2	2	2	2	1	2

COS/POS	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	2				
CO2	3	3	2	3				
CO3	3	3	2	2				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

BEC18L21 COMMUNICATION ENGINEERING LAB 0 0/0 3/0 1

1. DESIGN AND TESTING OF AMPLITUDE MODULATION AND DEMODULATION.
2. DESIGN AND TESTING OF FREQUENCY MODULATION AND DEMODULATION.
3. DESIGN AND TESTING OF PULSE AMPLITUDE MODULATION & DEMODULATION.
4. DESIGN AND TESTING OF PULSE WIDTH MODULATION & PULSE POSITION MODULATION.
5. DESIGN AND TESTING OF PRE-EMPHASIS AND DE-EMPHASIS.
6. DESIGN AND TESTING OF NARROW FREQUENCY MODULATION.
7. DESIGN AND TESTING OF ASK, FSK AND PSK
8. STUDY OF LINE CODING AND DECODING TECHNIQUES
9. STUDY OF SAMPLING
10. STUDY OF PULSE CODE MODULATION

Subject Code: BEC18012	Subject Name : WIRELESS NETWORKS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Computer networks	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To give a deep insight for the wireless network architectures, protocols, and applications.
- To study about Adhoc wireless networks and its MAC & Routing protocols.
- To understand the wireless sensor networks and its MAC & Routing protocols.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the concepts of WLAN and PAN
CO2	Identify and Analyze the issues in Adhoc wireless networks
CO3	Design MAC protocols and study its implementation in Adhoc networks.
CO4	Classify the different network routing protocols and potray their significance in the field of wireless networks.
CO5	Learn the architecture of wireless sensor networks and the method of data transmission

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	1	1	2	2	1	3
CO2	3	3	3	3	2	2	2	3	1	1	3	3
CO3	3	3	3	3	3	2	2	3	2	2	1	3
CO4	3	3	3	3	3	2	2	3	3	3	3	3
CO5	3	3	2	2	1	1	1	1	2	2	1	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	3
CO2	3	3	2	3
CO3	3	3	3	2
CO4	3	3	3	2
CO5	2	1	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18012 **WIRELESS NETWORKS** **3 1/0 0/0 4**

UNIT I WIRELESS LANS AND PANS 12Hrs

Introduction - FUNDAMENTALS OF WLANS- Technical Issues - Differences Between Wireless and Wired Transmission, Use of WLANs, Design Goals- Network Architecture - Infrastructure Based Versus Ad Hoc LANs, Components in a TypicalIEEE802.11 Network, Services Offered by a TypicalIEEE802.11 Network- IEEE802.11 STANDARD- Physical Layer, Basic MAC Layer Mechanisms- HIPERLAN standard-Bluetooth

UNIT II AD HOC WIRELESS NETWORKS 12Hrs

INTRODUCTION - Cellular and Ad Hoc Wireless Networks - definition, characteristics features, Applications of Ad Hoc Wireless Networks- Issues in ad hoc wireless networks - Ad Hoc wireless internet.

UNIT III MEDIUM ACCESS PROTOCOLS 12Hrs

MAC Protocols: design issues, Design goals of a MAC protocol For Ad Hoc wireless networksand classification of MAC protocols -Contention based protocols- with reservation, with scheduling mechanisms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15, 802.16.

UNIT IV NETWORK PROTOCOLS 12Hrs

Routing Protocols: Design issues, goals and classification of Routing Protocols - Proactive Vs reactive routing, Table-driven routing protocols: Destination sequence Distance – Vector routing Protocol, wireless Routing Protocol - On-demand routing protocols: Dynamic source Routing protocol, Ad Hoc on Demand Distance – vector Routing protocol - Hybrid Routing protocol : Core extraction distributed Ad Hoc routing protocol , Zone routing protocol - Power-aware routing protocols: Power – aware routing metrics.

UNIT V WIRELESS SENSOR NETWORKS 12Hrs

Introduction - Sensor Network Architecture - Data Dissemination - Data Gathering - MACPROTOCOLS for Sensor Networks - Location Discovery - Quality of a Sensor Network

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 60Hrs

TEXT BOOKS

1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures andprotocols, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

REFERENCES

1. *Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobilead hocnetworking, Wiley-IEEE press, 2004.Mohammad Ilyas, The handbook of adhoc wireless networks, CRC press, 2002.*
2. *T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad Hoc Network*
3. *Research," Wireless Commun. and Mobile Comp., Special Issue on Mobile Ad HocNetworking Research, Trends and Applications, vol. 2, no. 5, 2002, pp. 483–502.*
4. *A survey of integrating IP mobility protocols and Mobile Ad hoc networks, FekriM.Abduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, v no.12007*
5. *V.T. Raisinhani and S.Iyer "Cross layer design optimization in wireless protocolstacks"Comp. communication, vol 27 no. 8, 2004.*
6. *V.T.Raisinhani and S.Iyer,"ÉCLAIR; An Efficient Cross-Layer Architecture forwireless protocol stacks",World Wireless cong., San francisco,CA,May 2004.*
7. *V.Kawadia and P.P.Kumar,"A cautionary perspective on Cross-Layer design,"IEEEWireless commn.,vol 12, no 1,2005.*

Subject Code: BEC18ET4	Subject Name : INTERNET OF THINGS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Sensor, Linux Basics	ETL	1	0/1	3/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study basic of IoT and M2M.
- To study IoT with Cloud environment.
- To design IoT systems with Python and study physical devices.

COURSE OUTCOMES (COs) : (3- 5)
The students will be able to

CO1	Describe the fundamentals about IoT
CO2	Use the IoT concepts and its application
CO3	Design IoT systems with Cloud environment.
CO4	Articulate design of IoTdevices using Python software.
CO5	Develop new applications with Raspberry Pi and Intel Galileo Arduino board.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	2	2	2	3	3
CO2	3	3	3	3	3	3	2	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	3	3	3	3
CO4	3	3	3	3	3	2	3	2	2	3	3	2
CO5	3	3	3	3	3	3	2	3	2	3	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18ET4 INTERNET OF THINGS 1 0/1 3/03

UNIT I INTRODUCTION TO INTERNET OF THINGS 9 Hrs

Definition and Characteristics of IoT – Things in IoT – IoT Protocols – Logical Design of IoT – IoT enabling technologies – IoT Levels.

UNIT II DOMAIN SPECIFIC IoT AND M2M 9 Hrs

Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Life style – Introduction to M2M – Difference between IoT to M2M –SDN and NFV for IoT.

UNIT III IoT SYSTEM MANAGEMENT AND CLOUD 9 Hrs

Need for IoT System Management - SNMP – NETCONF – YANG – NETOPEER – IoT design methodology - Case study for IoT System – WAMP –AutoBahn for IoT – Xively – Django- Amazon Web for IoT – SkyNetIoT.

UNIT IV IoT SYSTEMS – LOGICAL DESIGN USING PYTHON 9 Hrs

Introduction – Installing Python – Python Data types and data structures – Control flow – Functions – Modules – Packages – File Handling – Data / Time Operations – Classes – Python packages of Interest for IoT.

UNIT VIoT PHYSICAL DEVICES 9 Hrs

Raspberry Pi – Linux on Raspberry Pi -Raspberry Pi Interfaces – Programming Raspberry Pi with Python – Arduino boards – Other IoT devices – Data analytics for IoT –Intel Galileo Arduino board Specification (with simple programs).

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. ArshdeepBahga.Vijaymadisetti ,*" Internet of things – A hands- on approach* " , Universities press, First Editon, 2015.
2. Adrian McEwen and Hakim Cassimally, "*Designing the Internet of Things*",Wiley,First edition 2014.
3. C HillarGastn, "*Internet of Things with Python*",Packt publishing, first edition ,2016.

REFERENCE BOOKS:

1. *Dominique D. Guinard and Vlad M. Trifa "Building the Web of Things With examples in Node.js and Raspberry Pi",June 2016 ISBN 9781617292682*
2. *CharalamposDoukas, "Building Internet of Things with the Arduino" ISBN/EAN13:1470023431 / 9781470023430*
3. *Gastón C. Hillar, "Internet of Things with Python", May 2016 , PACKT Publishing limited.*
4. *Marco Schwartz "Internet of Things with the Raspberry Pi: Build Internet of Things Projects Using the Raspberry Pi Platform", Kindle Edition.*

Subject Code: BEC18013	Subject Name : COGNITIVE RADIO	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Communication Theory	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To enable the student to understand the evolving paradigm of cognitive radio communication and the enabling technologies for its implementation.
- To enable the student to understand the essential functionalities and requirements in designing software defined radios and their usage for cognitive communication.
- To expose the student to the evolving next generation wireless networks and their associated challenges

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe the basics of the software defined radios.
CO2	To learn the hardware and software architecture of software defined radio
CO3	Design the wireless networks based on the cognitive radios
CO4	Gives an understanding of cognitive radio architecture
CO5	Explain the concepts behind the wireless networks and next generation networks

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	3	1	3	1	1	2	1	1
CO2	3	1	2	3	2	3	2	3	1	1	2	1
CO3	2	1	3	1	2	2	2	1	1	2	1	1
CO4	2	3	2	3	2	3	3	1	1	3	3	1
CO5	3	1	2	1	3	3	1	2	2	3	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	3
CO2	3	3	2	3
CO3	3	3	1	3
CO4	3	1	3	3
CO5	3	2	1	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

BEC18013 COGNITIVE RADIO 3 0/0 0/0 3

UNIT I INTRODUCTION TO SDR 9Hrs

Definitions and potential benefits, software radio architecture evolution – foundations, technology tradeoffs and architecture implications, Antenna for Cognitive Radio.

UNIT IISDR ARCHITECTURE 9Hrs

Essential functions of the software radio, architecture goals, quantifying degrees of Programmability, top level component topology, Computational properties of functional components, interface topologies among plug and play modules, architecture partitions.

UNIT IIIINTRODUCTION TO COGNITIVE RADIOS 9Hrs

Making radio self-aware, the cognition cycle, organization of cognition tasks, structuring knowledge for cognition tasks, Enabling location and environment awareness in cognitive radios – concepts, architecture, design considerations.

UNIT IV COGNITIVE RADIO ARCHITECTURE 9Hrs

Primary Cognitive Radio functions, Behaviors, Components, A–Priori Knowledge taxonomy, observe – phase data structures, Radio procedure knowledge encapsulation, components of orient, plan, decide, act phases; knowledge representation, design rules.

UNIT V NEXT GENERATION WIRELESS NETWORKS 9Hrs

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. Alexander M. Wyglinski, MaziarNekovee, and Y. Thomas Hou, “Cognitive Radio Communications And Networks - Principles And Practice”, Elsevier Inc., 2010.
2. E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, “Principles of Cognitive Radio”, Cambridge University Press, 2013.
3. Kwang-Cheng Chen and Ramjee Prasad, “Cognitive Radio Networks”, John Wiley & Sons Ltd., 2009.

REFERENCES BOOKS:

1. *Khattab, Ahmed, Perkins, Dmitri, Bayoumi, Magdy, “Cognitive Radio Networks - From Theory to Practice”, Springer Series: Analog Circuits and Signal Processing, 2009.*
2. *J. Mitola, “Cognitive Radio: An Integrated Agent Architecture for software defined radio”, Doctor of Technology thesis, Royal Inst. Technology, Sweden 2000.*
3. *Simon Haykin, “Cognitive Radio: Brain –empowered wireless communications”, IEEE Journal on selected areas in communications, Feb 2005.*
4. *Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, ShantidevMohanty, “NeXt generation /dynamic spectrum access / cognitive radio wireless networks: A Survey” Elsevier Computer Networks, May 2006.*
5. *Joseph Mitola, “Software Radio Architecture: A Mathematical Perspective” IEEE Journal on Selected Areas in Communication, Vol. 17, No. 4, April 1999.*
6. *HasariCelebi ,HuseyinArslan, “Enabling location and environment awareness in cognitive radios”, Elsevier Computer Communications, January 2008.*

Subject Code: BEC18L12	Subject Name : PROJECT PHASE - I	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: NIL	Lb	0	0/0	3/3	2

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES : The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	Formulate students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	Analyze research skills and demonstrate their proficiency in communication skills.
CO4	Make the students to face challenges of team work, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	3	1	2	2	3	3
CO2	3	3	3	3	3	3	3	2	2	2	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	2
CO4	3	2	3	3	3	3	2	3	3	3	3	3

Cos/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	3
CO3	3	2	3	3
CO4	3	2	2	3

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code:	Subject Name : Project Phase - II	T / L/ ETL	L	T / S.Lr	P/ R	C
BEC18L13	Prerequisite: NIL	Lb	0	0	12/12	8

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue , address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	Formulate students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	Analyse research skills and demonstrate their proficiency in communication skills.
CO4	Make the students to face challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	`	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	2	3	3	3
CO4	3	3	3	3	3	3	3	2	2	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				
CO4	3	3	3	3				

3/2/L1indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
							✓					

Subject Code: BEC18E01	Subject Name : MICROPROCESSOR AND MICROCONTROLLER	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital Electronics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the architecture, addressing modes, and assembly language program of 80386 microprocessor.
- To understand the concepts of different peripherals and their applications
- To learn the functions of 8051 microcontroller and ARM processor and their applications.

COURSE OUTCOMES (COs) :

The students will be able to

CO1	Write assembly language program in 8085 and 8086 and understand the design of advanced processors.
CO2	Show their ability to interface peripherals with microprocessors
CO3	Hone their inferences to develop a hardware using 8051 microcontroller
CO4	Demonstrate their skills in writing an ALP in 8051 to do real time applications
CO5	Apply their understanding to do a project to develop an application using ARM processor.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	3	1	1	2	2	2	1
CO2	3	3	3	3	3	3	1	2	2	3	2	2
CO3	2	2	2	1	3	3	2	3	3	3	3	2
CO4	3	3	2	3	3	2	2	3	2	2	1	3
CO5	3	2	3	2	3	3	3	3	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	2	2	3	2
CO3	3	3	3	3
CO4	3	2	3	3
CO5	3	2	2	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E01 MICROPROCESSOR AND MICROCONTROLLER 3 0/0 0/0 3

UNIT I INTEL 8 BIT, 16 BIT & 32 BIT MICROPROCESSORS 9 Hrs

Introduction to 8085 & 8086 microprocessors – Instruction sets – Advanced 80386 Architecture, Addressing modes – Data types of 80386 – Real address mode of 80386 – Segmentation , paging , Salient features of PENTUM.

UNIT II PERIPHERALS INTERFACING 9 Hrs

Interfacing serial I/O(8251)-Parallel I/O(8255) –Keyboard and display controller (8279)-ADC/DAC Interfacing-Timer (8253).Programmable Interrupt Controller (8259), DMA controller, Applications of 8085

UNIT III8051 MICROCONTROLLER 9 Hrs

8051 Microcontroller hardware I/O pins, Ports and circuits-External memory –Counters and Timers-Serial Data I/O –Interrupts.

UNIT IV 8051 PROGRAMMING AND APPLICATIONS 9 Hrs

8051 Instruction set –Addressing Modes –Assembly Language Programming -8051 interfacing LCD, ADC, Sensors, Stepper motors, Motors, Keyboard and DAC

UNIT V INTRODUCTION TO ARM PROCESSOR 9 Hrs

ARM Architecture –ARM programmer's model- ARM development tools-memory hierarchy-ARM assembly language programming-Simple Examples-Architectural support for operating system- ARM instruction Set-Embedded ARM Applications

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. Krishna Kant, "*Microprocessors and Microcontrollers, Architecture,programming and system design using 8085, 8086, 8051 and 8096*",PHI 2007.
2. Douglas V Hall, "*Microprocessor and Interfacing, Programming and hardware*",TMH, 2006.
3. R.S. Gaonkar,"*Microprocessor Architecture Programming and Application, with 8085"*, Wiley Eastern Ltd., New Delhi, 2013.

REFERNCE BOOKS:

1. *Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay "The 8051Microcontroller and Embedded Systems", Second Edition, Pearson Education 2008.*
2. *Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC",Delmar Publishers, 2007.*
3. *A K Ray, K M Bhurchandi, Advanced Microprocessors and Peripherals, TMH, 2007.*
4. *Stevefurber "ARM Systems on chip Architecture", Second Edition Addison Wesley trade computer publication,2000.*
5. *John .B.Peatman"Design with PIC Microcontrollers" ,Pearson Education, 3rd Edition, 2004*

Subject Code: BEC18E02	Subject Name : Semiconductor devices and its applications	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn the functions of special diodes and their applications.
- To acquire the knowledge about operation of power diodes and utilize them for various applications with a regulated power supply

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the characteristics of special diodes
CO2	Apply the diodes for basic electronic design
CO3	Remember the operations of inverters.
CO4	Illustrate the different types of converters.
CO5	Demonstrate the design of protection and switch gear

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	2	1	1	1	1	2	1	1
CO2	2	1	2	3	2	1	1	1	1	2	1	1
CO3	2	1	1	2	2	2	2	1	2	2	2	2
CO4	2	1	1	2	2	2	2	1	2	2	2	2
CO5	2	2	3	3	2	1	2	3	3	2	3	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	1
CO2	2	3	2	1
CO3	1	1	3	2
CO4	1	1	3	2
CO5	1	1	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E02 SEMICONDUCTOR DEVICES AND ITS APPLICATIONS 3 0/0 0/0 3

UNIT I SPECIAL DIODES 9Hrs

Breakdown Diodes-Avalanche Multiplication, Zener breakdown and its characteristics, Tunnel Diodes – Principle and Characteristics, Photodiode and its characteristics, Photo Voltaic Effect, and Light Emitting Diodes, Four Layer diode and its characteristics

UNIT II APPLICATIONS OF DIODES 9Hrs

Diode as clipper, clamper, comparator, sampling gate, voltage multipliers and peak detectors - Regulated Power Supply

UNIT III INVERTERS 9Hrs

Single Phase and three phase inverters-Voltage source inverters-current source inverters-Multilevel inverters-Resonant inverters

UNIT IV CONVERTERS 9Hrs

Single phase and three phase converters –Buck-Boost Converters-Dc to Dc converters-Ac to Ac Converters- Resonant Converters-Cycloconverters

UNIT V FIRING AND PROTECTING CIRCUITS 9Hrs

Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT - Over voltage, over current and gate protections

TEXT BOOKS :

1. Jacob Milman, Christos Halkias and ChetanD.Parikh, ‘Integrated Electronics, Analog and Digital Circuits and Systems”
2. Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004
3. B.W Williams ‘Power Electronics Circuit Devices and Applications’.

REFERENCESBOOKS :

1. P.S.Bimbra, ‘Power Electronics” ,KhannaPublishers,Eleventh Edition 2003
2. Ned Mohan,T.MUndeland and W.P Robbin, “Power Electronics: converters, Application and design” John Wiley and sons.Wiley India edition, 2006
3. P.C. Sen, “Modern Power Electronics”, Wheeler Publishing Co, First Edition, New Delhi, 1998

Subject Code:	Subject Name : BASICS OF ROBOTICS	T / L/ ETL	L	T / S.Lr	P/ R	C
BEC18E03	Prerequisite: Microprocessor and Microcontroller	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot.
- To develop a deep knowledge sensors and their applications in robot.
- To discuss about the various end effectors and manipulators.
- To develop a path planning and programming of robots.

COURSE OUTCOMES (COs) : (3- 5)

The students will be able to

CO1	Identify the importance of robotics in today and future goods production.
CO2	Describe the robot configuration and transmission systems.
CO3	Manipulate the electronic and pneumatic manipulators.
CO4	Investigate with the typical robot.
CO5	Implement specialized software and working of mobile robot.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	2	3	3	3	3
CO3	3	3	3	3	3	3	2	2	3	3	3	3
CO4	3	3	3	3	3	2	3	3	3	2	3	3
CO5	2	2	2	3	3	2	3	3	3	2	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	3	2
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E03 BASICS OF ROBOTICS3 0/00/03

UNIT I INTRODUCTION 9Hrs

Specifications of Robots- Classifications of robots – Work envelope - Flexible automation versus Robotic technology – Applications of Robots- robot kinematics and dynamics -Positions, Orientations and frames, Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations and Transformations - Transformation Arithmetic - D-H Representation - Forward and inverse Kinematics of Six Degree of Freedom Robot Arm – Robot Arm dynamics

UNIT II ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS 9Hrs

Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws.

UNIT III MANIPULATORS 9 Hrs

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic manipulators.

UNIT IV ROBOT END EFFECTORS 9Hrs

Classification of End effectors – Tools as end effectors. Drive system for grippers-Mechanical adhesive-vacuum, magnetic-grippers. Hooks Scoops. Gripper force analysis and gripper design. Active and passive grippers.

UNIT V PATHPLANNING & PROGRAMMING 9Hrs

Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion – straight line motion-Robot languages -.computer control and Robot software.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS:

1. Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.
2. John J.Craig , “Introduction to Robotics”, Pearson, 2009. 3. Mikell P. Grooveret. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York, 2008.

REFERENCE BOOKS:

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An Integrated Approach", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd., 2006.
2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics : Control, Sensing, Vision and Intelligence", McGraw Hill, 1987

Subject Code: BEC18E05	Subject Name : Antenna and Wave Propagation	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: EMF, TLWG	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study Antenna Parameters.
- To study Radiation Resistance, Antenna Efficiency Measurement.
- To study Antenna Arrays.
- To study different types Antennas
- To study Radio wave propagation.

COURSE OUTCOMES (COs) : (3- 5)
The students will be able to

CO1	Understand the knowledge about antenna basics.
CO2	Write about the radiation from a current element.
CO3	Analyze the antenna arrays.
CO4	Explain various types of antenna.
CO5	Describethe various types of radio wave propagation.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	2	2	1	2	2
CO2	3	3	3	3	3	3	2	2	2	2	2	2
CO3	3	3	3	3	3	2	2	2	2	1	2	2
CO4	3	3	3	3	3	2	2	2	2	1	2	2
CO5	3	3	3	3	3	2	2	3	2	1	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	2				
CO2	3	3	2	2				
CO3	3	3	2	2				
CO4	3	3	2	2				
CO5	3	3	2	2				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

Approval	B.Tech Electronics and Communication Engineering Regulation 2018

BEC18E05ANTENNA AND WAVE PROPAGATION 3 0/0 0/0 3

UNIT I ANTENNA BASICS 9Hrs

Antenna Parameters – Gain, Directivity, Effective Aperture Polarization, Beam width, Balun, Ground System, Top loading, monopole and Half wave dipole antenna, Short linear antenna, Beam solid angle, Antenna Temperature.

UNIT II RADIATION PRINCIPLE AND ANTENNA TERMINOLOGIES9Hrs

Principle of Radiation, pattern, Antenna Terminologies – Reciprocity Theorem, Friss Formula, Slot Antennas, SWR(Standing Wave Radiators)

UNIT IIIANTENNA ARRAYS9Hrs

Arrays – Two Element Arrays – Uniform Linear Array – Broadside Array – End fire array – Principle of Pattern Multiplication – Binomial Arrays.

UNIT IVSPECIAL ANTENNA9Hrs

Dish Antenna – Helical Antenna, Biconical Antenna, Microstip Patch Antenna, Turnstile Antenna, Yagi – uda antenna, Loop Antenna, Antenna Low and Medium Frequencies.

UNIT V WAVE PROPAGATION9Hrs

Wave Propagation - Surface Wave Propagation , Structure of the Ionosphere, Space Wave Propagation- Determination of Critical Frequencies - Maximum Usable Frequency - Effect of Earth's Magnetic Field - Fading - Super Refraction - Scatter Propagation.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. Constantine A.Balanis, "*Antenna theory analysis and design*" JohnWiley , 2nd Edition 2007.
2. G.S.V. Raju, "*Antenna wave propagation*", pearson education, 2004.
3. R.E. Collins, "*Antenna and Radio wave propagation*".

REFERENCE BOOKS:

1. *John D. Kraus, Ronald J Marhefka. "Antenna for all Appplications" Tata McGraw Hill 3nd Edition,2007.*
2. *A.R.Harish, M. Sachidanada, "Antenna and wave propagation", Oxford university press,2007.*
3. *W.L.Stutzman and G.A. Thiele, "Antenna analysis and design", John willey,2000.*

Subject Code: BEC18E06	Subject Name : Telecommunication Switching Systems	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Computer Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To get knowledge about the telecommunication industry, its services theoretical basics about the performance and operation in telecom networks.

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Describe and apply the fundamentals of telecommunication systems and associated technologies.
CO2	Understand and explain the reasons for switching and the relative merits of the various modes of switching.
CO3	Analyze and design systems related to traffic engineering.
CO4	Analyze the internal design and operation of telephone networks with regard to key signaling systems used in telecommunication networks.
CO5	Understand and analyze the switching techniques used in data networks.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	1	1	1	1	1	3	3
CO2	3	3	1	3	3	1	1	1	1	1	3	3
CO3	3	3	3	3	1	1	1	1	1	1	3	3
CO4	1	3	3	3	1	1	1	1	1	1	1	3
CO5	1	3	3	3	3	1	1	1	1	1	1	3

COs / PSOs	PSO1	PSO2	PSO3				
CO1	3	3	2	1	3	3	3
CO2	3	3	2	1	3	3	3
CO3	3	2	3	2	3	3	2
CO4	3	3	2	2	3	3	3
CO5	3	3	2	2	3	3	3

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✓						

BEC18E06TELECOMMUNICATION SWITCHING SYSTEMS 3 0/0 0/0 3

UNIT I Introduction 9 Hrs

Evolution of Telecommunications, Simple Telephone Communication, Manual switching system, major telecommunication Networks, Strowger Switching System, Crossbar Switching

UNIT II Switching Concepts 9 Hrs

SPC-its categorization, Enhanced Services, Two stage networks, Three stage networks, n-stage networks

Time multiplexed Space Switching, Time Multiplexed time switching, combination Switching, Three stage combination switching, n-stage combination switching.

UNIT III Traffic Engineering 9 Hrs

Network Traffic load and parameters, Grade of service and blocking probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay systems.

UNIT IV Telephone Networks 9 Hrs

Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Transmission Systems, Numbering Plan, Charging Plan, Signaling Techniques, In channel signaling, common channel signaling, Cellular mobile telephony.

UNIT V Data Networks 9 Hrs

EPABX system – block diagram, working – Data transmission in PSTN, data rates in PSTNs – ISO – OSI reference model – Motivation for ISDN – Networks and protocol architecture, ISDN standards, broadband ISDN, voice data integration.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. ThiagarajanVishwanathan, “Telecommunication Switching Systems and Networks”;PHI Publications.
2. J. E. Flood, “Telecommunications Switching, Traffic and Networks”, PearsonEducation.
3. B.Forouzan “Data Communications and Networking”, Pearson Education.

REFERENCE BOOKS:

1. John C. Bellamy, “Digital Telephony”, Third Edition; WileyPublications.
Andy Valder,”Understanding Telecommunication Networks”,IET press

Subject Code: BEC18E07	Subject Name : REAL TIME OPERATING SYSTEMS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Operating Systems Concepts	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Review of elements and fundamentals of Systems.
- To understand the embedded tools. z
- To understand the queues and scheduling

COURSE OUTCOMES (COs) :

The Student will be able to

CO1	Understand the fundamentals of embeddd system
CO2	Apply scheduling techniques for completing an operation
CO3	Remember the functions of key elements of RTOS
CO4	Implement the design of simple RTOS
CO5	Demonstrate the applications of software development tools in real time system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	3	1	1	1	1	1	2
CO2	2	3	3	3	3	2	1	1	2	3	2	2
CO3	1	3	3	2	3	1	1	1	3	3	1	2
CO4	1	3	3	3	3	2	1	1	2	2	1	2
CO5	2	2	3	3	3	1	1	1	2	2	1	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	2
CO2	1	2	3	1
CO3	1	2	2	1
CO4	1	2	3	2
CO5	1	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E07 REAL TIME OPERATING SYSTEMS 30/0 0/0 3

UNIT I EMBEDDED SYSTEM FUNDAMENTALS 9 Hrs

Introduction, Characteristics of embedded systems and challenges in system design –Design issues in embedded real-time systems, critical performance issues in embedded real-time systems.

UNIT II SURVEY OF SOFTWARE ARCHITECTURES 9 Hrs

Round –robin, Round-robin with interrupts, queues. Function- scheduling architecture, Real time operating system architecture, Scheduling architecture.

UNIT III ELEMENTS OF REAL TIME OPERATING SYSTEMS 9 Hrs

Tasks & Task states, Tasks & data, Semaphores & shares data, Message Queues, Mailboxes and Pipes, Timer functions, Events, Memory management and Interrupt Routines in an RTOS environment.

UNIT IVBASIC DESIGN USING REAL-TIME OPERATING SYSTEMS 9 Hrs

Principles, encapsulating semaphores & queues, hard real-time scheduling considerations, saving memory space, savingpower.

UNIT VEMBEDDED TOOLS 9 Hrs

Embedded software development tools- host and target machines, linker/locators for embedded software, getting embedded software into the target system. Debugging techniques- testing on host system, instruction set simulators, the assert, macro using laboratory tools.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs
TEXT BOOKS:

1. Wayne Wolf, "*Computers as Components- Principles of Embedded Computing Systems Design*", Academic press,2001.
2. David E. Simon, "*An Embedded Software Primer*", Pearson education, 1999.

REFERENCE BOOKS:

1. *Arnold S. Berger, "Embedded Systems Design- an Introduction to Processes, Tools & Techniques", CMP books, 2002.*
2. *Jean J. Labrosse, "Embedded Systems Building Blocks", CMP books, 2002.*

Michael Barr, "Programming Embedded Systems in C andC++", O'Reilly, 1999.

Subject Code: BEC18E09	Subject Name : Intelligent Instrumentation	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Electronic Circuit	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Introduce students to the use of various electrical/electronic instruments, their construction, applications, principles of operation, standards and units of measurements .Basic measurement and transducers concepts
- Provide students with opportunities to develop basic skills in the design of electronic equipment are using PLC.

COURSE OUTCOMES (COs) : (3- 5)

The student will be able to

CO1	Learn to concepts of transducers.
CO2	Understand the basic design techniques of signal generators and analyzers.
CO3	Gain knowledge about Instrumentation standard protocols.
CO4	Use various laboratory instruments like cathode ray oscilloscope, function generators and analyze various patterns.
CO5	Develop basic skills in designing of computer controlled instrumentation.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	2	2	1	1	2	3	3	3	3
CO2	3	3	3	3	3	3	3	2	2	3	2	2
CO3	3	1	1	2	3	3	2	1	3	3	3	3
CO4	3	3	3	2	2	2	3	1	2	3	3	3
CO5	3	3	3	2	2	2	3	1	2	3	3	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	1	3	3
CO2	3	3	3	3
CO3	3	2	3	3
CO4	3	3	2	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E09 INTELLIGENT INSTRUMENTATION 3 0/0 0/0 3

UNIT I TRANSDUCERS 9 Hrs

Transducer definition, classification, and performance characteristics. Potentiometer and its types, loading effect, sensitivity, piezo-resistive, equivalent circuits, charge and voltage sensitivity. Measurements, Instrumentation, Errors in Measurements, Calibration and Standard.

UNIT II SIGNAL GENERATOR AND SIGNAL ANALYZERS9Hrs

A.F. Generator, Pulse Generator, AM / FM Signal Generator, Function Generator, Sweep Frequency Generator, Wave Analyzers, Spectrum Analyzers, Logic Analyzer, Distortion Analyzers, Network Analyzer.

UNIT IIIINSTRUMENTATION STANDARD PROTOCOLS9 Hrs

Definition of protocol, HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Foundation Field bus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

UNIT IV DATA DISPLAY AND RECORDING SYSTEM9 Hrs

CRO, Single Beam, Dual Trace, Double Beam CRO, Digital Storage and Analog Storage Oscilloscope, Sampling Oscilloscope, Power Scope, Curve Tracer, Analog, Digital Recorders and Printers – Case Study on Lissajous Pattern.

UNIT V COMPUTER CONTROLLED TEST SYSTEM9 Hrs

Programmable logic controllers (PLC) Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PLC design, study of at least one industrial PLC.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS:

1. Rangan C.S. "*Instrumentation Devices and Systems*", Tata McGraw Hill, 1998.
2. SandeepRedkar, "Foundation Fieldbus control system", Rockwell Automation,2010,
3. K. Shawney "*Electronics and Electrical Instrumentation*", Tata McGraw Hill, 1975.

REFERENCES BOOKS:

1. *Bouwels A.J., "Digital Instrumentation", McGraw Hill, 1986.*
2. *Barney .C, "Intelligent Instrumentation ", Prentice Hall of India, 1985.*
3. *Oliver and Cage, "Electronic Measurements and Instruments and Instrumentation", McGraw Hill, 1975.*
4. *Deobelin, "Measurements Systems", McGraw Hill, 1990.*
5. *Cooper, "Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 1988.*

Subject Code: BEC18E10	Subject Name : Advanced Microprocessors	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Microprocessor and Microcontrollers	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To introduce the concepts in internal programming model of Intel family of microprocessors.
- To introduce the programming techniques using MASM, DOS and BIOS function calls.
- To introduce the architecture programming and interfacing of 16 bit microcontrollers.
- To introduce the concepts and architecture of RISC processor

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Explain the generalized architecture of advanced microprocessor
CO2	Develop algorithm/ program of advanced microprocessor or a particular task.
CO3	Appreciate the microprocessor based system design
CO4	Analyze the MOTOROLA MC 68000 family
CO5	Describe about the various RISC processors

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	2	1	3	3	1	3
CO2	3	3	3	3	2	2	1	2	3	3	3	3
CO3	3	3	2	2	1	1	2	2	1	3	2	3
CO4	3	3	3	3	1	1	3	1	2	2	3	2
CO5	3	3	3	3	1	1	1	1	3	3	1	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	3	1	1
CO3	3	2	2	1
CO4	3	1	2	2
CO5	3	1	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E10 ADVANCED MICROPROCESSORS 3 0/0 0/0 3

UNIT I THE INTEL X86 FAMILY 9Hrs

The Intel X86 Family Architecture, 32 bit Processor Evolution Systems Connections and Timing, Instruction and Data Formats, Instruction set of X86 Processors, Addressing Modes.

UNIT II INTEL X86 ASSEMBLY LANGUAGE PROGR 9Hrs

Implementation of Strings, Procedures, Macros, BIOS and DOS Services using X86 Assembly Language Programming, Memory and I/O Interfacing, Analog Interfacing and Industrial Control.

UNIT III SYSTEM DEVELOPMENT 9 Hrs

Microprocessors Based System Design, TMS 320 Series DSP Based Signal Processing, Microcontroller 8096, architecture, addressing mode and system design.

UNIT IV THE MOTOROLA MC 68000 FAMILY 9Hrs

The MC 68000 Architecture, CPU Registrars, Data Formats, Addressing Modes, Instruction Set and Assembler Directors, Memory Management Instruction and Data, Caches, Exception Processing.

UNIT V RISC PROCESSORS 9 Hrs

RISC vs CISC, RISC Properties and Evaluation, Advanced RISC Microprocessors, DEC ALPHA, The Power PC family.The SUN SPARC Family, the MIPS RX 100 Family, the Intel 860 Family. The Motorola M88000 Family, HP Precision Architecture.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS:

1. B.B. Bery, "The Intel Microprocessors 8086 / 8088, 80186 / 80188, 80286, 80386, 80486, PENTIUM, and PENTIUM Processors", Prentice Hall, 1997.
2. K Udayakumar, B.S. Uma Shankar, "Advanced Microprocessors and IBM PC Assembly Language Programming", Tata McGraw Hill, 1996

REFERENCES BOOKS:

1. *Daniel Tabak, "Advanced Microprocessors", McGraw Hill, 1995.*
2. *Douglas V. Hall, "Microprocessors and Interfacing – Programming Hardware", McGraw Hill, 1992.*
3. *W.A. Tribel& A. Singh, "The 68000 and 68020 Microprocessors – Architecture, Software and Interfacing Techniques", Prentice hall of India, 1991*
4. *Rifiquzzaman, "Microprocessors – Theory and Applications: Intel and MotorolaPrentice Hall, 1992.*
5. *Kenneth J. Ayala, "The 8051 Microcontroller, Architecture, Programming and Application", Penram International Publishing (India), 1996.6. John Peatman, "Design with Microcontrollers", McGraw Hill International, 1988*

Subject Code: BEC18E11	Subject Name :NANO ELECTRONICS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Physics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn and understand basic concepts of Nano electronics.
- To know the techniques of fabrication and measurement.
- To gain knowledge about Nanostructure devices and logic devices.

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Introduce the students to Nano electronics, Nano devices, and to identify quantum mechanics behind Nano electronics.
CO2	Demonstrate fabrication and measurement techniques
CO3	Describe the properties of Nano materials
CO4	Categorizethe Nano structure devices
CO5	Understand and explain the principle and application of logic devices.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	3	3	3	3	1	3	2	3
CO2	3	3	3	3	3	3	2	3	3	3	3	3
CO3	3	3	3	3	3	3	3	2	1	3	2	3
CO4	3	3	3	3	3	3	3	3	2	3	2	3
CO5	3	3	3	2	3	3	3	3	2	3	2	3

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	3	3				
CO3	3	3	3	3				
CO4	3	3	3	3				
CO5	3	3	3	3				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E11 NANO ELECTRONICS 3 0/0 0/0 3

UNIT I INTRODUCTION TO NANOELECTRONICS 9Hrs

Microelectronics towards biomolecule electronics-Particles and waves- Wave-particle duality- Wave mechanics- Schrödinger wave equation- Wave mechanics of particles: – Atoms and atomic orbitals- Materials for nanoelectronics- Semiconductors- Crystal lattices: Bonding in crystals- Electron energy bands- Semiconductor heterostructures- Lattice-matched and pseudomorphicheterostructures- Inorganic-organic heterostructures- Carbon nanomaterials: nanotubes and fullerenes

UNIT II FABRICATION AND MEASUREMENT TECHNIQUES 9Hrs

Growth, fabrication, and measurement techniques for nanostructures- Bulk crystal and heterostructure growth- Nanolithography, etching, and other means for fabrication of nanostructures and nanodevices- Techniques for characterization of nanostructures- Spontaneous formation and ordering of nanostructures- Clusters and nanocrystals- Methods of nanotube growth- Chemical and biological methods for nanoscale fabrication- Fabrication of nano-electromechanical systems

UNIT III PROPERTIES 9Hrs

Dielectrics-Ferroelectrics-Electronic Properties and Quantum Effects-Magneto electronics – Magnetism and Magneto transport in Layered Structures-Organic Molecules – Electronic Structures, Properties, and Reactions-Neurons – The Molecular Basis of their Electrical Excitability-Circuit and System Design-Analysis by Diffraction and Fluorescence Methods-Scanning Probe Techniques

UNIT IV NANO STRUCTURE DEVICES 9Hrs

Electron transport in semiconductors and nanostructures- Time and length scales of the electrons in solids- Statistics of the electrons in solids and nanostructures- Density of states of electrons in nanostructures- Electron transport in nanostructures-Electrons in traditional low-dimensional structures- Electrons in quantum wells- Electrons in quantum wires- Electrons in quantum dots- Nanostructure devices- Resonant-tunneling diodes- Field-effect transistors- Single-electron-transfer devices- Potential-effect transistors- Light-emitting diodes and lasers- Nano-electromechanical system devices- Quantum-dot cellular automata

UNIT V LOGIC DEVICES AND APPLICATIONS 9Hrs

Logic Devices-Silicon MOSFETs-Ferroelectric Field Effect Transistors-Quantum Transport Devices Based on Resonant Tunneling-Single-Electron Devices for Logic Applications-Superconductor Digital Electronics-Quantum Computing Using Superconductors-Carbon Nanotubes for Data Processing-Molecular Electronics

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45

TEXT BOOKS:

1. Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, "Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press 2011
2. SupriyoDatta,"Lessons from Nanoelectronics: A New Perspective on Transport", World Scientific2012
3. George W. Hanson,"Fundamentals of Nanoelectronics", Pearson 2009

REFERENCES BOOKS:

1. *Korkin, Anatoli; Rosei, Federico (Eds.), "Nanoelectronics and Photonics",Springer 2008*
2. *Mircea Dragoman, Daniela Dragoman, "Nanoelectronics: principles and devices", CRC Press 2006*
3. *Karl Goser, Peter Glösekötter, Jan Dienstuhl,"Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices", Springer 2004*
4. *W. R. Fahrner, Nanotechnology and Nan electronics: Materials, Devices, Measurement Techniques(SpringerVerlag Berlin Heidelberg 2005)*
5. *Mark A. Reed, TakheeLee,"Molecularnanoelectronics", American Scientific Publishers 2003*

Subject Code: BEC18E13	Subject Name :NEXT GENERATION IP NETWORKS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To have a complete understanding of IPV6 architecture
- To learn the key features of IPV6
- To know the techniques for avoiding network congestion

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Understand the key features of IPV6 architecture
CO2	Analyze the transmission and security of IPV6 protocol
CO3	Interpret the advantages of IPV6 over other networks
CO4	Develop a wireless network architecture
CO5	Apply their ideas for controlling and avoiding network congestion

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	3	3	3	1	1	1	1	1	2
CO2	1	1	1	3	1	3	1	1	1	1	1	1
CO3	1	3	1	1	3	1	2	1	3	1	1	1
CO4	1	1	1	1	1	3	1	1	1	2	1	1
CO5	1	1	1	3	1	1	1	1	1	3	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO 4
CO1	1	3	1	1
CO2	2	1	3	1
CO3	1	3	1	1
CO4	2	1	3	1
CO5	1	3	1	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium,1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E13 NEXT GENERATION IP NETWORKS 3 0/0 0/0 3

UNIT I IP V6 ADRESSING 9 Hrs

Next Generation Networks-Overview-IP V6 Specification-Addressing Architecture-Address Allocation Management-Unicast Address Allocation-Global Unicast Address Format-Testing Address Allocation-Multicast Addressing-Reversed IP V6 Subnet any cast addresses.

UNIT II IP V6 TRANSMISSION AND SECURITY 9Hrs

Internet Control Message Protocol-Hop-by-Hop Options-Header Compression-Packet Tunneling-Domain Name System-Transition Mechanisms-Routing-Renumbering-IP Privacy-Security Architecture for the Internet Protocol-IP Authentication Header-IP Encapsulation Security Payload-IP Authentication using Keyed MD5-The ESP DES-CBC Transform.

UNIT III IP V6 OVER DIFFERENT NETWORKS 9Hrs

IP V6 over Ethernet Networks-IP V6 over FDDI Networks-IP V6 over Token ring Networks- IP V6 over ARCnet Networks- IP V6 over PPP- IP V6 over NBMA Networks- IP V6 over ATM Networks.

UNIT IV WIRELESS IP NETWORK ARCHITECTURES 9Hrs

3GPP Packet Data Networks, Network architecture, Protocol Reference Model, Packet Data Protocols, Bearers, and connections for Packet Services, Packet Data Protocol (PDP) Context, Steps for a Mobile to Access 3GPP Packet-Switched Services, User Packet Routing and Transport, Configuring PDP Addresses on Mobile Stations, GPRS Attach Procedure, Access to MWIF Networks, Session Management.

UNIT V NETWORK CONGESTION CONTROL AND AVOIDANCE 9Hrs

Introduction-Queue Management-Scheduling-Types of flows-Queue Management Techniques: RED-FRED-SRED-PI Controller-REM- E-RED Scheduling Algorithms: Fair Queing-CFS.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. RFC 2373, -IP V6 Addressing Architecture, RFC 1881-IPv6 Address Allocation Management, (Unit I)
2. RFC 2463-Internet Control Message Protocol, RFC 2402-IP Authentication Header (Unit II)
3. RFC 2497-Transmission of IPv6 Packets over ARCnet Networks, RFC-2492-IPv6 over ATM Networks (Unit III)

REFERENCES BOOKS:

1. *http://www.faqs.org/rfcs/(Unit I, II, III)*
2. *JYH-CHENG CHEN, TAO ZHANG,"IP-Based Next Generation Wireless Networks (Systems, Architectures and Protocols)", by John Wiley & Sons, Published by John Wiley & Sons, Inc., Hoboken, New Jersey.2004. (Unit IV)*
3. *http://www.icir.org/floyd/red.html (Unit V)*

Subject Code: BEC18E14	Subject Name : NEURAL NETWORKS AND ITS APPLICATIONS	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:None	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the various neural network algorithms and its application in pattern recognition.

COURSE OUTCOMES (COs) :
The students will be able to

CO1	Describe the basic concepts of art neural networks.
CO2	Explain about BPN and BAM
CO3	Implement the concept of simulated annealing and CPN
CO4	Interpret the concepts of SOM and ART.
CO5	Train BPN algorithm.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	1	1	1	1	3	2	3
CO2	3	3	2	2	1	1	1	1	2	3	1	2
CO3	3	3	3	3	3	2	2	2	3	2	3	2
CO4	3	2	3	3	2	1	1	1	1	3	2	2
CO5	3	3	3	3	2	1	2	1	1	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	3
CO2	1	2	3	1
CO3	3	2	3	1
CO4	1	1	3	2
CO5	1	2	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E14 NEURAL NETWORKS AND ITS APPLICATIONS 3 0/0 0/0 3

UNIT IINTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 9 Hrs

Neuro – Physiology – General Processing Element – ADALINE – LMS Learning Rule – MADALINE – Perception Networks

UNIT II BPN AND BAM 9 Hrs

Back Propagation Network – Updating of Output and Hidden Layer Weights – Application of BPN – Associative Memory – Bi-Directional Associative Memory - Hopfield Memory – Traveling Sales Man Problem

UNIT III SIMULATED ANNEALING AND CPN 9 Hrs

Annealing, Boltzmann Machine – Learning – Application – Counter Propagation Network – Architecture – Training – Application.

UNIT IV SOM AND ART 9 Hrs

Self-Organizing Map – Learning Algorithm – Feature Map Classifier – Applications – Architecture of Adaptive Resonance Theory – Pattern Matching in ART Network.Neocognitron: Architecture of Neocognitron – Data Processing and Performance of Architecture of Spacio – Temporal Networks for Speech Recognition

UNIT V CASE STUDY 9 Hrs

Implementation of BPN Algorithm in a Computer Language - Application of Neural Networks for Pattern Recognition - Data Comparison - Hopfield Networks for an n-bit A/D Converter

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. Laurence Fausett, "*Fundamentals of Neural Networks: Architecture, Algorithms and Applications*", Prentice Hall, 1994.
2. J.A. Freeman and B.M. Skapura, "*Neural Networks, Algorithms Applications and Programming Techniques*", Addison-Wesley, 1990.

REFERENCE BOOKS:

1. *Martin T. Hagan, Howard B. Demuth "Neural Networks Design",2nd Edition, Martin Hagan, 2014*
2. *Simon Haykin, "Neural Networks and Learning Machines" -3/E - Pearson/ Prentice Hall 2009*

Subject Code: BEC18E16	Subject Name : Radar and Navigational Aids	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Physics	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To become familiar with fundamentals of RADAR
- To gain in-depth knowledge about the different types of RADAR and their operations
- Need for signal detection in RADAR and various detection techniques
- To become familiar with RADAR navigation techniques

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Distinguish the various types of radar
CO2	Understand the operation of high frequency signal generators.
CO3	Identify the targeted radar signals in noise
CO4	Analyze the propagation of radar waves and formation of clutter
CO5	Exhibit the different navigational aids

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	1	1	1	2	1	2
CO2	2	3	2	1	1	1	1	1	1	3	1	3
CO3	1	2	2	2	2	2	2	2	2	3	2	1
CO4	1	2	2	2	2	2	2	2	2	3	2	1
CO5	1	1	1	1	1	2	1	1	1	3	1	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	2	2	3	2				
CO2	2	3	2	3				
CO3	1	3	2	1				
CO4	1	2	2	2				
CO5	1	2	3	2				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E16 RADAR AND NAVIGATIONAL AIDS 30/0 0/0 3

UNIT I RANGE AND TYPES OF RADAR 9 Hrs

Range Parameters, Pulsed Radars, Signal to Noise Ratio, Integration of Pluses Beam Parameters, System Losses and Propagation Effects MTI; CW and Pulse-Doppler Radar, Delay Lines Tracking Radar, Mono pulse, Sequential, Simultaneous, Conical Scan and Monopulse Trackers, Beacons.

UNIT II TRANSMITTERS, RECEIVERS AND ANTENNA 9 Hrs

Klystron, Magnetron, TWT Amplifiers and Oscillators, Crossed Fields Devices, Parabolic Cassegrainian, Coefficient, Squares Antennas, Radomes, Feeds, Receivers, Performance Figures, Displays Scope and PPI Duplexers.

UNIT III DETECTION OF RADAR SIGNALS IN NOISE 9 Hrs

MF, Correlation Detection, Detector Characteristics, Automatic Detection, CFAR Receiver, Pulse Compression and Classification of Targets with Radar.

UNIT IV PROPAGATION OF RADAR WAVES AND CLUTTER 9 Hrs

Plane Earth and Spherical Earth Problem, Refraction and Diffraction, GTD Analyzers, Surface and Sea Clutter, Detection of Targets, Effects of Weather on Radar.

UNIT V RADAR TOPICS AND NAVIGATIONAL AIDS 9 Hrs

Synthetic Aperture, Over the Horizon Radar, ARSR, ASR, Bistatic and Monostatic Radars, LORAN, ILS, GCA, Direction Finder, VOR Concepts, Airborne Doppler Navigation.

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. M.I. Skoinik “Introduction to Radar Systems:, McGraw Hill 1981.
2. N.S. Nagaraja, Elements of Electronic Navigation Systems, 2nd Edition, TMH, 2000.

REFERENCES:

1. *F.E. Terman, “Electronics and Radio Engineering” McGraw Hill*
2. *Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004*
3. *J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004*

Subject Code: BEC18E17	Subject Name : Advanced Digital System	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital Electronics	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To enable the students the ability to design complex sequential circuits
- To equip the students with the ability to detect and correct faults using various algorithms

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Analyze and design synchronous sequential circuits.
CO2	Interpret the designing techniques of an asynchronous sequential circuit.
CO3	Experiment faults and apply testing algorithms for its functionality
CO4	Evaluate the principles of programmable devices for design of sequential circuit.
CO5	Exhibit the operating of emerging programmable logic devices.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	3	2	2	2	2
CO2	3	3	3	3	3	3	2	2	1	2	2	1
CO3	3	3	3	3	3	2	3	2	2	1	2	2
CO4	3	3	3	3	3	3	2	2	2	3	3	2
CO5	3	2	2	3	3	3	3	2	2	3	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	2
CO4	3	3	2	2
CO5	3	3	3	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E17 ADVANCED DIGITAL SYSTEM 3 0/0 0/0 3

UNIT I SEQUENTIAL CIRCUIT DESIGN 9 Hrs

Analysis of Clocked Synchronous Sequential Networks (CSSN), Modeling of CSSN, State Stable Assignment and Reduction, Design of CSSN, Design of Iterative Circuits, ASM Chart, ASM Realization, Design of Arithmetic circuits for Fast adder- Array Multiplier.

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN 9Hrs

Analysis of Asynchronous Sequential Circuit (ASC) – Flow Table Reduction – Races in ASC – State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers – Designing Vending Machine Controller – Mixed Operating Mode Asynchronous Circuits.

UNITIII FAULT DIAGNOSIS AND TESTABILITY ALGORITHMS 9 Hrs

Fault Table Method – Path Sensitization Method – Boolean Difference Method – Kohavi Algorithm – Tolerance Techniques – The Compact Algorithm – Practical PLA's – Fault in PLA – Test Generation – Masking Cycle – DFT Schemes – Built-in Self Test.

UNIT IV SYNCHRONOUS DESIGN USING PROGRAMMABLE DEVICES 9 Hrs

Programming Techniques -Re-Programmable Devices Architecture- Function blocks, I/O blocks, Interconnects, Realize combinational, Arithmetic, Sequential Circuit with Programmable Array Logic; Architecture and application of Field Programmable Logic Sequence.

UNIT V NEW GENERATION PROGRAMMABLE LOGIC DEVICES 9 Hrs

Fold back Architecture with GAL, EPLD, EPLA, PEEL, PML; PROM – Realization State Machine using PLD – FPGA – Xilinx FPGA – Xilinx 2000 - Xilinx 3000

Practical component P: Include case studies / application scenarios
Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOK:

1. Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.
2. Stephen Brown and ZvonkVranesic, "Fundamentals of Digital Logic with VHDL Deisgn", Tata McGraw Hill, 2002

REFERENCE BOOKS:

1. *Donald G. Givone, "Digital principles and Design", Tata McGraw Hill 2002.*
2. *Stephen Brown and ZvonkVranesic, "Fundamentals of Digital Logic with VHDL Deisgn", Tata McGraw Hill, 2002*
3. *3.MarkZwolinski, "Digital System Design with VHDL", Pearson Education, 2004*
4. *Parag K Lala, "Digital System design using PLD", BS Publications, 2003*
5. *John M Yarbrough, "Digital Logic applications and Design", Thomson Learning, 2001.*
6. *Nripendra N Biswas, "Logic Design Theory", Prentice Hall of India, 2001.*

Subject Code: BEC18E19	Subject Name :QUANTUM COMPUTING	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Physics	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand the building blocks of a quantum computer.
- To understand the principles, quantum information and limitation of quantum operations formalizing.
- To understand the various quantum algorithms.

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Demonstrate the importance of quantum computing and superposition states.
CO2	Explain Quantum operators and its applications.
CO3	Build quantum circuits with the knowledge of various quantum gates.
CO4	Apply the concept of different quantum algorithms and have the insight of QKD.
CO5	Identify Quantum errors and correct it using Quantum error correcting codes.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1	3	2	1	1	2	2	1	2	2	1	2	3
CO2	3	3	2	2	1	1	1	2	2	1	2	3
CO3	3	3	3	2	3	1	1	2	2	2	3	3
CO4	2	2	2	3	3	1	1	2	2	2	2	2
CO5	3	3	3	2	3	2	2	2	2	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	3
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E19 QUANTUM COMPUTING 3 0/0 0/0 3

UNIT I INTRODUCTION9 Hrs

Introduction to Quantum Computing- Power of Quantum Computing- Quantum Information- Quantum Computers. The Wave and the Corpuscular Nature of Light Photon Behavior, State Description, Measurement in Multiple Bases, Superposition States – The Superposition probability Rule.

UNIT II QUANTUM MECHANICS 9 Hrs

Quantum Postulates – State space, Evolution, Quantum Measurement, Distinguishing Quantum states, Projective measurements, POVM measurements -Quantum Mechanics-Hilbert Space-Linear Operators Tensor and Outer Products-Quantum Operators- Application Quantum mechanism: Super dense Coding - Double Silt Experiments.

UNIT IIIQUBITS AND QUANTUM GATES 9 Hrs

Qubits, Bloch Sphere Representation-Rotation Operation-The Measurement of a Single Qubits-A Pair of Qubits- Bell States- Qubits as Spin Half- Integer Particles- Qubits as Polarized Photon-Entanglement, Exchange of Information / Teleportation – Quantum Coping Circuit - The Non-Cloning Theorem-Quantum Gates – Universal Quantum Gate Gates – Matrix Representation – Quantum Circuits- Single and Multiple Qubit Controlled Operations.

UNIT IVQUANTUM ALGORITHM 9 Hrs

Turing Machine - Quantum Parallelism-Deutsch's Problem, Deutsch – Jozsa Algorithm -QFT(Quantum Fourier Transform)-Short's Factoring Algorithm-Simon's Algorithm-Quantum Search Algorithm-Quantum key distribution - Mathematical Models of Quantum Computers - Introduction Different implementations of quantum computer.

UNIT VQUANTUM ERROR CORRECTION 9 Hrs

Quantum error correction and simple examples – The Three Qubit flip code, Three Qubit Phase flip code, The Shor Code - Brief Introduction to Quantum Computing Software - Quantum error-correcting codes:Error models, Criteria for a good code: reversible operations.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS :

1. Dan C. Marinescu, Gabriela M. Marinescu, "*Approaching Quantum Computing*", Pearson Education 2008-09.
2. M.A. Neilson and I.L .Chuang "*Quantum computing and Quantum information"*, Cambridge University Press,2009.
3. Vishal Sahani "*Introduction to Quantum Computing*", TATA McGraw-Hill Publishing Company Limited.

REFERENCE BOOKS:

1. *A.Yu.Kitaev, A.H.Shen, M.N.Vyalyi, "Classical and Quantum Computation", American Mathematical Society.*
2. *Mark.M.Wilde, "Quantum information theory" Cambridge university press.*
3. *J.A.Jones, "Quantum information, computation and communication" Cambridge University Press.*
4. *Scott Aaronson, "Quantum computing since Democritus", Cambridge University Press 2013.*

Subject Code: BEC18E20	Subject Name : Power Electronics	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Solid State Devices	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study about power electronic circuits for voltage and current control and protection.
- To learn the switching characteristics of transistors and SCRs. Series and parallel functions of SCRs, Programmable triggering methods of SCR.
- To learn controlled rectification AC supplies.
- To study of converters and inverters.
- To learn about motor control, charges, SMPS and UPS.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the operation of power electronic devices.
CO2	Apply the triggering of SCR for natural and forced commutation.
CO3	Design phase controlled convertors using power diodes.
CO4	Develop different types of inverters and choppers.
CO5	Apply the concepts of power electronics in industries and HVDC system.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	2	2	2	2	2	1	2
CO2	3	2	3	3	2	2	2	2	1	2	1	2
CO3	3	3	3	2	3	1	2	1	1	2	2	1
CO4	2	3	3	3	1	1	1	1	1	2	1	2
CO5	3	3	3	3	1	1	1	1	1	2	1	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2
CO2	2	3	2	2
CO3	3	2	2	1
CO4	3	3	2	1
CO5	3	2	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E20 POWER ELECTRONICS 3 0/0 0/0 3

UNIT I POWER ELECTRONIC DEVICES 9 Hrs

Characteristics of Power Devices – Characteristics of SCR – Two Transistor Model of SCR,Characteristics of TRIAC, BJT, MOSFET, IGBT, GTO both Static and Switching Characteristics – Protection of Thyristors against Over Voltage – Over Current, dv/dt and di/dt.

UNIT II TRIGGERING & COMMUTATION TECHNIQUES 9Hrs

Turn on Circuits for SCR – Triggering with Single Pulse & Train of Pulses – Triggering with Microprocessor – Different Techniques of Commutation – Natural and Forced Commutation – Series & Parallel Operations.

UNIT III PHASE CONTROLLED CONVERTERS 9 Hrs

Converters – Single Phase – Three Phase – Half Controlled and Fully Controlled Rectifiers with R, RL and RLE Loads – Waveforms of Load Voltage and Line Current – Harmonic Factor, Power Factor, Ripple Factor, Distortion Factor – Operation with Freewheeling Diode – Effect of Source Inductance – Dual Converter.

UNIT IV INVERTERS & CHOPPERS 9Hrs

Voltage and Current Source Inverters, Resonant, Series Inverter – Basic Series Inverter, Modified, Improved – PWM Techniques – Single Phase AC Choppers with R and RL Load – Half Wave and Full Wave – DC Choppers – Various Classes of Operation – Buck, Boost and Buck – Boost Type Choppers – Merits and Applications.

UNIT V AC VOLTAGE CONTROLLERS & INDUSTRAIL APPLICATIONS 9 Hrs

Single-Phase and Three-Phase AC Voltage Controllers - Sequence Control of AC Voltage Regulators.Cycloconverters – Single-Phase and Three-Phase Cycloconverters, SMPS & UPS – Static Compensators – HVDC Transmission System.

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. Rashid, M.H., “Power Electronics - Circuits Devices and Applications”, Prentice Hall of India, 3 rd Edition, 2004.
2. Singh.M.D and Kanchandani, “Power Electronics”, Tata McGraw Hill & Hill publication Company Ltd, New Delhi, 2002.

REFERENCES:

1. *Dubey, G.K., Doradia, S.R., Joshi, A. and Sinha, R.M., “Thyristorised Power Controllers”, Wiley Eastern Limited, 1986.*
2. *Lander,W., “Power Electronics”, McGraw Hill and Company, Third Edition, 1993. 3. P.S. Bimbhra, “Power Electronics”, Khanna Publishers, 3rd Edition, 1999*.

Subject Code: BEC18E21	Subject Name : High Speed Switching Architecture	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Computer Networks	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To equip the students with the concepts of high speed switching techniques in ATM networks

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe the basic concepts of HSN
CO2	Interpret the switching concepts and LAN switching technology
CO3	Classify blocking & non – blocking architecture.
CO4	Operate quells in ATM switches.
CO5	Explain addressing model & switching topologies.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	1	1	2	3	2	2
CO2	3	3	3	3	2	1	3	3	3	1	3	1
CO3	2	3	2	1	1	1	2	2	3	2	1	3
CO4	3	3	3	3	1	2	1	1	3	1	1	3
CO5	3	3	3	2	1	2	2	2	2	3	3	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	1
CO2	3	3	3	2
CO3	3	2	3	1
CO4	3	3	1	1
CO5	2	1	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E21 HIGH SPEED SWITCHING ARCHITECTURE 3 0/00/03

UNIT I HIGH SPEED NETWORK 9 Hrs

Introduction-LAN, WAN, Network evolution through ISDN to B-isdn, Transfer mode and control of B-ISDN, SDH multiplexing structure, ATM standard, ATM Adaption layers

UNIT II LAN SWITCHING TECHNOLOGY 9 Hrs

Switching concepts, Switch forwarding techniques, Switch path control, LAB switching, cut through forwarding, Store and forward, Virtual LANS

UNIT III ATM SWITCHING ARCHITECTURE 9 Hrs

Switch models, blocking networks-Basic-and-enhanced banyan networks, sorting networks merge sorting, Re-arrange able networks-full-and-partial connection networks, Non-blocking networks-Recursive network construction, comparison of non-blocking network, Switches with deflection routing-shuffle switch, Tandem banyan

UNIT IV QUEUES IN ATM SWITCHES 9 Hrs

Internal Queuing-Input, Output and shared queuing multiple queuing networks Combined input, Output and shared queuing-performance analysis of Queued Switches

UNIT V IP SWITCHING 9 Hrs

Addressing model, IP Switching types-flow driven and topology driven solutions, IP over ATM address and next hop resolution, Multicasting, Ipv6 over ATM

Practical component P: Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. Ranier Handel, Manfred N Huber, Stefan Schroder, "ATM Networks- concepts protocols applications", 3rd Edition, Addison Wesley, New York, 1999
2. AchillePattavina, "Switching Theory: Architecture and performance in broadband ATM Networks", John Wiley & Sons Ltd., New York. 1998

REFERENCE BOOKS:

1. *Ranier Handel, Manfred N Huber, Stefan Schroder, "ATM Networks- concepts protocols applications", 3rd Edition, Addison Wesley, New York, 1999*
2. *AchillePattavina, "Switching Theory: Architecture and performance in broadband ATM Networks", John Wiley & Sons Ltd., New York. 1998*
3. *Christopher Y Metz, "Switching protocols & Architectures", McGraw Hill Professionals publishing, NewYork.1998.*

Subject Code: BEC18E22	Subject Name :INFORMATION CODING TECHNIQUES	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Digital Communication	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To have a complete understanding of error–control coding.
- To understand encoding and decoding of digital data streams.
- To introduce methods for the generation of these codes and their decoding techniques.
- To have a detailed knowledge of compression and decompression techniques.
- To introduce the concepts of multimedia communication.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the various coding theorems in information theory
CO2	Interpret the digital modulation techniques in digital coding
CO3	Analyze the different coding methods and apply it for error correction
CO4	Demonstrate the different compression techniques
CO5	Develop a code for audio/video signals

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	2	2	1	2	1
CO2	3	3	3	3	3	2	2	3	1	2	1	1
CO3	3	3	3	3	3	3	3	2	1	2	3	2
CO4	3	3	3	3	2	3	2	2	2	3	2	1
CO5	3	3	3	2	2	3	2	2	2	2	2	1

COs PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	2	1
CO4	3	3	2	2
CO5	3	3	2	1

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
					✓							

BEC18E22 INFORMATION CODING TECHNIQUES 3 0/0 0/0 3

UNIT I INFORMATION ENTROPY FUNDAMENTALS 9Hrs

Uncertainty, Information and Entropy – Source coding Theorem – Huffman coding –Shannon Fano coding – Discrete Memory less channels – channel capacity – channel coding Theorem – Channel capacity Theorem.

UNIT II DATA AND VOICE CODING 9Hrs

Differential Pulse code Modulation – Adaptive Differential Pulse Code Modulation – Adaptive sub band coding – Delta Modulation – Adaptive Delta Modulation – Coding of speech signal at low bit rates (Vocoders, LPC).

UNIT III ERROR CONTROL CODING 9Hrs

Linear Block codes – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – Convolutional codes.

UNIT IV COMPRESSION TECHNIQUES 9 Hrs

Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.

UNIT V AUDIO AND VIDEO CODING 9Hrs

Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXTBOOKS:

1. Simon Haykin, “Communication Systems”, John Wiley and Sons, 4th Edition, 2001.
2. Fred Halsall, “Multimedia Communications, Applications Networks Protocols and Standards”, Pearson Education, Asia 2002; Chapters: 3,4,5.

REFERENCES BOOKS:

1. *Mark Nelson, “Data Compression Book”, BPB Publication 1992.*
2. *Watkinson J, “Compression in Video and Audio”, Focal Press, London, 1995.*

Subject Code: BEC18E24	Subject Name :Optical Network and Switching Techniques	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn basic elements of optical communication
- To understand networks and switching techniques

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the basic elements of optical fiber.
CO2	Understand the concept of switching network in OSI layer. .
CO3	Explain all types of optical networks.
CO4	Analyze multiple access methods in WDM.
CO5	Understand the all optical switches.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	3	1	1	1	1	1	1	1	3
CO2	3	3	1	1	1	1	3	1	1	1	3	1
CO3	1	3	3	1	1	3	1	1	1	3	1	1
CO4	1	3	3	1	3	1	3	1	1	3	1	3
CO5	3	1	1	3	1	1	3	1	1	1	1	3

COs PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	2	1	1
CO3	2	3	2	2
CO4	1	3	2	2
CO5	3	3	1	1

3/2/1 indicates Strength of Correlation 3- High,2- Medium,-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E24 OPTICAL NETWORK AND SWITCHINGTECHNIQUES 3 0/0 0/0 3

UNIT I INTRODUCTION 9Hrs

Optical communication – Basics of sources, transmitters, Modulators, Optical fiber, photo detectors, and receivers – Switching in networks – circuit switched – Packet switched – cell switched – Virtual circuit switched – Burst switched (fast circuit switched) – Transmission /Asynchronous – synchronous.

UNIT II SWITCHING NETWORKS 9Hrs

Layering in packet switched networks – motivation – commonly used abstraction: Physical layer – Data link layer – Network layer – Transport layer – Application layer – Layering in circuit switched networks – Physical layer – Multiplexing standards – Signaling – CAS, CCS, SS7 concept – Data plane – management plane – control plane – concept.

UNIT III OPTICAL TRANSMITTER AND RECEIVERS 9Hrs

First generation networks – SDH/SONET – Computer interconnections – ESCON – Fiber channel – HIPPI – FDDI – ATM –DQDB – Components – description – Mode locked laser (for ps pulses) – Tunable filters – multiplexers – De-multiplexers – Tunable wavelength convertors – Optical amplifiers.

Fiber – EDFA – SOA – Tunable transmitters – Tunable receivers – Dispersion compensating fibers – Multiplexing techniques – SDM – TDMA – WDMA (OFDMA) – DWDM – SCM – CDMA – Protocols for single channel broadcast networks – ALOHA, CSMA/CD – Problems with CSMA/CD – Definition of high speed network.

UNIT IV MULTIPLE ACCESS METHODS 9Hrs

Classifications of multiple access methods – Random access – Reserved access – Scheduled access – Multichannel multiple access protocols – Desirable characteristics of protocol – Scalability – Fairness – TTTR – TTFR – FTTR – FTFR – Problem of wavelength stability – Multi hop WDM network – Shuffle net – MSN – Wavelength routed networks – Mesh – Ring – Traffic grooming problem – IP over optical framework – ASON – MpeS – Burst switched network (buffer less networks).

UNIT V OPTICAL SWITCHES 9Hrs

All –optical circuit switches – All−optical packet switches – Broadcast and select – Wavelength routed – Spaced switch based – Discussion on various switch architectures – Packet buffering techniques: Travelling type – Recirculating type: Protection and restoration – Restoration mechanism: Restoration timing issues – Path protection- Span protection – P –cycles.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, 4 thEdition., 2010.
2. Hussein T.Mouftah and JaafarM.H.Elmirghani, " Photonic Switching Technology – Systems and Networks ",IEEE Press, New York -10016-5997,ISBN – 0-7803-4707-2.
3. C.Siva Rama Murthy and Mohan Gurusamy, " WDM Optical Networks – Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi –2002.

REFERENCE BOOKS:

1. *John M. Senior , "Optical Fiber Communication", Second Edition, Pearson Education, 2007.*
2. *Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2009.*
3. *J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3 rd Edition, 2008.*
4. *J.Gower, "Optical Communication System", Prentice Hall of India, 2001.*
5. *Uyless Black, " Optical Network: Third Generation Transport System",Pearson Education, Ist edition,2002.*
6. *Rajiv Ramaswamy and Kumar N.Sivarajan, "Optical Networks – A Practical Persepctive", Morgan Kauffman, 2004*

Subject Code: BEC18E25	Subject Name : Device Modeling	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Solid State Devices	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To understand passive devices and structures
- To understand the integrated BJT and MOS devices

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Discuss the types and structures of resistors & capacitors in IC.
CO2	Criticize the dynamic & static behavior of integrated diodes.
CO3	Learn different models of integrated BJT.
CO4	Study the modeling of MOSFETS &their characteristics.
CO5	Analyze the small signal & large signal modeling of devices using SPICE.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	2	3	2	3	2	3	2
CO2	3	3	3	3	3	2	3	3	2	2	3	3
CO3	3	3	3	3	3	1	3	2	3	1	3	3
CO4	3	3	3	3	3	2	3	3	3	2	3	3
CO5	3	3	3	3	3	2	3	3	3	2	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	3	3
CO3	3	2	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E25 DEVICE MODELING 3 0/0 0/0 3

UNITI INTEGRATED PASSIVE DEVICES 9 Hrs

Types and Structures of Resistors and Capacitors in Monolithic Technology – Dependence of Model Parameters on Structure.

UNIT III NTEGRATED DIODES 9 Hrs

Junction and Schottky Diodes in Monolithic Technologies – Static and Dynamic Behavior – Small and Large Signal Models – SPICE Models.

UNIT III INTEGRATED BIPOLAR TRANSISTOR 9 Hrs

Types and Structures in Monolithic Technologies – Basic Model (Eber Moll_-Cunmel – Poon Model – Dynamic Model, Parasitic Effects – SPICE Model –Parameter Extraction.

UNIT IV INTEGRATED MOS TRANSISTOR 9 Hrs

n-MOS and p-MOS Transistor – Threshold Voltage -Threshold Voltage Equations – MOS Device Equations – Basic DC Equations Second Order Effects – MOS Models Small Signal AC Characteristics – MOSFET SPICE Model Level 1,2,3,4

UNIT V SPICE MODELLING 9 Hrs

Advanced Concepts of Large Signal & Low Signal Modeling

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS:

1. Daniel Foty, “MOSFET Modeling with Spice” prentice hall, 1997.
2. Neil Weste and Kamran Eshranghian “Principles of CMOS VLSI Design, A System Perspective”, “Addition – Wesley, 1993.

REFERENCES BOOKS:

1. *Jacob Millman& Arvin Millman, “Micro Electronics”, McGraw Hill (Second Edi) 1987.*
2. *M. Satyagi, John Wiley “ Introduction to Semi-conductor materials and devices”, New Edition.*

Subject Code: BEC18E26	Subject Name : VLSI Technology	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Solid State Devices	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To enable the students to understand various design flow in VLSI and their applications in fuzzy systems

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Study the fabrication of CMOS transistor & its layout.
CO2	Interpret the interconnection resistance & capacitance & their extraction.
CO3	Learn the distribution of clock signals in a chip.
CO4	Illustrate VLSI implementation of FLC and study about testing techniques.
CO5	Design different types of adders and multiplier.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	2	1	3	2	3	3	3	3
CO2	3	3	2	3	3	2	3	2	3	3	3	3
CO3	3	3	3	2	3	3	3	2	3	2	3	3
CO4	3	3	3	3	3	3	3	1	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	2	3				
CO2	3	3	2	3				
CO3	3	3	3	3				
CO4	3	3	2	3				
CO5	3	3	3	3				

3/2/1 indicates Strength of Correlation 3- High,2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E26 VLSI TECHNOLOGY 3 0/0 0/0 3

UNIT I VLSI DESIGN FLOW 9 Hrs

Design hierarchy concepts of regularity, modularity & locality VLSI Design styles - CMOS Fabrication Technology- Introduction, Fabrication Process flow- basic steps, CMOS n-well process, Advanced CMOS fabrication technologies, layout design rules-Introduction-Full – custom Mask Layout design –CMOS Layout design rules – CMOS inverter Layout design – Layout of CMOS NAND & NOR gates – Complex CMOS Logic gates

UNIT II PARASITIC EXTRACTION & PERFORMANCE ESTIMATION FROM PHYSICAL STRUCTURE 9 Hrs

Introduction – Reality with inter connection –MOSFET capacitances-interconnect capacitance estimation – interconnect resistance estimation

UNIT III CLOCK SIGNALS & SYSTEM TIMING 9Hrs

On chip clock generation & distribution using ring & pierce crystal oscillator – non – overlapping clock signals and gate level implementation – H-tree clock distribution N/W – clock skew reduction – Zero – Skew clock routing N/W- Clock distribution N/W for DEC alpha µp chips

UNIT IV TESTABILITY OF INTEGRATED SYSTEMS-VLSI FOR FUZZY LOGIC SYSTEMS 9 Hrs

Design constraints – Testing – The rule of ten – terminology – Failures in CMOS – Combinational Logic Testing – Practical Ad-Hoc DFT guidelines – Scan design techniques- Integrated implementations of FLC, Digital implementation of FLC's, Analog implementation of FLC's, Mixed digital / analog implementations of Fuzzy systems, CAD automation for FLC DESIGN, NN implementing fuzzy systems.

UNIT V ARITHMETIC FOR DIGITAL SYSTEMS 9Hrs

Introduction – notation systems – Principles of generation & propagation – 1 bit full adder – Enhancement Techniques for Adders – multi operand – Adders – Multiplication – Addition and Multiplication in Galois Fields GF(2n)

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOK:

1. Cheng., SZE., "VLSI Technology"., Prentice Hall of India,
2. Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt Ltd., 1993.

REFERENCES BOOKS:

1. *Cheng., SZE., "VLSI Technology"., Prentice Hall of India,*
2. *Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt Ltd., 1993.*
3. *Horspool., Gorman., "The ASIC Handbook", Tata McGraw Hill Publications., 1999*
4. *Randall .L. Geiger and P. E. Allen, "VLSI Design Techniques for Analog and Digital Circuits", McGraw Hill International Company, 1990*

Subject Code: BEC18E27	Subject Name : Biomedical Instrumentation	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Measurement and Instrumentation, control Systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To study the methods of recording various bio potentials
- To study how to measure biochemical and various physiological information
- To understand the working of units which will help to restore normal functioning
- To understand the use of radiation for diagnostic and therapy
- To understand the need and technique of electrical safety in Hospitals

COURSE OUTCOMES (COs) :
The students will able to

CO1	Enable the students to develop knowledge of how instruments work in the various department and laboratories of a hospital and thereby recognize their limitations.
CO2	Interpret technical aspects of medicine.
CO3	Familiarize students with various medical equipment's and their technical aspects. Understand medical diagnosis and therapy.
CO4	Introduce students to the measurements involved in some medical equipment's.
CO5	Understanding the problem and ability to identify the necessity of equipment's to a specific problem.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	3	3	3	3	1	3	3
CO2	1	1	1	2	1	3	3	2	3	1	2	2
CO3	1	2	1	2	1	3	3	3	3	2	3	2
CO4	1	1	1	1	2	3	3	3	3	2	2	2
CO5	1	2	2	1	2	3	3	3	3	2	2	2

COs / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	1	1	3	2				
CO2	1	2	3	1				
CO3	1	2	3	2				
CO4	3	2	3	3				
CO5	3	2	3	2				

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E27 BIOMEDICAL INSTRUMENTATION 3 0/0 0/03

UNIT I BASIC PHYSIOLOGY 9 Hrs

Cells and their Structures – Transport of Ions Through Cell Membrane – Resting and Excited State – Trans membrane Potential – Action Potential – Bio-Electric Potential – Nervous System – Physiology of Muscles – Heart and Blood Circulation – Respiratory System – Urinary System.

UNIT II BASIC TRANSDUCER PRINCIPLES AND ELECTRODES 9 Hrs

The Transducer Principles – Active Transducers – Passive Transducers – Transducer for Bio-Medical Application – Electrode Theory- Bio-Potential Electrode – Bio-Chemical Transducer.

UNIT III CARDIOVASCULAR SYSTEM 9 Hrs

The Heart and Cardiovascular System – Blood Pressure – Characteristics of Blood Flow – Heart Sounds - Electro Cardiograph – Measurements of Blood Pressure – Measurement of Blood Flow and Cardiac O/P Plethysmography – Measurements of Heart Sounds

UNIT IV X-RAY AND RADIOISOTOPE INSTRUMENTATION: 9 Hrs

X-ray Imaging Radiography – Fluoroscopy – Image Intensifiers – Angiography - Medical use of Radioisotopes – Beta Radiations – Detectors – Radiation Therapy.

UNIT V BIO-TELEMETRY 9 Hrs

Introduction to Bio-Telemetry – Physiological Parameters Adaptable to Bio-Telemetry – The Components of Bio-Telemetry Systems – Implantable Units – Applications of Telemetry in Patient Care – Application of Computer in Bio-Medical Instrumentation, Anatomy of Nervous System – Measurement from the Nervous System – EEG – EMG.

Practical component P: Include case studies / application scenarios
Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOKS:

1. M. Arumugam, "*Bio-medical Instrumentation*" – Anuradha Agencies Publishers, 1992.
2. Khandpur," *Handbook on Biomedical Instrumentation*" – Tata McGraw Hill Co Ltd., 1989.

REFERENCE BOOKS:

1. *Leusis Cromwell Fred, J. Werbell and Erich A.pfraffer, "Biomedical instrumentation and Measurements" – Prentice Hall of India, 1990.*
2. *Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment Technology", John Wiley and Sons, New York, 1997*

Subject Code: BEC18E28	Subject Name :EMBEDDED SOFTWARE DESIGN	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Basic C Programming	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To learn C language and assembly programming for embedded system.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the concept of basic embedded system
CO2	Write a simple program using C and assembly
CO3	Differentiate the methods of IO programming using interrupts
CO4	Applying scheduling methods for multi-threaded programming
CO5	Demonstrate the principle of shared memory and memory management

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	2	1	1	1	1	1	2
CO2	1	2	2	2	3	1	1	1	1	2	3	2
CO3	1	3	2	3	3	1	1	1	1	2	2	1
CO4	1	3	3	3	3	1	1	2	3	2	2	2
CO5	1	2	3	3	3	2	2	3	2	2	3	2

COs PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	1	1	1	1				
CO2	2	2	3	1				
CO3	1	2	3	1				
CO4	2	2	3	2				
CO5	1	1	3	2				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E28 Embedded Software Design 30/0 0/0 3

Unit I Introduction to embedded system and data representation 9Hrs

Embedded system-Design goals for Embedded software- Real time and multi-tasking-Embedded processors and languages-Building an embedded application-Data representation-Fixed precision binary numbers-Binary representation of Integers and real numbers-ASCII and BCD number.

Unit II Programming in C and assembly Language 9Hrs

Integer data types – useful typedefs and defines - manipulating bits in memory and I/O ports – Accessing memory – mapped I/O devices – structures -variant access – programming in assembly – register usage conventions – addressing options – instruction sequencing – procedure call and return – parameter passing – retrieving parameters .

UNIT III Input output programming 9Hrs

I/O instructions – synchronization, transfer rate and latency – polled waiting loops – interrupt driven I/O-interrupt service routine-Buffers and queues –ISR in assembly and C – Non-maskable interrupts - Software interrupts – Exceptions - direct memory access –comparison of methods .

UNIT IV Concurrent software and scheduling 9Hrs

Foreground/background systems - Multi threaded programming – shared resources and critical sections – thread states – pending threads – context switching – round-robin scheduling – priority based scheduling – assigning priorities – deadlock –watchdog timers.

UNIT V Memory management and shared memory 9 Hrs

Objects in C – scope – lifetime –automatic allocation – static allocation – Dynamic allocation- recognizing shared objects – reentrant functions – read only data – accessing shared memory.

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOK:

1. Daniel W. Lewis, “Fundamentals of embedded software where C and assembly meet”, Pearson Education, 2002. 2. Steve Heath, “Embedded system design”, Elsevier, 2003.

REFERENCES:

1. *Daniel W. Lewis, “Fundamentals of embedded software where C and assembly meet”, Pearson Education, 2002. 2. Steve Heath, “Embedded system design”, Elsevier, 2003.*
2. *David E. Simon, “An Embedded Software Primer”, Pearson Education, 2003*.

Subject Code: BEC18E29	Subject Name : Spread Spectrum Communication	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Communication Theory, Digital Communication	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Toenable the students to learn the concepts of spread spectrum systems and their performance metrics

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Describe the basic principles of DSSS & FHSS.
CO2	Performance analysis on the spread spectrum modulation formats.
CO3	Observe the various typeof spread spectrum modulation formats.
CO4	Recognize the difference & benefits of spreading codes.
CO5	Estimate the spreading code acquisition and tracking circuits.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	1	3	2	2	3	2	2
CO2	3	3	2	3	2	3	3	2	2	2	3	2
CO3	3	3	3	3	3	3	2	3	2	3	2	3
CO4	3	3	3	3	2	2	2	1	2	3	3	3
CO5	3	3	3	3	3	3	3	2	3	2	3	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	2	2	3				
CO2	3	3	2	2				
CO3	3	3	3	3				
CO4	2	3	3	2				
CO5	3	3	2	3				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E29 SPREAD SPECTRUM COMMUNICATION 3 0/00/03

Subject Code: BEC18E30	Subject Name : Network Management	T / L/ ETL	L	T / S.Lr	P/ R	C

UNIT I INTRODUCTION 9 Hrs

Communication in the presence of pulse noise jamming - Low probability detection scheme - Director Sequence Spread Spectrum (DSSS) and Frequency Hop Spread Spectrum Systems and examples of Spread Spectrum Systems

UNIT II PERFORMANCE CHARACTERIZATION OF DIGITAL DATA TRANSMISSION 9 Hrs

Detection of binary signals in AWGN - Quadrature multiplexed signaling schemes - Signaling through band limited channels - Equalization of digital data transmission system - Realization imperfections – Degradations in performance.

UNIT III SPREAD SPECTRUM SYSTEMS 9 Hrs

Direct sequence spread spectrum methods employing BPSK, QPSK and MSK - Frequency Hop spread spectrum methods - Coherent slow frequency Hop technique - Non coherent slow and fast frequency Hop spread spectrum techniques - Hybrid DS/FH spread spectrum - Complex envelope representation of spread spectrum systems.

UNIT IV BINARY SHIFT REGISTER SEQUENCES FOR SPREAD SPECTRUM SYSTEMS 9 Hrs

Definition - PN sequence generator fundamentals - Maximal length sequences - Properties, Power spectrum and Polynomial tables for maximal length sequences - Gold codes - Rapid Acquisition systems - Non-linear code generators.

UNIT V SYNCHRONIZATION OF SPREAD SPECTRUM SYSTEMS: 9 Hrs

Optimal tracking of wideband signals - Early-late tracking loops - Code tracking loops for FHSS - Optimum synchronization techniques - Multiple dwell and sequential detectors - Synchronization using a matched filter - Synchronization by estimating the received spreading code.

Practical component P: Include case studies / application scenarios
Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOK:

3. Ziemer, R.E & Peterson, R.L., "Digital Communication and Spread Spectrum Systems", Mac millan Publishing Co., 1985.
4. Holms, J.K., "Coherent Spread Spectrum systems", Wiley Interscience, 1982.

REFERENCES BOOKS:

1. *Ziemer, R.E & Peterson, R.L., "Digital Communication and Spread Spectrum Systems", Mac millan Publishing Co., 1985.*
2. *Holms, J.K., "Coherent Spread Spectrum systems", Wiley Interscience, 1982.*
3. *Dixon, R.C., "Spread Spectrum Systems", Wiley Interscience, 1976.*
4. *Charles E Cook.,etal, "Spread-Spectrum Communications", IEEE Press, Inc, New York,*

	Prerequisite: Computer Networks	T	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To enable the students learn the concepts of managing the various categories of networks and analyzes its performance.

COURSE OUTCOMES (COs) : (3- 5)

The Students will be able to

CO1	Understand the fundamentals of various network topologies.
CO2	Discuss cellular concepts in designing a mobile communication system
CO3	Analyze different models of SNMP and their working.
CO4	Appreciate & analyze the diverse functions of broad band network management.
CO5	Analyze the different applications of network management.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**3**
CO2	**3**	**3**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
CO3	**3**	**3**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
CO4	**1**	**3**	**1**	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**
CO5	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1	**3**	**1**	**2**	**1**				
CO2	**1**	**3**	**1**	**1**				
CO3	**1**	**3**	**1**	**2**				
CO4	**3**	**1**	**2**	**3**				
CO5	**1**	**3**	**1**	**3**				

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E30 NETWORK MANAGEMENT 3 0/00/3

Subject Code: BEC18E31	Subject Name : Satellite Communication	T / L/ ETL	L	T / S.Lr	P/ R	C

UNIT I FUNDAMENTALS OF COMPUTER NETWORK TECHNOLOGY 9Hrs

Network Topology, LAN, Network node components – Hubs, Bridge, Gateways, Switches, WAN, ISDN – Transmission Technology, communication protocols and standards

UNIT II OSI NETWORK MANAGEMENT 9Hrs

OSI Network management model – Organizational model – Information model, communication model. Abstract Syntax Notation – Encoding structure, Macros Functional model CMIP / CMIS

UNIT III INTERNET MANAGEMENT (SNMP) 9Hrs

SNMP-Organizational model – system Overview, The information model, communication model-Functional model, SNMP proxy server, Management information, protocol remote monitoring

UNIT IV BROADBAND NETWORK MANAGEMENT 9Hrs

Broadband networks and services, ATM Technology-VP, VC, ATM Packet, Integrated service, ATMLAN emulation, Virtual LAN. ATM Management Information base, Role of SNMD and ILMI in ATM Management, M1, M2, M3, M4 Interface. ATM Digital Exchange Interface Management

UNIT V NETWORK MANAGEMENT APPLICATIONS 9Hrs

Configuration management, Fault management, performance management, Event Correlation Techniques security Management Service Level Management

Practical component P: Include case studies / application scenarios

Research component R: Future trends / research areas / Comparative Analysis

Total Number of Hours: 45 Hrs

TEXT BOOK:

1. Mani Subramaniyan, "Network Management Principles and Practice", Addison Wesly.Newyork 2000 2.Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management", Eastern

REFERENCES BOOKS:

1. *Mani Subramaniyan, "Network Management Principles and Practice", Addison Wesly.Newyork 2000 2.Lakshmi G. Raman, "Fundamentals of Telecommunication Network Management", Eastern*
2. *Economy Edition IEEE, Press, New Delhi-1999*
3. *Salah Aiiarous, Thomas Plevayk, "Telecommunications Network Management Technologies and Implementations", eastern Economy Edition IEEE press, New Delhi. 1998*

	Prerequisite: Communication Systems	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- Overview of satellite systems in relation to other terrestrial systems
- Study of satellite orbits and launching.
- Study of earth segment and space segment components
- Study of satellite access by various users.
- Study of DTH and compression standards.

COURSE OUTCOMES (COs) :
The students will be able to

CO1	Recognize various element of orbital Mechanics
CO2	Interpret various multiple access and switching techniques.
CO3	Illustrate the concepts involved in satellite link design
CO4	Analyze the principles, concepts and operation of satellite communication systems
CO5	Examine the various process of earth station design.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**2**	**1**	**2**
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
CO3	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**2**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**2**	**3**	**1**	**2**
CO5	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**3**	**2**	**1**	**3**

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**2**	**2**	**2**
CO2	**3**	**3**	**3**	**2**
CO3	**3**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**2**
CO5	**3**	**3**	**1**	**1**

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E31 SATELLITE COMMUNICATION 30/0 0/0 3

UNIT IELEMENTS OF ORBITAL MECHANICS 9 Hrs

Equation, Orbital Elements, Orbital Perturbation, Tracking and Orbital Determination, Orbital Correction Control.

ELEMENTS OF COMMUNICATION SATELLITE DESIGN

Space Environment, Spacecraft Configuration, Spacecraft Subsystem, Payload, Reliability Consideration – Spacecraft Integration and Testing.

UNIT IIMULTIPLE ACCESS TECHNIQUES 9 Hrs

FDM – FM – FDMA, TDMA, SSMA / CDMA, RANDOM MULTIPLE Access Techniques; Packet Switching and Packet Satellite Networks Satellite on Board Processing and Switching.

UNIT IIISATELLITE LINK DESIGN 9 Hrs

Types of System: BSS, Performance Requirements and Standards for Telephony, TV and DATA, Performance Impairments, Noise, Interference, Inter modulation, Design of Typical Satellite Links.

UNIT IVDOMESTIC SATELLITE SYSTEMS 9 Hrs

The INSAT System, International System, INTELSAT, IMMARSAT, Satellite Based Personal Communication LEO, ICO, GEO Systems.

UNIT VEARTH STATION DESIGN 9 Hrs

Earth Station Configuration, Site Selection, Antenna and Tracking Systems, Receiver and Transmitter Subsystems, Terminal Equipment: Telephone / Video Interface, Rearward Links, Miscellaneous Facilities Like Echo Suppressor, FM Digitizers, Ground Station Measurements, Elements of Frequency Co-ordination and Control, VSAT Networks and Terminals – Satellite Broadcasting, Satellite TV Systems.

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOKS:

1. T. Pratt and C.W. Bostian, "*Satellite Communication*" – John Wiley & Son, 1986.
2. A. Abdul Namith, "Satellite *Communication*"-Lakshmi Publications.

REFERENCE BOOKS:

1. *B.N. Agarwal, "Design of Geosynchronous Spacecraft" – Prentice Hall, 1986.*
2. *D. Roddy, "Satellite Communication" – Prentice Hall, 1989*
3. *M. Richharia,"Satellite Communication SystemsDesign Principles", Macmillan Press Ltd. Second Edition 2003.*

Subject Code: BEC18E32	Subject Name :OPERATING MOBILE COMMUNICATION	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To make the students learn the concepts of basic cellular communication
- To learn about the various propagation models
- To develop mobile applications and design a M2M communication

COURSE OUTCOMES (COs) : (3- 5)
The Students will be able to

CO1	Describe basic wireless systems and standards
CO2	Discuss cellular concepts in designing a mobile communication system
CO3	Explain various propagation models and multipath fading channels
CO4	Apply the OS fundamentals to develop native applications
CO5	Design a M2M communication for latest IOS applications

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	2	1	1	1	1	1	2
CO2	1	3	3	3	1	1	2	2	1	2	2	1
CO3	3	1	3	1	2	1	1	1	2	1	2	1
CO4	1	3	3	3	3	1	2	1	1	2	1	2
CO5	2	3	3	3	3	2	1	2	2	1	1	1

COs / PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	3	2	2
CO2	3	3	2	1
CO3	3	3	1	1
CO4	3	2	2	2
CO5	1	3	1	3

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills
					✓				

BEC18E32 OPERATING MOBILE COMMUNICATION 30/0 0/0 3

UNIT I INTRODUCTION TO WIRELESS SYSTEMS AND STANDARDS 9Hrs

Introduction to wireless communication: Evolution of mobile communications, mobile radio systems-Examples, trends in cellular radio and personal communications. 2G, EDGE, 3G, 4G (LTE) and 5G, VoIP, Wi-Fi and Bluetooth, Wireless Networks and Standards, WLL, Blue tooth. AMPS, GSM, IS-95 and DECT

UNIT II CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9Hrs

Cellular Concept: Frequency reuse, channel assignment, hand off, Interference and system capacity, tracking and grade of service, Improving Coverage and capacity in Cellular systems.

UNIT III MOBILE RADIO PROPAGATION 9Hrs

Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Impulse model, Small scale Multipath measurements, parameters of Mobile multipath channels, types of small scale fading, statistical models for multipath fading channels.

UNIT IV OPERATING SYSTEM 9Hrs

Different OS Platforms - Windows, Android, iOS; Process for Software OS installation – Requirements for testing - Native applications – Secured environment

UNIT V M2M Communication 9Hrs

Low Power and Battery Operated IOT Communication, Bluetooth Low Energy(BLE), Zigbee, Z-Wave, LoRa, Narrow Band-Internet Of Things(NB-IOT), Cat-M/LTE-M

Practical component P : Include case studies / application scenarios

Research component R : Future trends / research areas / Comparative Analysis

Total Number of Hours: 45Hrs

TEXT BOOK

1. T.S.Rappaport, "Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
2. ArashHabibiLashkari, MohammadrezaMoradhaseli," Mobile Operating Systems and Programming : Mobile Communications "**VDM Verlag Dr. Müller (July 7, 2011),**

REFERENCES BOOKS:

1. *R.Blake,"WirelessCommunicationTechnology",ThomsonDelmar,2003.*
2. *W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications, Second Edition, McGraw- HillInternational,1998.*
3. *tephen G. Wilson, " Digital Modulation and Coding", Pearson Education, 2003.*
4. *https://www.iotforall.com/cellular-iot-explained-nb-iot-vs-lte-m/*