SCHEME & SYLLABUS

(Choice Based Credit System)

for

B. TECH.

in

ELECTRONICS & COMMUNICATION ENGINEERING

(w.e.f. Session 2022-23)

Program Code: ECE-301

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

SCHOOL OF ENGINEERING

RIMT UNIVERSITY, MANDI GOBINDGARH, PUNJAB

TABLE OF CONTENTS

SECTION-1

Vision & Mission of the University

VISION

To become one of the most preferred learning places a centre of excellence to promote and nurture future leaders who would facilitate in desired change in the society

MISSION

- To impart teaching and learning through cutting edge technologies supported by the world class infrastructure
- To empower and transform young minds into capable leaders and responsible citizens of India instilled with high ethical and moral values

SECTION-2

Vision and Mission of the Department

VISION

To contribute to the society through excellence in knowledge-based education utilizing the potential of engineering and technology with a deep passion for wisdom, culture and values.

MISSION

- To provide quality education to meet the current needs of industry and society.
- To provide a learning ambience by enhancing innovations, problem solving skills, leadership qualities, team-spirit and ethical responsibilities.
- To provide exposure to latest tools, technologies, promoting research and development-based activities in the emerging areas of engineering and technology.

SECTION-3

About the Program

Electronics and Communication engineering is one of the core field of engineering which deals in communication, fibre optics, microwave antenna & radar engineering, analog& digital electronics, digital signal processing and signals & system and related to design, innovations and development of various devices like smart radios, LED TVs, smartphones, robotics solutions and computer & accessories etc. Electronics and Communication engineers play a critical role in healthcare, home appliances, transport systems, cell phones, core manufacturing, automation, IT, control, pharmaceutical and many other industries. There is drastic growth in Electronics, Communication and computing due to upcoming MAKE IN INDIA, DIGITAL INDIA and SKILL INDIA campaign. Without electronics, it is impossible to work. There is a great demand of Electronics and Communication Engineers due to the development of new technologies like IOT, Artificial intelligence and Robotics all over the world.

SECTION-4

Program Educational Objectives (PEOs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

PROGRAMME EDUCATION OBJECTIVES (PEOs)

The program Educational Objectives of Electronics and Communication Engineering program of RIMT University intend to produce graduates having competence to:

PEO 1	Continuing the education leading to graduate programs in engineering and interdisciplinary areas to emerge as competent technologist, experts, educators and researchers
PEO 2	Research, innovate and re-learn with ever changing global economic and technological environment maintaining professional discipline and high ethical standard

PROGRAMME OUTCOMES (POs)

Electronics and Communication Engineering graduates will be able to,

PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11	**Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

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PROGRAMME SPECIFIC OUTCOMES (PSOs)

Electronics and Communication Engineering graduates will be able to,

PSO 1	To use problem solving skills to develop and test the electronics based systems for a given specification with efficient solutions using electronics equipment / systems / instruments by applying fundamental knowledge of basic science, engineering, mathematics and computing.
PSO 2	To design & develop the solutions for a given problem as per real industry defined problems by imparting the knowledge of circuits & devices, communication system and embedded systems
PSO3	To generate solutions for social and ecological issues related to the professional engineering while working in a team so to enhance critical & innovative thinking through multidisciplinary environment approach.

SECTION-5

Curriculum / Scheme with Examination Grading Scheme

INDUCTION PROGRAM

Induction Program (Mandatory)	
Duration	03 weeks
Frequency	Induction program for students to be offered right at the start of the first year
Activities	• Physical Activity • Sports, Yoga & Stress Management • Creative Arts • Universal Human Values • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

SEMESTER WISE SUMMARY OF THE PROGRAMME: B.TECH. (ELECTRONICS & COMMUNICATION ENGINEERING)

S. No.	Semester	No. of Contact Hours	Marks	Credits
1.	I	28	900	22
2.	II	28	900	22
3	III	29	800	24
4	IV	33	900	24
5	V	31	900	25
6	VI	33	1000	24
7	VII	31	800	23
8	VIII	-	500	10
	Total	**213**	**6700**	**174**

EXAMINATION GRADING SCHEME

Marks Percentage Range	Grade	Grade Point	Qualitative Meaning
80-100	O	10	Outstanding
70-79	A^+	9	Excellent
60-69	A	8	Very Good
55-59	B^+	7	Good
50-54	B	6	Above Average
45-49	C	5	Average
40-44	P	4	Fail
0-39	F	0	Fail
ABSENT	AB	0	Fail

Percentage Calculation: CGPA *10

FIRST SEMESTER

Course		Contact Hours/Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Course Code	**Course Title**	**L**	**T**	**P**			**Internal**	**External**	**Total**	
BPHY 1122	Applied Physics	3	1	0	4	4	40	60	100	3 Hrs
BMAT-1111	Engineering Mathematics-I	3	1	0	4	4	40	60	100	3 Hrs
BENG-1101	Communicative English	3	0	0	3	3	40	60	100	3 Hrs
BELE-1101	Basics of Electrical & Electronics Engg.	3	0	0	3	3	40	60	100	3 Hrs
BEVS-1001	Environmental Science	2	0	0	2	2	40	60	100	3 Hrs
BPHY-1185	Applied Physics Lab	0	0	2	1	2	50	50	100	3 Hrs
BENG-1172	Communicative English Lab	0	0	2	1	2	50	50	100	3Hrs
BELE-1171	Basics of Electrical & Electronics Engg. Lab	0	0	2	1	2	50	50	100	3Hrs
BMEC-1171	Manufacturing Practice	0	0	6	3	6	50	50	100	3 Hrs
TOTAL		**14**	**2**	**12**	**22**	**28**			**900**	

SECOND SEMESTER

Subject		Contact Hours/Week			Credit	Contact Hrs.	Evaluation Scheme (% of Total Marks)			Exam Duration (Hours)
Code	**Title**	**L**	**T**	**P**			**Internal**	**External**	**Total**	
BELE-1001	Energy Management	2	0	0	2	2	40	60	100	3 Hrs
BCHM-1206	Applied Chemistry	3	1	0	4	4	40	60	100	3 Hrs
BMAT-1211	Engineering Mathematics-II	3	1	0	4	4	40	60	100	3 Hrs
BCSE-1201	Programming for Problem Solving	3	0	0	3	3	40	60	100	3 Hrs
BMEC-1201	Elements of Mechanical Engg.	3	0	0	3	3	40	60	100	3 Hrs
BMEC-1202	Engineering Drawing with CAD*	0	0	6	3	6	50	50	100	3 Hrs
BCHM-1273	Applied Chemistry Lab	0	0	2	1	2	50	50	100	3 Hrs
BCSE-1271	Programming for Problem Solving Lab	0	0	2	1	2	50	50	100	3 Hrs
BENG-1001	Soft Skills-I Lab	0	0	2	1	2	50	50	100	3 Hrs
Total		**14**	**2**	**12**	**22**	**28**			**900**	**27 Hrs**

Program: B.Tech (Electronics & Communication Engineering)

Department: Department of Electronics & Communication Engineering
Year: 2nd Year / 3rd Semester

Total Credits: 24
Contact Hours: 29

			Contact Hours/Week			Exam Duration (Hrs)		Relative Weights (%)					Total
Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Theory**	**Practical**	**CWA**	**LWA**	**MTE**	**ETE**	**EPE**	
BMAT-2311	Engineering Mathematics III	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2372	Programming with Python	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2304	Electronic Devices and Circuits	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2303	Network Analysis and Synthesis	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2302	Electronic Measurements & Instrumentation	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2371	Electronic Devices and Circuits Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-2372	Programming with Python Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-2373	**Institutional Training**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
		24	**15**	**10**	**4**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**800**

Program: B.Tech (Electronics & Communication Engineering)

Department: Department of Electronics & Communication Engineering
Year: 2nd Year / 4th Semester

Total Credits: 24
Contact Hours: 33

			Contact Hours/Week			Exam Duration (Hrs)		Relative Weights (%)					Total
Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Theory**	**Practical**	**CWA**	**LWA**	**MTE**	**ETE**	**EPE**	
BECE-2401	Analog Communication Systems	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2402	Digital Electronics	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2403	Signals & Systems	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2404	Electromagnetic Field Theory	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2405	Pulse Wave Shape & Switching	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-2471	Analog Communication Systems Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-2472	Digital Electronics Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-2473	Signals & Systems Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BTPD-3421	Soft Skills-I	**1**	**-**	**-**	**2**				**50**	**-**	**-**	**50**	**100**
		24	**15**	**10**	**8**								**900**

Program: B.Tech (Electronics & Communication Engineering)
Department: Department of Electronics & Communication Engineering

Year: 3rd Year / 5th Semester

Total Credits: 25
Contact Hours: 31

			Contact Hours/Week			Exam Duration (Hrs)		Relative Weights (%)					Total
Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Theory**	**Practical**	**CWA**	**LWA**	**MTE**	**ETE**	**EPE**	
BECE-3501	Linear Integrated Circuits	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3502	Microprocessors	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3503	Antenna and Wave Propagation	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3504	Digital Signal Processing	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3505	Linear Control Systems	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3571	Linear Integrated Circuits Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-3572	Microprocessors Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-3573	Digital Signal Processing Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-3574	**Software Training**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
		25	**15**	**10**	**6**								**900**

Program: B.Tech (Electronics & Communication Engineering)
Department: Department of Electronics & Communication Engineering
Year: 3rd Year / 6th Semester

Total Credits: 24
Contact Hours: 33

			Contact Hours/Week			Exam Duration (Hrs)		Relative Weights (%)					Total
Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Theory**	**Practical**	**CWA**	**LWA**	**MTE**	**ETE**	**EPE**	
BECE-3601	Digital Communication Systems	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3602	Microwave & RADAR Engg.	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3603	Wireless & Mobile Communication	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3604	Embedded Systems	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
Dept. Elective-1		**3**	**3**	**0**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE-3671	Digital Communication Systems Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-3672	Microwave Engineering Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-3673	Embedded Systems Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BTPD-3622	**Soft Skill-II**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE-3674	**Project Pre-synopsis**	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
		24	**15**	**8**	**10**								**1000**

Program: B.Tech (Electronics & Communication Engineering)
Department: Department of Electronics & Communication Engineering
Year: 4th Year / 7th Semester

Total Credits: 23
Contact Hours: 31

			Contact Hours/Week			Exam Duration (Hrs)		Relative Weights (%)					Total
Code	**Course Title**	**Credits**	**L**	**T**	**P**	**Theory**	**Practical**	**CWA**	**LWA**	**MTE**	**ETE**	**EPE**	
BECE -4701	Computer Networks	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE -4702	VLSI Design	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE -4703	Optical Communication Systems	**4**	**3**	**2**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
	Dept. Elective-II	**3**	**3**	**-**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
	Open Elective-I	**3**	**3**	**-**	**-**	**3**	**-**	**10**	**-**	**30**	**60**	**-**	**100**
BECE -4771	VLSI Design Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE -4772	Optical Communication Systems Lab.	**1**	**-**	**-**	**2**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
BECE -4773	**Major Project**	**3**	**-**	**-**	**6**	**-**	**-**	**-**	**50**	**-**	**-**	**50**	**100**
		23	**15**	**6**	**10**								**800**

Program: B.Tech (Electronics & Communication Engineering)
Department: Department of Electronics & Communication Engineering
Year: 4th Year / 8th Semester

Total credit: 16
Contact Hours: 00

			Contact Hours/Week			Exam Duration (Hrs)		Relative Weights (%)					Total
Code	Course Title	Credits	L	T	P	Theory	Practical	CWA	LWA	MTE	ETE	EPE	
BECE-4871	TRAINING	10	-	-	-	-	-	-	250	-	-	250	500
Total		10	-	-	-	-	-	-	250	-	-	250	500

Department Elective-I

*Digital System Design	(BECE-3611)
* INFORMATION THEORY & CODING	(BECE-3612)
*Mobile Computing	(BECE-3613)
* Artificial Intelligence & Expert System	(BECE-3614)

Department Elective-II

*Satellite Communication	(BECE-4711)
*Speech & Image Processing	(BECE-4712)
*Wireless Sensor Network	(BECE-4713)
*Computer Vision	(BECE-4714)

CWA: Class Work Assessment **LWA: Lab Work Assessment**
ETE: End Term Examination **MTE: Mid Term Examination**

EPE: End Practical Examination

SECTION-6

Detailed Syllabus with Course Outcomes

SYLLABUS

SEMESTER-III

SUBJECT TITLE: MATHEMATICS-III
SUBJECT CODE: BMAT-2311
SEMESTER: III
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60

Duration of Exam; 3 Hrs

Objective and outcome of course:

The course is designed in such a way to make student aware of mathematical subjects and their uses. After completion of the course they will get expertise in solving practical problems using mathematical aids.

Contents of Syllabus:

UNIT-I

Fourier Series (10 lectures)

Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.

UNIT-II

Laplace Transforms (15 lectures)

Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

UNIT-III

Partial Differential Equations & Applications of PDEs (15 lectures)

Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

UNIT-IV

Functions of Complex Variable (20 lectures)

Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

Course Outcomes:

CO1	**BMAT-2311.1**	Understand the concept of partial differentiation and their applications and the concept Asymptotes of, Curvature & Curve Tracing.

CO2	**BMAT-2311.2**	Apply the techniques of multiple integral.
CO3	**BMAT-2311.3**	Compute various matrices by applying the concepts of linear algebra.
CO4	**BMAT-2311.4**	Understand the concepts of complex variables.

Recommended Books:

1. Kreyszing, E., Advanced Engineering Mathematics, Eighth edition, John Wiley, New Delhi.
2. Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3. Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957.
4. Peter. V. O'Nil, Advanced Engineering Mathematics, Wadsworth Publishing Company.
5. Taneja, H. C., Engineering Mathematics, Volume-I & Volume-II, I. K. Publisher.
6. Babu Ram, Advance Engineering Mathematics, Pearson Education.
7. Bindra, J. S., Applied Mathematics, Volume-III, Kataria Publications.
8. Advanced Engineering Mathematics, O'Neil, Cengage Learning

SUBJECT TITLE: ELECTRONIC DEVICES AND CIRCUITS
SUBJECT CODE: BECE-2304
SEMESTER: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40

End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various electronic devices, their circuits & behaviour under various conditions.

1. To aware the students about the various electronic devices and their circuits.

2. To impart knowledge of BJTs and FETs.

3. To provide the students detailed concepts FET and MOSFET.

4. To analyze low frequency transistor models.

Unit I

Semiconductor diode Theory of PN junction diode, Band structure of open circuited PN junction, Volt Ampere Characteristics, Temperature Dependence of PN diode, LED, LCD and Photo- diodes, Tunnel diode, Zener diode as Voltage Regulator.

Unit II

Transistors, Characteristics and Biasing Transistor, Types of Transistor, Transistor current components, Transistor as an Amplifier, Transistor characteristics in CB, CE and CC modes. Operating point, bias stability, various biasing circuits, Construction, Characteristics & applications of Junction Field Effect Transistor (JFET) and MOSFET.

Unit III

Large Signal Amplifiers: Class A direct coupled with resistive load, Transformer coupled with resistive load, harmonic distortion, variation of output power with load, Push-Pull Amplifiers, operation of class- B push-pull amplifier, crossover distortion, transistor phase inverter, complementary- symmetry amplifier.

Unit IV

Feedback Amplifiers and Oscillator: Feedback Concept, Effect of negative feedback on gain, bandwidth, stability, distortion and frequency Response, Sinusoidal

Oscillators, Sinusoidal oscillators; criterion for oscillation, Different types of oscillators: RC Phase Shift, Wein Bridge, Hartley, Colpitts and Crystal Oscillators. Derivation of expression for frequency and amplitude of these oscillators.

Unit V

Low Frequency Transistor Model: Transistor Hybrid Model, h parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters in CB, CE and CC configuration.

Course Outcomes:

CO1	**BECE-2304.1**	Understand the concepts of junction diodes and their applications.
CO2	**BECE-2304.2**	Analyze BJT characteristics and determine their behaviour under low and high frequencies.
CO3	**BECE-2304.3**	Analyze various concepts of FETs and their characteristics.
CO4	**BECE-2304.4**	Design low frequency model and observe its various characteristics

Suggested Readings/ Books:

1. Electronic Devices & Circuits by Millman- Halkias, Tata Mcgraw Hill
2. Electronic Devices & Circuits Theory by Boylested, Pearson Education.
3. Electronic Fundamentals & Application, by J.D. Ryder, PHI.
4. Electronic Devices, by Floyd, Pearson Education.
5. Electronics Devices & Circuits by J.B.Gupta, Katson

SUBJECT TITLE: NETWORK ANALYSIS AND SYNTHESIS

SUBJECT CODE: BECE-2303

SEMESTER: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To provide the knowledge to students about the various network theorems.
2. To make the students aware about the various transient responses for various signals.
3. To provide them basic concepts of different types of two port networks and their synthesis.
4. To impart knowledge about different passive filter design.

Unit-I(12 Hrs.)

Laws and Basic Theorems: Fundamental Laws and Concepts – Kirchoff's current and voltage laws, Node and mesh analysis using classical method and Laplace transform, Concept of independent and dependent sources, Analysis of special signal waveforms, Duality in networks.

Network Theorems –Superposition, Reciprocity, Thevenin's, Norton's, Millman's, Maximum power transfer, Tellegan's, Circuit analysis using these theorems.

UNIT-II(12 Hrs.)

Transient Analysis: Fundamental signals and their mathematical expressions, Transient response analysis of RL, RC and RLC for various signals using differential equations and Laplace transform.

UNIT-III(12 Hrs.)

Two Port Networks: Fundamental concepts of network synthesis, Hurwitz Polynomials, Positive real functions, Properties of RC, RL & LC networks, Foster and Cauer forms of realization,

UNIT-IV(12 Hrs.)

Passive Filter Design: K-derived, m-derived, Low pass filter, High pass filter, Band pass filter, Band stop filter, their magnitude and phase response

Course Outcomes:

CO1	**BECE-2303.1**	An ability to design, analyze and synthesis of various networks and circuits.
CO2	**BECE-2303.2**	Knowledge of mathematical forms such as Laplace transforms & designing of filters and circuits.
CO3	**BECE-2303.3**	Synthesis of networks using fundamental concepts.
CO4	**BECE-2303.4**	To understand, design and analysis of various passive filter design.

Recommended Books:

1. Vanvalkenburg, 'Network Analysis', Prentice Hall of India Pvt. Ltd., New Delhi.

2. D. RoyChoudhary, 'Network and Systems', New Age International Publisher.

3. Franklin F. Kuo, 'Network Analysis and Synthesis', John Wiley.

4. Someshwar C. Gupta, 'Circuit Analysis - with Computer Applications to Problem Solving', Jon W. Bayless

SUBJECT TITLE: ELECTRONIC MEASUREMENT AND INSTRUMENTATION

SUBJECT CODE: BECE-2302

SEMESTER: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To provide knowledge about different types of measuring, waveform generation, and analysis of electronic instruments.

2. Exposure to various analog measuring instruments.

3. To provide detailed knowledge about different bridges.

4. To understand CRO and its operation.

Unit–I

Units, Dimensions and Standards: SI Units, Determination of absolute units of current and resistance, Standards of EMF, Resistance, Capacitance, Mutual inductance and their construction, Equivalent circuit representation, Figures of Merit, Construction of variable standards and Decade Boxes.

General Theory of Analog Instruments: Primary and secondary instruments, indicating recording and integrating types, operating torques damping and controlling torques, Torque/ weight ratio, pointers and scales.

Unit–II

Analog Measuring Instruments: Principles of operation, Construction, Errors, calibration, areas of application of the following types of instruments for measurement of voltage, current, power, energy, frequency and power factor: (a) PMMC (b) Dynamometer (c) Moving Iron (d) Induction (e) Thermal (f) Electrostatic Extension of Ranges by Shunts. Multipliers: Power and Energy Measurements in Poly Phase Circuits.Potentiometers (Only Principles, Operation & applications of DC & AC potentiometer) (a) Simple concepts of potentiometers. (b) Principle of DC potentiometer, applications. (c) Principle operation of AC potentiometer with advantages/ Disadvantages/ applications.

Unit – III

Measurement of Resistances: Low, Medium & High Resistance their measurement.

Bridges: Measurement of R, L, C, M, O by Wheatstone, Kelvin, Maxwell Hay, Anderson, Owen, Heaviside, Campbell, Schering, Wien bridges, Bridge sensitivity, Errors, Detectors, Shielding and screening, Wanger, Earthing.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-2302.1**	Analyze operation of different instruments and able to describe different terminology related to measurements.
CO2	**BECE-2302.2**	Recognize and understand various analog measuring instruments.
CO3	**BECE-2302.3**	Measure resistance using various methods.
CO4	**BECE-2302.4**	Find various measurements using CRO.

Recommended Books:

1. A.K. Sawhney, 'Electrical & Electronic Measurement and Instrumentation', Dhanpat Rai & Publishers.

2. J.B. Gupta, 'A Course in Electrical and Electronics Measurement & Instrumentation', S.K. Kataria & Sons.

3. W.D. Cooper1, 'Electronic Instrumentation and Measurement Techniques', Prentice Hall.

Subject Title: Programming with Python
Subject Code: BECE-2305
Semester: 3
Contact Hours / Week:

Lecture(L)	Tutorial(T)	Practical(P)	Credit(C)
3	2	-	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam: 3Hrs

Course Objectives:

1. To understand why Python is a useful scripting language for developers.
2. To learn how to design and program Python applications.
3. To learn how to use lists, Tuples, and dictionaries in Python programs.
4. To learn how to identify Python object types.
5. To learn how to use indexing and slicing to access data in Python programs.

S.No	Topic(s)	Contact Hours
1.	Introduction to Python: Overview, History, importance, characteristics, features and applications. Local Environment Setup, Getting Python, Installation, Environment Variables, IDE. pyCharm, Anaconda, Jupyter etc. Basics of Python: Syntax: Interactive vs Script Programming, Identifiers, Reserved Words, Lines and Indentation, Single line Multiline Statements, Command Line. Variable Types: assignment, Data Types (Numbers, String, List, Tuple, Dictionary). Operators, Decision Making, Loops and Date & Time.	13
2.	Functions & Packages: Define & Call Functions, Pass by reference vs value, Function Arguments (Required, Keyword, Default, Variable length), Anonymous Functions, return statement, Global vs Local vs Dir vs Reload. Import Statement, PYTHONPATH and Packages. Files I/O and Exception Handlings: Input, Opening and Closing, file Object Attributes, Reading and Writing, File Positions, Directories. Standard Exceptions, Exception Handling, Assertion, except Clauses, Argument and Raising with Exceptions, User Defined Exceptions.	12
3.	Object Oriented with Python: Classes, Objects, Class-variable, Function Overloading, Operator Overloading, Instantiation, Inheritance, Garbage Collection, Overriding, Base Overloading and Data Hiding. Regular Expressions, Matching vs Searching, Modifiers, Patterns, Special Characters and Syntax	13
4.	Programming with Python Modules: Python Tools & Utilities, Matplotlib, Module Creation, Modules locating, NumPy, Pandas, SciPy, Django and etc. python examples with A.I.	12

Course Outcome:

CO1	**BECE-2305.1**	Understand Python syntax and semantics and be fluent in the use of Python flow control and Functions
CO2	**BECE-2305.2**	Develop, run and manipulate Python programs using Core data structures like Lists, Dictionaries, and use of Strings Handling methods
CO3	**BECE-2305.3**	Develop, run and manipulate Python programs using File Operations and searching pattern using regular expressions.
CO4	**BECE-2305.4**	Interpret the concepts of object oriented programming using Python
CO5	**BECE-2305.5**	Determine the need for python modules, libraries to design games, GUI and create efficient web applications using Matplotlib, NumPy, Pandas, Django

Suggested Readings / Books:

1. SheetalTaneja Naveen Kumar," Python Programming: A Modular Approach, by Pearson, 2017.
2. Downey, Allen B. Think Python: How to Think Like a Computer Scientist (Version 1.6.6 Ed.), 2012.
3. Hamilton, Naomi. "The A-Z of Programming Languages: Python", 2008.
4. Lutz, Mark Learning Python (5th ed.). O'Reilly Media, 2013.
5. Pilgrim, Mark Dive into Python 3. Apress, 2009
6. JISU ELSA JACOB, BHARATH VISAM S, “Python Programming”, Katson Books 2022
7. Sushil Bhardwaj, “Introduction to Python Programming”, Kalyani Publishers, 2022.

SUBJECT TITLE: ELECTRONIC DEVICES AND CIRCUITS LAB
SUBJECT CODE: BECE-2371
SEMESTER: 3

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

1. Able to understand and identification of various electronic components.
2. To understand and plot characteristics of various semiconductor devices.
3. To understand the applications of Transistors as amplifier in various configurations.

List of Experiments:

1. Study of Zener regulator as voltage regulator.

2. Study of Half wave, full wave & Bridge rectifiers.

3. To plot the input and output characteristics of CE configuration.

4. To plot JFET characteristics in CS configuration.

5. To study the characteristics of a Class- A amplifier.

6. To study the characteristics of Class- B amplifier.

7. To study the characteristics of Class- B push-pull amplifier.

8. To study the characteristics of complementary symmetry amplifier.

9. To study the response of RC phase shift oscillator and determine frequency of oscillation.

10. To study the response of Hartley oscillator and determine frequency of oscillation.

11. To study the response of Colpitt's oscillator and determine frequency of oscillation.

12. To study the response of Wien Bridge oscillator and determine frequency of oscillation.

Course Outcomes:

CO1	**BECE-2371.1**	An ability to understand all types of electronics devices and circuits.
CO2	**BECE-2371.2**	An ability to conduct experiments, as well as to analyze and interpret various data sheets.
CO3	**BECE-2371.3**	An ability to understand various configuration of transistors.

Subject Title: Programming with Python Lab

Subject Code: BECE-2372
Semester: 3
Contact Hours / Week:

Lecture(L)	Tutorial(T)	Practical(P)	Credit(C)
-	-	2	1

Internal Assessment: 50
End Term Exam: 50

Objective: To learn the concepts of data structure and algorithms and its implementation. The course has the main ingredients required for a computer science graduate and has all the necessary topics for assessment of data structures and algorithms

Name of Experiment

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method).
3. Exponentiation (power of a number).
4. Find the maximum of a list of numbers.
5. Linear search and Binary search.
6. Selection sort, Insertion sort.
7. Merge sort.
8. First n prime numbers.
9. Multiply matrices.
10. Programs that take command line arguments (word count).
11. Find the most frequent words in a text read from a file.
12. Simulate elliptical orbits in Pygame.
13. Simulate bouncing ball using Pygame.
14. Program to generate different waves.
15. Program to generate different graphs.
16. Tower of Hanoi.
17. Program To Find Given Number is Armstrong Number or not.
18. Bubble Sort Algorithm.
19. Program to interface with an Image (open CV).
20. Program to develop web page (Django).

Course Outcome:

CO1	**BECE-2372.1**	Develop, run and manipulate Python programs using Core data structures like Lists, Dictionaries, and use of Strings Handling methods
CO2	**BECE-2372.2**	Develop, run and manipulate Python programs using File Operations and searching pattern using regular expressions.
CO3	**BECE-2372.3**	Interpret the concepts of object oriented programming using Python

CO4	**BECE-2372.4**	Determine the need for python modules, libraries to design games, GUI and create efficient web applications using Matplotlib, NumPy, Pandas, Django

SYLLABUS

SEMESTER-IV

SUBJECT TITLE: ANALOG COMMUNICATION SYSTEMS
SUBJECT CODE: BECE-2401
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objective:
The course will introduce the participants to the signal representation in both time and frequency domain, basic analog communication techniques like modulation theory, system design for analog modulator and demodulator, random process and noise analysis.

Unit I

Base Band Signals and Systems: Introduction, Elements of communication system, Noise & its types; Noise Figure & noise factor, Noise equivalent temperature. Modulation & Demodulation, Mixing; Linear & Nonlinear, need of modulation, types of modulation systems, basic transmission signals, Frequency multiplexing technique.

Unit II

Analog Modulation Techniques: Introduction, theory of amplitude modulation; AM power calculations, AM current calculations, AM modulation with a complex wave, theory of frequency modulation; mathematical analysis of FM, spectra of FM signals, narrow band of FM, Wide band FM, Theory of phase modulation, phase modulation obtained from frequency modulation, comparison of AM & FM, Comparison of PM & FM.

Unit III

AM Transmission: Introduction, generation of Amplitude Modulation, Low level and high level modulation, basic principle of AM generation; square law modulation, Amplitude modulation in amplifier circuits, suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.

Unit IV

AM Reception: Receiver Parameters; Selectivity, Sensitivity, Fidelity, Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver; Basic elements of AM super heterodyne Receiver; RF Amplifier, Neutralization of RF Amplifiers, Class of operation of RF Amplifiers, High power RF Amplifiers, Image Frequency Rejection, methods of increasing Bandwidth, frequency Conversion and Mixers; Additive Mixing, Bipolar Transistor Additive Mixer, self excited Additive Mixers, multiplicative mixing, Tracking & Alignment, IF Amplifier, AM detector; square law detector, Envelope or Diode detector, AM detector with AGC, Distortion in diode detectors, AM detector Circuit using Transistor, Double hetro-dyne receiver, AM receiver using a phase locked loop (PLL), AM receiver characteristics.

Unit V

FM Transmission: FM allocation standards, generation of FM by direct method, Varactor diode Modulator, Cross by Direct FM Transmitter, Phase-Locked-Loop Direct FM Transmitter, Indirect generation of FM; Armstrong method, RC phase shift method, Frequency stabilized reactance FM transmitter.

Unit VI

FM Reception: Frequency demodulators, Tuned circuit frequency discriminators; Slope Detector, Balance Slope Detector, Foster Seeley discriminator, Ratio Detector, FM detection using PLL, Zero crossing detector as a Frequency Demodulator, pre emphasis and de emphasis, limiter circuits, FM Capture effect, FM receiver, FM stereo transmission and reception, Two way FM Radio Transmitter and Receiver.

Unit VII

SSB Transmission: Introduction, Single Side band systems, AM-SSB; Full carrier, Suppressed carrier , reduced carrier, Independent side band, and Vestigial side band, Comparison of SSB Transmission to conventional AM, Generation of SSB; Filter method, Phase Shift Method, Third Method.

Unit VIII

SSB Reception: SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Single Side band receivers; Single side band BFO Receivers, Coherent Single side band BFO Receivers, Single Side band Envelop detection receiver.

Unit IX

Pulse Modulation Transmissions and Reception: Introduction, Sampling Theorem Pulse Amplitude Modulation (PAM), Natural PAM Frequency Spectra for PAM , Flat-top PAM, Sample and hold circuits, Time division Multiplexing, PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM); Pulse Width Modulation(PWM), Pulse Position Modulation (PPM), PPM Demodulator.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-2401.1**	Students will understand issues related to transmission of signals through communication channels.
CO2	**BECE-2401.2**	Students will understand analog communication systems using amplitude modulation and demodulation.
CO3	**BECE-2401.3**	Students are familiar with analog radio transmitters and receivers.
CO4	**BECE-2401.4**	Students will be familiar with analog pulse communication systems.

Recommended Books:

1. Electronic communication Systems by Kennedy & Davis, Tata Mcgraw Hill.
2. Analog Communication Systems by Manoj Kumar & Manisha, Satya Prakashan, New Delhi, 2nd Edition.
3. Electronic Communication System, Tomasi, Pearson Education.
4. Electronic Communication, Roddy, Pearson Education.
5. Analog Communication Systems by Symon Hykens, John Wiley & Sons .

SUBJECT TITLE: DIGITAL ELECTRONICS
SUBJECT CODE: BECE-2402
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To provide knowledge about basics of digital electronics.

2. To impart knowledge about designing of digital circuits.

3. Students will use schematics and symbolic Algebra to represent digital gates in the creation of solutions to design problems

Unit I

Number System and Binary Code: Introduction, Binary, Octal and Hexadecimal Number System (Conversion, Addition & Subtractions). Signed and unsigned numbers, Binary Subtractions using 1's and 2's compliment, ASCII code, Excess 3 code, Gray code, BCD code and BCD additions.

Minimization of logic function: OR, AND,NOT,NOR,NAND,EX-OR, EX-NOR, Basic theorem of Boolean Algebra, Sum of Products and Product of Sums, canonical form, Minimization using K-map and Q-M method.

Unit II

Combinational Circuits: Introduction, Combinational circuit design, Encoders, decoders, Adders, Sub tractors and Code converters. Parity checker, seven segment display, Magnitude comparators. Multiplexers, De-multiplexer, Implementation of Combinational circuit using MUX.

Unit III

Sequential Circuits: Introduction, flip flops, Clocked flip flops, SR, JK, D, T and edge triggered flipflops. Excitation tables of Flip flops. Shift Registers, Type of Shift Registers, Counter, Counter types, counter design with state equation and state diagrams.

D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A converter, steady state accuracy test, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter Successive approximation A/D converter, dual slope A/D converter, A/D accuracy and resolution.

Unit IV

Semiconductor Memories: Introduction, Memory organisation, Classification and characteristics of memories, Sequential memories, ROMs, R/W memories, Content addressable memories, Programmable Logic Devices.

Unit V

Logic Families: RTL, DCTL, DTL, TTL, ECL, CMOS and its various types, Comparison of logic families.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-2402.1**	Students will simplify a digital design problem as part of the systematic approach to solve a problem.
CO2	**BECE-2402.2**	To analyze and understand various sequential circuits & various Digital Logic families.
CO3	**BECE-2402.3**	To design Analog to Digital and Digital to Analog converters.
CO4	**BECE-2402.4**	To analyse and understand semiconductor memories and logic families.

Suggested Readings / Books:

1. Morris Mano, Digital Design, Prentice Hall of India Pvt. Ltd
2. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
3. R.P.Jain, Modern Digital Electronics, 3 ed., Tata McGraw-Hill publishing Company limited, New Delhi, 2003. Thomas L. Floyd, Digital Fundamentals, Pearson Education, Inc, New Delhi, 2003
4. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital System -Principles and Applications, Pearson Education. Srivastava/Srivastava/Srivastava, Digital Design: HDL Based Approach, Cengage

SUBJECT TITLE: SIGNAL AND SYSTEMS
SUBJECT CODE: BECE-2403
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To introduce the students about the theoretical concepts associated with processing continuous & discrete time signals & systems.

2. To make the students aware about the signal transmission through linear networks

3. To be able to think critically & to apply problem solving & reasoning strategies to the analysis of various types of signals & systems.

Unit I

Classification of Signals and Systems: Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic & aperiodic, random &deterministic signals, Even& Odd Signals, Energy & Power Signals, Description of continuous time and discrete time systems.

Unit II

Analysis of Continuous Time Signals: Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and its properties in Signal Analysis, Power Spectral Density and Energy spectral density.

Unit III

Linear Time Invariant -Continuous Time Systems: Linear Time invariant Systems and their properties. Differential equation & Block diagram representation, Impulse response, Convolution integral, Frequency response (Transfer Function), Fourier transforms analysis.

Unit IV

Analysis of Discrete Time Signals: Sampling of CT signals and aliasing, DTFT and its properties, Z-transform and properties of Z-transform.

Unit V

Linear Time Invariant - Discrete Time System: Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms.

Unit VI

Random Signal Theory: Introduction to probabilities, Definition, probability of Random events, Joint and conditional probability, probability Mass function statistical averages.

Probability density functions and statistical averages. Examples of P.D. function, transformation of random variables random processes, stationary, True averages and Ergodic.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-2403.1**	Ability to analyse various types of signals in communication system.
CO2	**BECE-2403.2**	Developing skills to understand random signals.
CO3	**BECE-2403.3**	Solve the problems LTI system.
CO4	**BECE-2403.4**	Solve the problems of difference equation, Z- Transformation, DTFT system.

Recommended Books:

1. Signals and Systems by Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Pearson Education.
2. Fundamentals of Signals and Systems by Edward W Kamen & Bonnie's Heck, Pearson Education.
3. Communication Signals & System by Simon Haykins, John Wiley & Sons.
4. Signals and Systems by H P Hsu, Rakesh Ranjan, Schaum's Outlines, Tata McGraw Hill.
5. Digital Signal Processing by S Salivahanan, A. Vallavaraj, C. Gnanapriya, McGraw Hill International.
6. Signals and Systems by Simon Haykins and Barry Van Veen, John Wiley & sons, Inc.

SUBJECT TITLE: ELECTROMAGNETIC AND FIELD THEORY
SUBJECT CODE: BECE-2404
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course objectives:
To introduce the concepts of different coordinate systems, Maxwell`s equations, static electric and magnetic fields and methods of solving for the quantities associated with these fields, time varying fields and displacement current, propagation of electromagnetic waves and their applications in practical problems.

Unit–I

Introduction: Review of Electrostatic and Magnetostatics, definition of gradient, divergent and curl of a vector and their physical significance, Coulomb's law, Gauss law, Faraday Law, Laplace and Poison equations.

Unit II

Time Varying Fields: Maxwell's equations in differential and integral forms concept of displacement current. Boundary conditions, Helmholtz equations.

Unit III

Plane Wave and Electromagnetic Waves: Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth Wave equation, Sinusoidal time variation, polarization, Surface impedance, Poynting theorem and Poynting vector.

Unit IV

Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart, Circuit representation of parallel plane transmission lines. Parallel plane transmission line with losses. Distortion less condition.
Wave Guides: Waves between parallel planes, Waveguide Types, Modes, TE and TM waves in rectangular wave guides. Impossibility of TEM wave in wave guides, cut-off frequencies, dispersion relations, velocities of propagation, Wave impedance and characteristics impedances. Transmission line analogy for wave guides. Attenuation and factor of wave guides. Dielectric slab wave guides.

Course Outcomes:
After undergoing this course student will be able to:

CO1	**BECE-2404.1**	To differentiate different types of coordinate systems and use them for

		solving the problems of electromagnetic field theory.
CO2	**BECE-2404.2**	To describe static electric and magnetic fields, their behavior in different media, associated laws, boundary conditions and electromagnetic potentials.
CO3	**BECE-2404.3**	To use integral and point form of Maxwell`s equations for solving the problems of electromagnetic field theory.
CO4	**BECE-2404.4**	To describe time varying fields, propagation of electromagnetic waves in different media, pyonting theorem, their sources & effects and to apply the theory of electromagnetic waves in practical problems.
CO4	**BECE-2404.5**	To apply concepts of Wave reflection and refraction, Smith Chart in practical Field.

Recommended Books:

1. Electromagnetic Wave : Jordan and Balmain : PHI And Radiation System
2. Electromagnetics : Kraus : T.M.H.
3. Telecommunications : Fraser

SUBJECT TITLE: PULSE WAVESHAPE AND SWITCHING
SUBJECT CODE: BECE-2405
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To Introduce the students the wave shaping circuits, Switching Characteristics of diode and transistor To analyze different types of Multi vibrators and their design procedures
2. To Introduce Time-base Generators and Principles of Synchronization & Frequency division.
3. To Understand Sampling Gates and to Design NAND and NOR gates using various logic families.

Unit I

Introduction to Basic Elements and Waveforms: Passive and Active circuit elements, AC through inductor and capacitor, AC through Resistor-inductor and resistor-capacitor in series, Series and parallel resonance circuit, Different input signals, Average and RMS value.

Unit II

Bistable Multivibrators: Role of feedback in electronic circuits, Fixed bias and self-bias bistable multivibrator, Speed-up Capacitors, unsymmetrical and symmetrical triggering, Application of Trigger input at the base of OFF Transistor, Application of Trigger input at the base of ON Transistor, Bisatble multivibrator as T Flip-Flop, Schmitt trigger circuit, Calculation of Upper Tripping Point and Lower Tripping Point.

Unit III

Monostable and Astable Multivibrators: Collector Couple and Emitter Coupled Monostable multivibrator, Expression for Gate width, Astable Collector coupled and emitter coupled multivibrator, complementary Transistor Astable multivibrator.

Unit IV

Switching Characteristics of Devices: Diode and transistor as electronic switch, Breakdown mechanism in diode, Effect of temperature on diode, Charge storage phenomena, Switching times in diode and transistor, Delay time, Rise time, Storage time and fall time, Use of Schotkey diode for reducing storage time.

Unit V

Linear Wave Shaping: Low pass RC Network, Response to standard waveforms circuits, Integrator High Pass RC circuits, Response to standard waveforms, Differentiator, Double differentiation, Attenuator.

Unit VI

NON- Linear Wave Shaping: Clipping circuits (diode & transistor), Diode comparators, Transistor differential comparator, Operational amplifier comparator, clamping circuits, Practical clamping circuit, clamping circuit theorem.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-2405.1**	To understand the basic working & design of wave shaping circuits.
CO2	**BECE-2405.2**	To analyze and Design of Multi-vibrator circuits and their applications.
CO3	**BECE-2405.3**	To understand Time-base generators and sampling gates.
CO4	**BECE-2405.4**	Knowledge about Linear and non linear waveshaping.

Suggested Readings / Books:

1. Pulse and Digital Switching Circuits by Milliman, Taub; Tata Mcgraw Hill
2. Pulse and Digital Circuits by Mothiki S. Prakash Rao; Tata Mcgraw Hill
3. Pulse & Digital Circuits, by Rao K, Pearson Education.
4. Switching Theory & Logic Design, by Rao , Pearson Education.
5. Wave Generation and Shaping by Strauss McGraw Hill.
6. Pulse and Switching Circuits by Sanjeev Kumar; Dhanpat Rai & Company

SUBJECT TITLE: ANALOG COMMUNICAION SYSTEM LAB
SUBJECT CODE: BECE-2471
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

1. To familiarize with modulation & demodulation techniques and study their waveforms on oscilloscope.
2. To impart working knowledge of Voltage Controlled Oscillator.
3. To familiarize students with the functions of oscillators, filters, amplifiers, LC networks, modulators, limiters, mixers, and detectors in AM, FM, PM, SSB, and PLL circuits.

EXPERIMENTS

1. To study Amplitude Modulation using a transistor and determine depth of modulation.
2. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect.
3. Frequency Modulation using Voltage Controlled Oscillator.
4. Generation of DSB-SC signal using Balanced Modulator.
5. Generation of Single Side Band (SSB) signal.
6. Study of Phase Lock Loop (PLL) and detection of FM Signal using PLL.
7. Measurement of Noise Figure using a noise generator.
8. Study functioning of Super heterodyne AM Receiver.
9. Familiarization of PLL, measurement of lock/captures range, frequency demodulation, and frequency multiplier using PLL.
10. Measurement of Sensitivity, Selectivity and Fidelity of radio receivers.

Note: At least 08 experiments are required to be performed.

Course Outcomes:

CO1	**BECE-2471.1**	An ability to perform transmission of signals from transmitter to receiver using various analog modulation and demodulation techniques
CO2	**BECE-2471.2**	Study of transmission and reception process.
CO3	**BECE-2471.3**	Study of PLL and their measurements.

SUBJECT TITLE: DIGITAL ELECTRONICS LAB
SUBJECT CODE: BECE-2472
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

1. To give students a practical knowledge about all types of digital circuits.

2. To give students a working knowledge to connect digital circuits and verify their truth tables.

3. To give students a knowledge about integrated circuits of different combinational and sequential circuits.

EXPERIMENTS

1. To Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates and their Realization of OR, AND, NOT and XOR functions using universal gates.

2. To Realize of Half Adder using Logic gates.

3. To Realize of Full Adder using Logic gates.

4. To Realize of Half Subtractor using Logic gates

5. To Realize of Full Subtractor using Logic gates

6. To Design 4-Bit Binary-to-Gray Code Converter.

7. To Design 4-Bit Gray-to-Binary Code Converter.

8. To study and design 4-Bit magnitude comparator using logic gates.

9. To study and design multiplexer Truth-table and their verification.

10. Realization of Half adder and Full adder using MUX.

11. To study and design Demultiplexer Truth table and their verification

12. Realization of Half subtractor and Full subtractor using DEMUX.

13. To study and verify Truth-table of RS, JK, D, JK Master Slave Flip Flops.

14. To design MOD-7 Synchronous up-counter using JK/RS/D Flip Flops.

15. To Study different shift registers, viz. SIPO, SISO, PIPO, PISO.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-2472.1**	An ability to test and verify working and truth tables of combinational and sequential circuits.
CO2	**BECE-2472.2**	Working knowledge of different converters.
CO3	**BECE-2472.3**	To perform multiplexer and demultiplexer.

SUBJECT TITLE: SIGNAL AND SYSTEMS LAB
SUBJECT CODE: BECE-2473
SEMESTER: 4

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

1. To give students a practical knowledge about continuous and discrete time signals.
2. Knowledge about the elementary signals.
3. Students get the knowledge about the LTI system describe by difference equation.
4. Understand the basics of Z-Transform.

EXPERIMENTS

1. Generation of continuous and Discrete Unit step signal.
2. Generation of exponential and Ramp Signal in Continuous and Discrete Domain.
3. Continuous and Discrete time Convolution.
4. Adding and subtracting two Given Signals (Continues as well as Discrete Signals)
5. To develop program modules based on operation on sequences like signal shifting, signal folding, signal addition and signal multiplication.
6. To develop program for discrete convolution and correlation.
7. To develop program for finding response of the LTI system described by the difference equation.
8. To develop program for computing inverse Z-transform.
9. To study Difference Equation to develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.

Course Outcomes:
After undergoing this course student will be able to:

CO1	**BECE-2473.1**	Study of continuous & discrete time signals.
CO2	**BECE-2473.2**	Able to find the response of LTI systems described by difference equation.
CO3	**BECE-2473.3**	To compute inverse Z-transform.
CO4	**BECE-2473.4**	To compute the discrete convolution & correlation.

SYLLABUS

SEMESTER-V

SUBJECT TITLE: LINEAR INTEGRATED CIRCUITS
SUBJECT CODE: BECE-3501
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To introduce the basic building blocks of linear integrated circuits.
2. To learn the linear and non-linear applications of operational amplifiers.
3. To introduce the theory and applications of analog multipliers and PLL.
4. To learn the theory of ADC and DAC.
5. To introduce the concepts of waveform generation and introduce some special function ICs.

Unit–I

Introduction to Op–Amp: Operational Amplifier, Block diagram, analysis and its schematic symbol, interpretation of IC 741 datasheet and characteristics, practical op–amp, all important electrical parameters and their values, Op-amp applications in open loop configuration.
Concept of Feedback, Op–Amp with Negative Feedback: Introduction and Block diagram representation of feedback configurations, Voltage Series feedback amplifier, Voltage Shunt feedback and derivation of important electrical parameters.

Unit-II

Introduction to Operational Amplifiers and Characteristics: Introduction, Block diagram, characteristics and equivalent circuits of an ideal op-amp, various types of Operational Amplifiers and their applications, Power supply configurations for OP-AMP applications, inverting and non-inverting amplifier configurations.
The Practical op-amp: Introduction, input offset voltage, offset current, thermal drift, Effect of variation in power supply voltage, common-mode rejection ratio, Slew rate and its Effect, PSRR and gain –bandwidth product, frequency limitations and compensations, transient response.

Unit-III

Amplifiers and Oscillators: Summing amplifier, Integrators and differentiators, Instrumentation amplifier, Differential input and differential output amplifier, Voltage-series feedback amplifier, Voltage-shunt feedback amplifier, Log/ Antilog amplifier, isolation amplifiers, Triangular/rectangular wave generator, phase-shift oscillators, Wein bridge oscillator, analog multiplier-MPY634, VCO.

Unit-IV

Active Filters: Characteristics of filters, Classification of filters, Magnitude and frequency response, Butterworth 1st and 2nd order Low pass, High pass and band pass filters, Chebyshev filter characteristics, Band reject filters, notch filter: all pass filters, self-tuned filters.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-3501.1**	Design linear and nonlinear applications of op – amps.
CO2	**BECE-3501.2**	Design applications using analog multiplier and PLL.
CO3	**BECE-3501.3**	Design ADC and DAC using op – amps.
CO4	**BECE-3501.4**	Generate waveforms using op – amp circuits.
CO5	**BECE-3501.5**	Analyse special function ICs.

Recommended Books:

1. Ramakant A. Gayakward, 'Op–Amps & Linear Integrated Circuits', Pearson Education.
2. William D. Stanley, 'Operational Amplifiers with Linear Integrated Circuits', Merrill Publishing Company.
3. Millman & Grabal, 'Micro Electronics', Tata McGraw Hill

SUBJECT TITLE: MICROPROCESSORS
SUBJECT CODE: BECE-3502
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objective:
To illustrate some basic concepts of microprocessors through the use of assembly language programming , the microprocessor as a programmable digital system element , the operation of microprocessors and machine language programming & interfacing techniques.

Unit-1

Introduction to Microprocessor: Overview of Microprocessor Structure and its operation. Microprocessor evolution and its types.

Unit-2

8085 Microprocessor: 8085 MPU, Memory Interfacing, Memory mapped I/O and peripheral mapped I/O 8085 Microprocessor Programming model. Introduction to 8085 instructions, programming techniques, counters and time delays, stack and subroutines, interrupts of 8085.

Unit-3

8086 Microprocessor: 8086 internal architecture, 8086-system configuration and timing, minimum and maximum mode, memory segmentation, address modes, instruction set descriptions and assembly language programming based on 8086.

Unit-4

Microprocessor system peripheral and interface: Introduction to interfacing, 8155, 8255, 8279, 8254, DMA controller, programmable interrupt controller, USART interfacing with 8085 MPU.

Course Outcomes:
After undergoing this course student will be able to:

CO1	**BECE-3502.1**	The student will be able to analyse, specify, design, write and test assembly language programs of moderate complexity.
CO2	**BECE-3502.2**	The student will be able to select an appropriate ‘architecture’ or program design to apply to a particular situation
CO3	**BECE-3502.3**	The student will be able to understand the operation of microprocessors and machine language programming & interfacing techniques.

Recommended Text Books:-

1. Microprocessor Architecture, Programming and application with 8085 by Gaonkar.
2. Introduction to Microprocessor by B. Ram.
3. Microprocessor Interfacing, programming and hardware by D. V. Hall.

SUBJECT TITLE: ANTENNA AND WAVE PROPAGATION
SUBJECT CODE: BECE-3503
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objective:

To provide To describe the electromagnetic radiation with application to antenna theory and design, the basic knowledge about the fundamentals of antenna, the radio wave propagation phenomena in modern communication systems .

Introduction: Physical concept of Radiation in single wire, two wire, and dipole, Current Distribution on a thin wire antenna.

Fundamental Parameters of Antenna: Radiation Pattern, Radiation Power Density, Radiation intensity, Directivity, Gain, Antenna efficiency, Beamwidth, Bandwidth, Polarisation, Antenna Input Impedance, Elementary idea about self and mutual impedance, Radiation efficiency, Effective aperture, Antenna Temperature.

Linear Wire Antennas: Retarded potential, Infinitesimal dipole, Current distribution of short dipole and half wave dipole, Far-field, Radiating near-field and reactive near-field region, Monopole and Half wave dipole.

Antenna Arrays: Array of two point sources, Array factor, n-element linear array with uniform amplitude and spacing, Analysis of Broadside array, Ordinary end-fire array, Hansen-woodyard end fire array, n-element linear array with non-uniform spacing, , Analysis of Binomial and Dolph-Tschebyscheff array, Scanning Array, Superdirective array.

Aperture Antennas: Field Equivalence principle, Rectangular and circular aperture antennas, Horn antenna, Babinet's Principle, Slot Antenna, Reflector antenna.

Ground wave Propagation: Friis Free space equation, ,Reflection from earth's surface, Surface and Space wave propagation for vertical and horizontal dipole, Field strength of Space wave, Range of space wave propagation, Effective earth's radius, Effect of earth imperfections and atmosphere on space wave propagation, Modified refractive index, Duct propagation, Tropospheric propagation.

Ionospheric Propagation: Structure of ionosphere, propagation of radio waves through ionosphere, Refractive index of ionosphere, Reflection and refraction of waves by ionosphere, Critical frequency, Maximum usable frequency, Optimum working frequency, Lowest usable high frequency, virtual height, Skip Distance, Effect of earth's magnetic field.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-3503.1**	Be able to describe the electromagnetic radiation with application to antenna theory and design.
CO2	**BECE-3503.2**	Be able to make the students understand the radio wave propagation phenomena in modern communication systems.
CO3	**BECE-3503.3**	Be able to understand the applications of the electromagnetic waves in free space.

Text Books:

1. Antenna Theory ,Balanis C.A ,John Wiley & sons.
2. Electromagnetics and radiating systems, Jordan E.C.,PHI.

Reference Books:

1. Antenna and radio wave propagation, Collins R.E., McGraw Hill.
2. Antenna Theory , Krauss J.D.,McGraw Hill.

SUBJECT TITLE: DIGITAL SIGNAL PROCESSING
SUBJECT CODE: BECE-3504
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To learn discrete Fourier transform and its properties.
2. To know the characteristics of IIR and FIR filters learn the design of infinite and finite impulse response filters for filtering undesired signals.

UNIT I

Introduction: Limitations of analog signal processing, Advantages of digital signal processing and its applications; Some elementary discrete time sequences and systems; Basic elements of digital signal processing such as convolution, correlation and autocorrelation, Concepts of stability, causality, linearity, difference equations. DFT and its properties; Linear Periodic and Circular convolution; Linear Filtering Methods based on DFT; Fast Fourier Transform algorithm using decimation in time and decimation frequency techniques; Goertzel algorithm.

UNIT II

The Z Transform: Introduction, Z-Transform, Region of convergence; Inverse Z Transform methods, properties of Z transform.

UNIT III

Design of Digital Filters: Structures of realization of discrete time system, direct form, Cascade form, parallel form and lattice structure of FIR and IIR systems. Linear Phase FIR filters; Design methods for FIR filters; IIR filter design by Impulse Invariance, Bilinear Transformation, Matched Z-Transformation, Analog and Digital Transformation in the Frequency Domain.

UNIT IV

DSP Processors: Architectures of ADSP and TMS series of processor.

Course Outcomes:

After undergoing this course student will be able to:

CO1	**BECE-3504.1**	Know about the discrete time signals, Linear filter methods based on DFT, DSP processors.
CO2	**BECE-3504.2**	Analyse the solution of problems by Z-Transformation.

CO3	**BECE-3504.3**	Apply DFT for the analysis of digital signals & systems.
CO4	**BECE-3504.4**	Design IIR and FIR filters.

RECOMMENDED TEXT BOOK

1. Digital Signal Processing Principles, Algorithms and Application John G Proakis, Dimtris G Manolakis 4th 2009.
2. Discrete-Time Signal Processing Alan V Oppenheim, Ronald W Schafer, John R Back 2nd 2008, Prentice Hall.
3. Digital Signal Processing S. Salivahan, A Vallavaraj, Gnanpiya 1st 2008 Tata McGraw Hill.
4. Digital Signal Processing-A computer based approach S. K. Mitra 1st 2006 Tata McGraw Hill
5. Jervis, ―Digital Signal Processing‖, Pearson Education India.
6. Introduction to Digital Signal Processing Johny R.Johnson 1st 2006, Prentice Hall.

BTEC-503 LINEAR INTEGRATED CIRCUI

SUBJECT TITLE: LINEAR CONTROL SYSTEMS
SUBJECT CODE: BECE-3505
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To introduce the elements of control system and their modeling using various Techniques.

2. To introduce methods for analyzing the time response, the frequency response and the stability of systems

Unit I

Introductory Concepts: Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems, Block diagrams, some illustrative examples.

Modeling: Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Transfer function, Block diagram representation, signal flow graphs and associated algebra, characteristics equation.

Unit II

Time Domain Analysis: Typical test - input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion.

Unit III

Root Locus Technique: The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot.

Control Components: Error detectors - potentiometers and synchros, servo motors, a.c. and d.c. techno generator.

Unit IV

Frequency Domain Analysis: Closed loop frequency response, Bode plots, stability and loop transfer function. Frequency response specifications, Relative stability, Relation

between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.

Course Outcomes:

Upon completion of the course, students will be able to:

CO1	**BECE-3505.1**	Perform time domain and frequency domain analysis of control systems required for stability analysis.
CO2	**BECE-3505.2**	Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
CO3	**BECE-3505.3**	Determine the (absolute) stability of a closed-loop control system
CO4	**BECE-3505.4**	Apply root-locus technique to analyze and design control systems.

Suggested Readings / Books

1. Dorf Richard C. and Bishop Robert H., *Modern Control System*, Addison -Wesley, Pearson New Delhi Ogata K., *Modern Control Engineering*‖, Prentice Hall,
2. Kuo B. C., *Automatic Control System*‖, Prentice Hall
3. Nagrath I.J. and Gopal M., *Control System Engineering*, Wiley Eastern Ltd.
4. Singh / Janardhanan, Modern Control Engineering, Cengage Learning

SUBJECT TITLE: LINEAR INTEGRATED CIRCUITS LAB
SUBJECT CODE: BECE-3571
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

1. To introduce about the differential and operational amplifier and their performance parameters.
2. To introduce about the various applications of operational amplifier.
3. To learn the concept of filters and its types, designing of function generator and VCO.

LIST OF EXPERIMENTS

1. To study differential amplifier configurations.

2. To measure the performance parameters of an Op amp.

3. Application of Op amp as Inverting and Non Inverting amplifier.

4. To study frequency response of an Op Amp.

5. To use the Op-Amp as summing, scaling & averaging amplifier.

6. To use the Op-Amp as Instrumentation amplifier.

7. Design differentiator and Integrator using Op-Amp.

8. Application of Op Amp as Log and Antilog amplifier. Design Low pass, High pass and Band pass 1st order butterworth active filters using Op Amp.

9. Design Phase shift oscillator using Op-Amp.

10. Design Wein Bridge oscillator using Op-Amp.

11. Application of Op Amp as Sawtooth wave generator.

12. Application of Op Amp as Zero Crossing detector and window detector.

13. Application of Op Amp as Schmitt Trigger.

14. Design a delay circuit using 555 timer.

15. Design of a function generator.

16. Design of a Voltage Controlled Oscillator.

Course Outcomes:

Upon completion of the course, students will be able to:

CO1	**BECE-3571.1**	To study about the differential and operational amplifier.
CO2	**BECE-3571.2**	Design of operational amplifier for various applications.
CO3	**BECE-3571.3**	Design of various types of Oscillator.
CO4	**BECE-3571.4**	Designing of basic filters.

SUBJECT TITLE: MICROPROCESSORS LAB
SUBJECT CODE: BECE-3572
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objective:

This is laboratory course meant to write programs using 8085/8086 microprocessor.

LIST OF EXPERIMENTS

1. Study of 8085 Microprocessor Kit.

2. Write a program to add two 8-bit number using 8085.

3. Write a program to add two 16-bit number using 8085.

4. Write a program to subtract two 8-bit number using 8085.

5. Write a program to subtract two 16-bit number using 8085.

6. Write a program to multiply two 8-bit numbers by repetitive addition method using 8085.

7. Write a program to multiply two 8-bit numbers by rotation method using 8085.

8. Write a program to multiply 16-bit number with 8-bit number using 8085.

9. Write a program to generate fibonacci series using 8085.

10. Write a program to sort series using bubble sort algorithm using 8085.

11. Study 8086 Microprocessor kit.

12. Write a program to copy 12 bytes of data from source to destination using 8086.

13. Write a program to find maximum and minimum from series using 8086.

14. Write a program to control the operation of stepper motor using 8085/8086 microprocessors and 8255 PPI.

15. Write a program for finding square of a number using look-up table and verify.

16. Write a program to control the temperature using 8085/8086 microprocessors and 8255 PPI.

17. Write a program to control the traffic light system using 8085/8086 microprocessors and 8255 PPI.

18. Write a program to control speed of DC motor using 8085/8086 microprocessors and 8255 PPI.

Course Outcomes:

Upon completion of the course, students will be able to:

CO1	**BECE-3572.1**	Write programs for common arithmetic operations with 8-bit/16-bit numbers using 8085.
CO2	**BECE-3572.2**	Write programs for transfer, sort block of data with 8085/8086 processor(s).
CO3	**BECE-3572.3**	Write programs for controlling stepper and DC motors using Microprocessor(s).

SUBJECT TITLE: DIGITAL SIGNAL PROCESSING LAB
SUBJECT CODE: BECE-3573
SEMESTER: 5

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objective:
This laboratory course deals with the Hands-on experiments related to the study of Digital Signal Processing and its applications.

LIST OF EXPERIMENTS

Perform the following exercises using MATLAB :

1. To develop elementary signal function modules (m-files) for unit sample, unit step, exponential and unit ramp sequences.
2. Write a program in MATLAB to generate standard sequences.
3. Write a program in MATLAB to compute power density spectrum of a sequence.
4. To develop program modules based on operation on sequences like signal Shifting, signal folding, signal addition and signal multiplication.
5. Write a program in MATLAB to verify linear convolution.
6. Write a program in MATLAB to verify the circular convolution.
7. To develop program for finding magnitude and phase response of LTI system Described by system function H(z).
8. To develop program for finding response of the LTI system described by the difference equation.
9. To develop program for computing inverse Z-transform.
10. To develop program for computing DFT and IDFT.
11. To develop program for conversion of direct form realization to cascade form realization.
12. To develop program for cascade realization of IIR and FIR filters.
13. To develop program for designing FIR filter.
14. To develop program for designing IIR filter.
15. To write a MATLAB program for noise reduction using correlation and autocorrelation methods.
16. To write a MATLAB programs for pole-zero plot, amplitude, phase response and impulse response from the given transfer function of a discrete-time causal system.
17. Write a program in MATLAB to find frequency response of different types of analog filters.
18. Write a program in MATLAB to design FIR filter (LP/HP) through Window technique a. Using rectangular window b. Using triangular window

Course Outcomes:

Upon completion of the course, students will be able to:

CO1	**BECE-3573.1**	Write programs to develop various signals.
CO2	**BECE-3573.2**	Write programs to generate standard sequences
CO3	**BECE-3573.3**	Develop programs to verify convolution.
CO4	**BECE-3573.4**	Develop programs to design various filters.
CO5	**BECE-3573.5**	Develop programs to compute DFT & IDFT.

SYLLABUS

SEMESTER-VI

SUBJECT TITLE: DIGITAL COMMUNICATION SYSTEMS
SUBJECT CODE: BECE-3601
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:
1. To provide knowledge about basics of Communication system and various digital modulation and demodulation techniques.
2. To learn design of useful circuits required in communication system.
3. To provide knowledge about various transmitter and receiver circuits used in communication.
4. To provide students with tools for communication signal analysis.

UNIT I

Elements of Digital Communication System:- Block diagram of Digital Communication system, Digital representation of Analog signals, Advantages and Disadvantages of Digital Communication system, Bandwidth -S/N trade off, Hartley Shannon Law, Sampling theorem . Concept of amount of Information and entropy, Shannon Fano Source Coding, Huffman source coding and Lempel-Ziv Source coding algorithm.

UNIT-II

Pulse Code Modulation:- Sampling, Sampling Rate, Aliasing, quantization error, Uniform and Non uniform quantization, Dynamic Range, Coding efficiency, A law & μ law companding, Bandwidth of PCM, Block diagram of PCM system, Delta Modulation, Continuously variable Slope Delta Modulator (CVSDM) or Adaptive Delta Modulation, Differential Pulse Code Modulation, Intersymbol Interference, Eye Patterns.

UNIT-III

Line Coding & Multiplexing Techniques: Line Coding & its properties. NRZ & RZ types, signaling format for unipolar, Polar, bipolar (AMI) & Manchester coding and their power spectra (No derivation), HDB and B8ZS signaling, Nyquist's criterions for pulse shaping, Fundamentals of time division multiplexing, Statistical TDM. Basics of TDMA, FDMA and CDMA.

UNIT-IV

Digital Carrier Modulation & Demodulation Techniques: Introduction, Amplitude Shift Keying (ASK), ASK Spectrum, ASK Modulator, Coherent ASK Detector, Noncoherent ASK

Detector, Frequency Shift Keying (FSK), FSK Bit Rate and Baud, Bandwidth and Frequency Spectrum of FSK, FSK Transmitter, Non-coherent FSK Detector, Coherent FSK Detector, FSK Detection Using PLL, Binary Phase Shift Keying, Binary PSK Spectrum, BPSK Transmitter, Coherent PSK Detection, Quadrature Phase Shift Keying (QPSK), QPSK Demodulator, Offset QPSK, $\pi/4$ QPSK, Comparison of conventional QPSK, Offset QPSK and $\pi/4$ QPSK, M-Ary BPSK, Quadrature Amplitude Modulation (QAM); MQAM transmitters and receivers, Band Width efficiency, Carrier Recovery; Squaring Loop & Costas Loop, Differential PSK, DBPSK transmitter and receiver, Constant Envelop Modulation; Minimum Shift Keying (MSK) & Gaussian Minimum Shift Keying (GMSK), matched filter receivers, bandwidth consideration and probability of error calculations for ASK, PSK, FSK schemes.

Course Outcomes:

CO1	**BECE-3601.1**	To understand the various blocks/stages in a digital communication system.
CO2	**BECE-3601.2**	Analyze the performance of a baseband and pass band digital communication system.
CO3	**BECE-3601.3**	Perform the time and frequency domain analysis of the signals in a digital communication system.
CO4	**BECE-3601.4**	Analyze the performance of various multiplexing techniques.

TEXT BOOK RECOMMENDED

1. Electronic Communication System Fundamentals through Advance Wayne Tomasi 5th 2009 Pearson Education.

2. Communication Systems, Fourth Edition, Simon Haykin, Wiley publication.

BOOKS RECOMMENDED

1. Modern Electronic Communication, (6th edition), by Gary M. Miller, published by Prentice-Hall, 1999

2. Introduction to Communication Systems, third edition, by F. G. Stremler, AddisonWesley, 1990.

3. Digital Communication, E.A. Lee and D.G. Messerschmitt, , Kluwer Academic Publishers,1994

4. Digital Communication Receivers, H. Meyr, M. Moeneclaey, S.A. Fechtel, Wiley, 1998

5. Modulation and Coding Techniques in Wireeless Communications by EVGENII KROUK, SERGEI SEMENOV, WILEY, 2011.

SUBJECT TITLE: MICROWAVE & RADAR ENGINEERING

SUBJECT CODE: BECE-3602
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

Microwave Systems, Radar and Navigation are elective courses that have learning achievements to understand the concept of microwave systems and know the components of a microwave system, understand the working principles of microwave systems, understand the concept of radar, know the types of radars and understand the principles and it's working.

Course outcomes:

1. Able to understand the concept of microwave systems and knowing the components of a microwave system.
2. Able to understand the working principles of microwave systems.
3. Understand the concept of radar, knowing the types of radars and understanding their working principles.

CONTENT OF COURSE:

1. **Microwave Tubes:** Limitations of conventional tubes, construction, operation and properties of Klystron Amplifier, reflex Klystron, Magnetron, Travelling Wave Tube (TWT), Backward Wave Oscillator (BWO), Crossed field amplifiers.
2. **Microwave Solid State Devices:** Limitation of conventional solid state devices at Microwaves, Transistors (Bipolar, FET), Diodes (Tunnel, Varactor, PIN), Transferred Electron Devices (Gunn diode), Avalanche transit time effect (IMPATT, TRAPATT, SBD), Microwave Amplification by Stimulated Emission of Radiation (MASER).
3. **Microwave Components:** Analysis of Microwave components using s-parameters, Junctions (E, H, Hybrid), Directional coupler, Bends and Corners, Microwave posts, S.S. tuners, Attenuators, Phase shifter, Ferrite devices (Isolator, Circulator, Gyrator), Cavity resonator, Matched termination.
4. **Microwave Measurements:** Power measurements using calorimeters and bolometers, Measurement of Standing Wave Ratio (SWR), Frequency and wavelength, Microwave bridges.

5. **Introduction to Radar Systems:** Basic Principle: Block diagram and operation of Radar, Radar range Equation, Pulse Repetition Frequency (PRF) and Range Ambiguities, Applications of Radar.
6. **Doppler Radars:** Doppler determination of velocity, Continuous Wave (CW) radar and its limitations, Frequency Modulated Continuous Wave (FMCW) radar, Basic principle and operation of Moving Target Indicator (MTI) radar, Delay line cancellers, Blind speeds and staggered PRFs.
7. **Scanning and Tracking Techniques:** Various scanning techniques (Horizontal, vertical, spiral, palmer, raster, nodding), Angle tracking systems (Lobe switching, conical scan, monopulse), Range tracking systems, Doppler (velocity) tracking systems.

Course Outcomes:

CO1	**BECE-3602.1**	Able to understand the concept of microwave systems and knowing the components of a microwave system.
CO2	**BECE-3602.2**	Able to understand the working principles of microwave systems.
CO3	**BECE-3602.3**	Understand the concept of radar, knowing the types of radars and understanding their working principles.

Recommended Books:

1. M.Kulkarni, Microwave and Radar Engineering, Umesh Publications, 5th Edition, 2018.
2. Jordan E.C., Electromagnetics and radiating systems, PHI 1995
3. J.D.Krauss, Antenna Theory, McGraw Hill 1999.
4. C.A.Balanis, Antenna Theory, John Wiley & sons 4th Edition 2016.
5. R.L.Yadava, Antenna and wave propagation, PHI 2011

SUBJECT TITLE: WIRELESS & MOBILE COMMUNICATION
SUBJECT CODE: BECE-3603
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives: The student should be made to:
1. Know the characteristic of wireless channel.
2. Learn the various cellular architectures.
3. Be familiar the various multiple access techniques.
4. Understand the various standards & systems.

CONTENT OF COURSE:

Unit-I

Introduction: A basic cellular system, performance criteria, operation of cellular systems, planning a cellular system, analog & digital cellular systems. Examples of Wireless Communication Systems: Paging Systems, Cordless Telephone Systems, Cellular Telephone Systems. Blue tooth and Zig Bee.

Unit-II

Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting.

Unit-III

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Space Division Multiple Access, Packet Radio Protocols; Pure ALOHA, Slotted ALLOHA.

Unit-IV

Wireless Systems & Standards: AMPS and ETACS, United states digital cellular (IS- 54 & IS 136), Global system for Mobile (GSM): Services, Features, System Architecture, and Channel Types, Frame Structure for GSM, Speech Processing in GSM, GPRS/EDGE specifications and features. 3G systems: UMTS & CDMA 2000 standards and specifications. CDMA Digital standard (IS 95): Frequency and Channel specifications, Forward CDMA Channel, Reverse CDMA Channel, Wireless Cable Television.

Unit-V

Future trends: 4G mobile techniques, LTE-Advance systems

Course Outcomes:
At the end of the course, the student should be able to:

CO1	**BECE-3603.1**	Characterize wireless channels.

CO2	**BECE-3603.2**	Design and implement cellular systems.
CO3	**BECE-3603.3**	Compare the standards of wireless systems.
CO4	**BECE-3603.4**	Understand the upcoming trends of wireless systems

Recommended Text Books:

1. T.S.Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson Education Asia, 2010.
2. William C Y Lee, Mobile Cellular Telecommunications, 2nd Edition, MGH, 2004.
3. Raj Pandya, ―Mobile and Personal Communication systems and services‖, Prentice Hall of India, 2001.

SUBJECT TITLE: EMBEDDED SYSTEMS
SUBJECT CODE: BECE-3604
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 50
End Term Exam: 50
Duration of Exam; 3 Hrs

Course Objectives:
This course deals with the concepts and design requirements for understanding the Embedded System Design and its fundamentals.

CONTENT OF COURSE:

1. **Arm Processor Architecture:** Architecture, Registers, Interrupts & Vector Table, I/O Ports, ARM Processor family, JTAG, I2C bus
2. **Arm Programming Instructions:** Introduction to Different Instruction Set: Data processing instructions, Addressing modes, Load Store Instructions, PSR (Program Status Register) Instructions, Conditional Instructions, Interrupt Instructions
3. **C Programming:** Integrated Development Environment (IDE) for C/C++ Programming, C/C++ Programs using Function Calls, Pointers, Structures, Integers & Floating Point Arithmetic, Code using Instruction Scheduling, Register Allocation, Conditional Execution & Loops.
4. **Interfacing Peripherals:** Interfacing of ADC & DAC, Sensors, LCD Display, PWM Generation, Stepper Motor, DC Motor, Biometric, RFID, ZIGBEE, GSM Interfaces, Memory, SD-MMC Card, Debugging Tools

Course Outcomes:
At the end of the course, the student should be able to:

CO1	**BECE-3604.1**	Understand hardware interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
CO2	**BECE-3604.2**	Reviews and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
CO3	**BECE-3604.3**	Understand Embedded networking concepts based upon connected MCUs.

Recommended Books:

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

SUBJECT TITLE: DIGITAL COMMUNICATION SYSTEMS LAB
SUBJECT CODE: BECE-3671
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

1. To know the principles of sampling & quantization.

2. To study the various waveform coding schemes.

3. To learn the various baseband transmission schemes.

4. To understand the various Band pass signaling schemes.

EXPERIMENTS

1. Study of Time Division Multiplexing system.

2. Study of pulse code modulation and demodulation.

3. Study of delta modulation and demodulation and observe effect of slope overload.

4. Study pulse data coding techniques for various formats.

5. Data decoding techniques for various formats.

6. Study of amplitude shift keying modulator and demodulator.

7. Study of frequency shift keying modulator and demodulator.

8. Study of phase shift keying modulator and demodulator.

9. Error Detection & Correction using Hamming Code

10. Digital link simulation: error introduction & error estimation in a digital link using MATLAB (SIMULINK)/ communication simulation packages.

Course Outcomes:
At the end of the course, the student should be able to:

CO1	**BECE-3671.1**	Design PCM systems.
CO2	**BECE-3671.2**	Design and implement base band transmission schemes.
CO3	**BECE-3671.3**	Design and implement band pass signaling schemes.
CO4	**BECE-3671.4**	Analyze the spectral characteristics of band pass signaling schemes and their noise performance.

SUBJECT TITLE: MICROWAVE ENGINEERING LAB

SUBJECT CODE: BECE-3672
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objective:

This is basic course meant to give hands on experience of various types of Microwave components and important measurements related to Microwave and Antenna Engineering.

List of Experiments

1. Study of microwave components and instruments.
2. Study and analyse the V I Characteristics of Gunn Diode.
3. Measurement of Klystron characteristics.
4. Measurement of VSWR and standing wave ratio.
5. Measurement of Dielectric constants.
6. Measurement of Directivity and coupling coefficient of a directional coupler.
7. Measurement of Frequency and Wavelength.
8. Calibration of the attenuation constant of an attenuator.
9. Determination of the radiation characteristics and gain of an antenna.
10. Determination of the phase-shift of a phase shifter.
11. Study and use of Magic Tee, H Plane Tee and E plane tee as a Mixer etc.

Course Outcomes:
At the end of the course, the student should be able to:

CO1	**BECE-3672.1**	Learn about general Microwave components and Microwave bench.
CO2	**BECE-3672.2**	Measure common parameters related to Microwave Oscillator(s).
CO3	**BECE-3672.3**	Determine frequency and wavelength of waveguides.
CO4	**BECE-3672.4**	Measure and plot radiation patterns of various types of Antennas.

SUBJECT TITLE: EMBEDDED SYSTEMS LAB
SUBJECT CODE: BECE-3673
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

This course deals with the concepts and design requirements for understanding the Embedded System Design and its fundamentals.

List of Experiments

1. Study of ARM7 Development Kit.
2. Write ARM Processor program to Flash LED
3. Interfacing of an LCD Display
4. Write a program to interface an ADC
5. Write a program to generate a Ramp waveform using DAC interface
6. Write a program to control a Stepper Motor
7. Write a program to control the speed of DC motor
8. Interface relays and write a program to control them
9. Interface ZIGBEE with ARM to control more external devices
10. Interfacing of Biometric information recorder
11. Interfacing RFID module with ARM Microcontroller
12. Interfacing GSM Module with ARM Microcontroller
13. Interfacing Bluetooth Module to control the LEDs
14. Interface Wi-fi Module to Display the text on LCD
15. Interfacing of Touch Screen & Control with ARM Microcontroller.

Course Outcomes:
At the end of the course, the student should be able to:

CO1	**BECE-3673.1**	Learn about the basic architecture of 32-bit microcontrollers
CO2	**BECE-3673.2**	Understand hardware interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.

CO3	**BECE-3673.3**	Reviews and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
CO4	**BECE-3673.4**	Understand Embedded Networking concepts based upon connected MCUs.

SUBJECT TITLE: DIGITAL SYSTEM DESIGN (DEPARTMENT ELECTIVE-1)
SUBJECT CODE: BECE-3611
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:
1. To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.
2. To introduce the concept of memories and programmable logic devices.
3. To illustrate the concept of synchronous and asynchronous sequential circuits.

CONTENT OF COURSE:

UNIT-I

Introduction to Digital Design Concepts: Review of digital design fundamentals, minimization and design of combinational circuits, sequential machine fundamentals.
Finite State Machines: Finite state model, Memory elements and their excitation functions, Synthesis of Synchronous sequential circuits, Capabilities and limitations of FSM, Design, Modeling and Simulation of Moore and Mealy machines.

UNIT-II

Multi-input System Controllers Design: System controller, controller design principles, timing and frequency considerations, DFD development, controller architecture design, asynchronous input handling, state assignment concepts, flip-flop level implementation using VEM's.
Sequential Design using LSI & MSI circuits: Using decoders, multiplexers in sequential circuits, sequential network design using ROMs, PLAs and PALs, Programmable gate Arrays (PGAs).

UNIT-III

Clocked Sequential Finite State Machines: State diagram, analysis of synchronous circuits, derivation of state graphs and tables, reduction of state tables, state assignment, design of sequence detectors, serial data code conversion, design of synchronous sequential state machine, design and applications of counters and shift registers.

Unit-IV

Asynchronous Sequential Finite State Machines: Introduction, analysis of asynchronous networks, races and cycles, derivation of primitive flow tables, reduction of primitive flow tables, state assignments, hazards, asynchronous sequential network design.

Course Outcomes:
At the end of the course, the student should be able to:

CO1	**BECE-3611.1**	Design and implement Combinational circuits.
CO2	**BECE-3611.2**	Design and implement synchronous and asynchronous sequential circuits.
CO3	**BECE-3611.3**	Multi-input system controller design.

Recommended Books:

1. William I. Fletcher, 'An Engineering Approach to Digital Design', PHI.
2. M. Morris Mano, 'Digital Design', Pearson Education. .
3. Jr. Charles H. Roth, 'Fundamentals of Logic Design', Jaico Publishers.
4. John Wakerly, 'Digital Design, Principles and Practices', Pearson Education.

SUBJECT TITLE: INFORMATION THEORY & CODING (DEPARTMENT ELECTIVE-1)
SUBJECT CODE: BECE-3612
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

This course deals with knowledge and importance with understanding of Information Theory and Coding along with coding techniques.

CONTENT OF COURSE:

UNIT-1

Basic Concepts of Information Theory : The concept of Amount of Information, Average Information, Entropy, Information rate, Shannon's Theorem, Mutual information; Channel capacity; BSC and other channels, Capacity of a Gaussian Channel, Bandwidth – S/N Trade-off, Introduction to Channel Capacity & Coding, Channel Models, Channel Capacity Theorem, Shannon Limit. Huffman source coding algorithm, Lempel Ziv source coding algorithm.

UNIT-II

Introduction to Error Control Coding: Linear Block Codes: Introduction to Linear Block codes, Syndrome and Error detection, Minimum distance of block code, Hamming Code.

Cyclic Codes: Description of Cyclic codes, Generator and parity check matrices of cyclic codes, error detection decoding of cyclic codes.

UNIT-III

BCH Codes: Description of codes, Decoding of BCH codes, Implementation of error connection.

UNIT-IV

Convolution Codes: Encoding of convolution codes, structural properties of Convolution codes, Distance Properties of convolution codes.

Automatic Repeat Request Strategies: Stop and wait, Go back and selective repeat ARQ strategies, Hybrid ARQ Schemes.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO1	**BECE-3612.1**	Understand the concept of information and entropy.
CO2	**BECE-3612.2**	Understand Shannon's theorem for coding.
CO3	**BECE-3612.3**	Calculation of channel capacity.
CO4	**BECE-3612.4**	Apply coding techniques.

Recommended Books:

1. F.M Reza: Information Theory, Mc Graw Hill

2. ShuLin & J Costeib: Error Control Coding, PHI

3. Dass, Mullick & Chatterjee: Digital Communication, John Wiley, Ed. 1992

4. Information Theory and Reliable Communication: Robert G. Gallanger Mc Graw Hill, 1992

5. Related IEEE/IEE publications

SUBJECT TITLE: MOBILE COMPUTING (DEPARTMENT ELECTIVE-1)
SUBJECT CODE: BECE-3613
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objective: Students should be made to learn:

1. Basic concept of cellular system.
2. Wireless protocol IEEE802.11 with different layers
3. Various protocols/routing algorithms for wireless communication.
4. Mobile adhoc network

Unit-I

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept, GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems.

Unit II

Mobile Network & Transport Layer: Mobile IP Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, Dynamic Host Configuration Protocol (DHCP), Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Unit III

Wireless Networking: Wireless LAN Overview: MAC issues, IEEE 802.11-overview,PHY & MAC layer, Blue Tooth- architecture and protocol, Wireless multiple access protocols, Wireless applications, Mobile IP, WAP: protocol stack.

Unit III

Mobile Ad hoc Networks: Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment, Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Course Outcomes:
At the end of this course students will demonstrate the ability to:

CO1	**BECE-3613.1**	Implements different routing algorithms for wireless transmissions.
CO2	**BECE-3613.2**	Analyze wireless systems according to IEEE standards.
CO3	**BECE-3613.3**	Learn and understand the pros and cons of MANET.

Reference Books:

1. J. Schiller, Mobile Communications, Addison-Wesley, second edition, 2004.
2. Raj Pandya, Mobile & Personal Communication Systems and Service, PHI.
3. Asoke k Talukder , Roopa R Yavagal, Mobile Computing , Technology, Application & Service Creation. Tata Mc Graw Hill
4. Stojmenovic and Cacute, ―Handbook of Wireless Networks and Mobile Computing‖, Wiley, 2002.

SUBJECT TITLE: ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS (DEPARTMENT ELECTIVE-1)
SUBJECT CODE: BECE-3614
SEMESTER: 6

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objective:
This course will introduce the basic principles in artificial intelligence research. It will cover simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, natural language processing, expert systems, vision and robotics will be explored.

S.No	Contents	Contact Hours
1.	**Introduction:** History of AI - Intelligent agents – AI and Applications - Problem spaces and search - Heuristic Search techniques – Best-first search – Informal search strategies-A* algorithm, Iterative deepening A*(IDA), small memory A*(SMA). Game Playing: Minimax search procedure - Adding alpha-beta cut-offs.	8
2.	Expert systems, Definitions types, components, expert system development process, knowledge elicitation, Conceptualization, battering formulizations methods of knowledge acquisition, interviewing, sensor data capturing.	8
3.	**Knowledge Representation:** Approaches and issues in knowledge representation Knowledge - Based Agent- Propositional Logic – Predicate logic –Reasoning.	8
4.	**Reasoning under uncertainty:** Basic probability, Bayes rule, Bayesian networks, Fuzzy Logic.	8
5.	**Planning and Learning:** Basic representation of plans, types of planning. Forms of Learning – Supervised, unsupervised and reinforcement learning, decision trees, Neural Networks.	8

Course Outcomes:
At the end of this course students will demonstrate the ability to:

CO1	**BECE-3614.1**	Demonstrate fundamental understanding of artificial

		intelligence (AI) and expert systems.
CO2	**BECE-3614.2**	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3	**BECE-3614.3**	Demonstrate proficiency in applying scientific method to models of machine learning.
CO4	**BECE-3614.4**	Demonstrate proficiency in applying scientific method to models of machine learning.

Suggested Books:

1. Elaine Rich, Kevin Knight and ShivashankarB.Nair, 'Artificial Intelligence', 3rd Edn., Tata McGraw-Hill, 2009.
2. Stuart J. Russell and Peter Norvig, 'Artificial Intelligence: A Modern Approach', Pearson Education Asia, 2nd Edn., 2003.
3. N.P. Padhy, 'Artificial Intelligence and Intelligent System', Oxford University Press, 2nd Edn., 2005.
4. RajendraAkerkar, 'Introduction to Artificial Intelligence', Prentice-Hall of India, 2005.
5. Patrick Henry Winston, 'Artificial Intelligence', Pearson Education Inc., 3rd Edn., 2001.
6. Eugene Charniak and Drew Mc Dermott, 'Introduction to Artificial Intelligence', Addison-Wesley, ISE Reprint, 1998.

SYLLABUS

SEMESTER-VII

SUBJECT TITLE: COMPUTER NETWORKS
SUBJECT CODE: BECE-4701
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objective:

This is one of the fundamental courses meant to understand the important concepts related to Computer networking.

Unit-I

Introduction

Introduction, Network Topologies, Wired Vs wireless Networks, LAN, MAN, WAN, Internet, Intranet & Extranet, Connection-Oriented and Connectionless Services, Need of Protocols, TCP/IP reference Model, comparison of OSI & TCP/IP. Bridges, Hubs and Switches, Virtual LANs

Unit-II

Network Protocols

ALOHA, Carrier Sense Multiple Access Protocols, ARP, RARP, Framing, One-Bit Sliding Window Protocol, Protocol Using Go Back N, Protocol Using Selective Repeat, High-Level Data Link Control (HDLC)

Unit-III

Congestion Control in Data Networks

Congestion Prevention Policies, Congestion Control in Virtual-Circuit Subnets, Congestion Control in Datagram Subnets, Effects of Congestion, Load Shedding, Jitter Control, Congestion Control in Packet-Switching Networks

Unit-IV

Routing Algorithms

The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts, Routing in Ad Hoc Networks, Node Lookup in Peer-to-Peer Networks

Unit-V

Internetwork Protocols

Internet Protocol & IP Addresses, Principles of Internetworking, Internet Protocol Operation, IPv6, Virtual Private Networks and IP Security.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO1	**BECE-4701.1**	Explain the functions of the different layer of the OSI Protocol.
CO2	**BECE-4701.2**	Describe the function of each block of wide-area networks

		(WANs), local area networks (LANs) and Wireless LANs (WLANs).
CO3	**BECE-4701.3**	Develop the network programming for a given problem related TCP/IP protocol.
CO4	**BECE-4701.4**	Learn about routing protocols, routing algorithm, IPV6/IPV4, IP security.

Reference Books:

1. William Stallings ―Computer Networking with Internet Protocols And Technology‖, Pearson Education.

2. Andrew S. Tanenbaum ―Computer Networks‖, PHI

3. Keneth C. Mansfield, Jr. James L. Antonakos ―An Introduction to Computer Networking‖, PHI.

SUBJECT TITLE: VLSI DESIGN
SUBJECT CODE: BECE-4702
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:
1. In this course, Hardware Description Language such as VHDL and Verilog are studied.
2. Digital circuits, combinational and digital circuits, are described using VHDL and Verilog.

Unit-I(12 Hrs.)

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages, Introduction to VHDL, Data objects, Classes and data types, Operators, Overloading, and Logical operators. Types of delays, Entity and Architecture declaration Introduction to behavioural, dataflow and structural models.

Unit-II (12 Hrs.)

VHDL Statements: Assignment statements, Sequential Statements and Process, Conditional Statements, Case Statements, Array and Loops, Resolution Functions, Packages & Libraries, Concurrent Statements.
Applications of VHDL: Combinational Circuit Design such as such as Multiplexers, Encoders, Decoders, Code Converters, Comparators, and Implementation of Boolean functions etc.,

Unit-III(12 Hrs.)

Applications of VHDL:- Sequential Circuit Design such as Flip flops, Shift registers: left shift register, Right shift register, left-right shift register, Universal shift register, Counters: Up counter, down counter, UP-Down counter etc.

Unit-IV(12 Hrs.)

Verilog:-Verilog as HDL, HDL model abstraction-behavioral, RTL, structural, switch model, verification, Modeling of combinational logic, sequential logic, tasks and functions,

Course Outcomes:
At the end of this course students will demonstrate the ability to:

CO1	**BECE-4702.1**	Model the digital system using Hardware Description Language.
CO2	**BECE-4702.2**	Understand the concepts and various processes related to VLSI
CO3	**BECE-4702.2**	Understand the VLSI Circuit Design processes and Gate level design.
CO4	**BECE-4702.2**	Learn about VHDL Synthesis and the tools involved.

Recommended Books:

1. Bhasker, 'A VHDL Primmer', Prentice Hall.

2. Weste and Eshrighian, 'Principle of CMOS VLSI Design', Pearson Education.
3. D.A. Pucknell and K. Eshraghian, ‘Basic VLSI Design’, Prentice Hall India, New Delhi.
4. Brown and Vranesic, 'Fundamentals of Digital Logic with VHDL Design', TMH.
5. Verilog HDL: Digital Design & Synthesis – by Samir Palnitker

SUBJECT TITLE: OPTICAL COMMUNICATION SYSTEMS
SUBJECT CODE: BECE-4703
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	2	0	4

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objective:

The objective of the course is to provide a good understanding of optical communication systems and the ability to perform design calculations for basic passive optical networks. The course starts with introduction to light wave basics and geometric optics. Then single and multimode light wave propagation in step and graded index fibers and various dispersion mechanisms are then covered. Coherent (LASER) and incoherent (LED) optical sources and modulation techniques are studied next. PIN and APD based optical receivers and various noise processes are then discussed.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand the basics of Optical Communication and Optical fibres

2. Learn about the Optical Transmitters and Receivers

3. Explain the Light wave Architecture and systems

4. Ability to explain the manufacturing, modulation and wave mixing in Optical Communication

Unit-I

Introduction: Need of Fiber Optic Communications, Evolution of Light wave Systems, Basic Concepts; Analog & Digital Signals, Channel Multiplexing, Modulation Formats, Optical Communication Systems, Light wave System Components; Optical Fibers as a Communication Channel, Optical Transmitters, Optical Receivers.

Unit-II

Optical Fibers: Step-Index Fibers, Graded Index Fibers, Wave Propagation; Fiber Modes, Single-Mode-Fibers, Dispersion in Single-Mode Fibers; Group Velocity Dispersion, Material Dispersion, Wave guide Dispersion, Higher-order Dispersion, Polarization-Mode Dispersion, Dispersion-Induced Limitations; Basic Propagation Equation, Limitations on the Bit Rate, Fiber Bandwidth , Fiber Losses; Attenuation Coefficient, Material Absorption, Rayleigh Scattering, wave guide Imperfections, Nonlinear Optical effects; Stimulated Light Scattering, Nonlinear Phase Modulation, Four Wave Mixing, Fiber Manufacturing; Design Issues, Fabrication Methods, Cables and Connectors.

Unit-III

Optical Transmitters: Basic Concepts; Emission and Absorption Rates, p-n Junctions, Non radiative Recombination, Semi conductor Materials, Light Emitting Diodes; Power-current Characteristics, LED spectrum, Modulation Response, LED Structures, Semi Conductor

Lasers; DFB Lasers, Coupled Cavity semiconductor Lasers, Tunable Semiconductor Lasers, Vertical Cavity Semiconductor Lasers, Laser Characteristics, Small & Large Signal Modulation, Source Fiber Coupling.

Unit-IV

Optical Receivers: Basic concepts, p-n Photo Diodes, p-i-n Photo Diodes, Avalanche Photo Diode, MSM Photo detector, Receiver Design, Receiver Noise; Noise mechanism, Receiver sensitivity; Bit error rate, Minimum Receiver Power, Sensitivity Degradation, Receiver Performance.

Unit-V

Light Wave Systems: System Architecture, Loss limited Light wave systems, Dispersion limited Light wave systems, Power Budget, Long Haul systems, Sources of Power Penalty; Model Noise, Dispersive Pulse Broadening, Mode Partition Noise, Frequency Chirping, Reflection Feedback Noise.

Unit-VI

Multi channel Systems: WDM Light wave systems, Optical TDM Systems, Subscriber Multiplexing, Code Division Multiplexing.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO1	**BECE-4703.1**	Understand the basics of Optical Communication and Optical fibres
CO2	**BECE-4703.2**	Learn about the Optical Transmitters and Receivers
CO3	**BECE-4703.3**	Explain the Light wave Architecture and systems
CO4	**BECE-4703.4**	Ability to explain the manufacturing, modulation and wave mixing in Optical Communication

Reference Books:

1. Senior J. Optical Fiber Communications, Principles & Practice, PHI.

2. Keiser G., Optical Fiber Communication Mc graw-hill.

3. Govind P. Agrawal, Fiber Optics Communication Systems John Wiley & Sons (Asia) Pvt. Ltd.

4. Djafar K. Mynbeav, ―Fiber-Optics Communications Technology‖ Pearson.

SUBJECT TITLE: VLSI DESIGN LAB
SUBJECT CODE: BECE-4704
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objectives:

1. To learn Hardware Descriptive Language (Verilog / VHDL)
2. To learn the fundamental principles of VLSI circuit design in digital and analog domain.
3. To familiarize fusing of logical modules on FPGAs
4. To provide hands on design experience with professional design (EDA) platforms.

EXPERIMENTS

1. Design of basic Gates: AND, OR, NOT.
2. Design of universal gates
3. Design of 2:1 Mux using other basic gates
4. Design of 2 to 4 Decoder
5. Design of Half-Adder, Full Adder, Half Substractor, Full Substractor
6. Design of 3:8 Decoder
7. Design of 8:3 Priority Encoder
8. Design of 4 Bit Binary to Grey code Converter
9. Design of 4 Bit Binary to BCD Converter using sequential statement
10. Design an 8 Bit parity generator (with for loop and Generic statements)
11. Design of 2,s Complementary for 8-bit Binary number using Generate statements

SEQUENTIAL DESIGN EXPERIMENTS

1. Design of all type of Flip-Flops using (if-then-else) Sequential Constructs
2. Design of 8-Bit Shift Register with shift Right, shift Left, Load and Synchronous reset.
3. Design of Synchronous 8-bit Johnson Counter.
4. Design of Synchronous 8-Bit universal shift register (parallel-in, parallel-out) with 3- state output (IC 74299)
5. Design of 4 Bit Binary to BCD Converter using sequential statement.
6. Design counters (MOD 3, MOD 5, MOD 8, MOD 16)
7. Design a decimal up/down counter that counts up from 00 to 99 or down from 99 to 00.
8. Design 3-line to 8-line decoder with address latch

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO1	**BECE-4704.1**	Write HDL code for basic as well as advanced digital integrated circuits.
CO2	**BECE-4704.2**	Import the logic modules into FPGA Boards.
CO3	**BECE-4704.3**	Synthesize Place and Route the digital IPs.
CO4	**BECE-4704.4**	Design, Simulate and Extract the layouts of Analog IC Blocks using EDA tools.

Note: At least 12 experiments are required to be performed

SUBJECT TITLE: OPTICAL COMMUNICATION SYSTEMS LAB
SUBJECT CODE: BECE-4705
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	2	1

Internal Assessment: 50
End term Assessment: 50

Course Objective:

This is one of the experimental courses meant to understand the important concepts related to Optical Fibres and Communication.

LIST OF EXPERIMENTS

1) To set up and study optical analog link.

2) To Set up and study optical digital link.

3) Study and measurement of bending loss.

4) Study and measurement of attenuation and loss in fiber.

5) Study and measurement of Numerical Aperture of optical fiber.

6) Measurement of optical power using optical power meter.

7) To study the transmission of TDM signal through fiber.

8) To study the bit rate of optical fiber link.

9) Study of various multiplexing techniques.

10) To determine the BER of wireless systems using M-ARY.

Course Outcomes:
At the end of this course students will demonstrate the ability to:

CO1	**BECE-4705.1**	To perform experiments based on optical communication in order to understand in depth concepts of latest communication system.
CO2	**BECE-4705.2**	To study various types of optical sources and light detectors
CO3	**BECE-4705.3**	To know methods of slicing and connecting techniques of optical fibres
CO4	**BECE-4705.4**	To study different types of losses in optical fibres.

SUBJECT TITLE: SATELLITE COMMUNICATION (DEPARTMENT ELECTIVE-2)
SUBJECT CODE: BECE-4711
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. To introduce various aspects in the design of systems for satellite communication.
2. Students will be able to understand link design for satellite communication.
3. To provide the knowledge of various multiple access techniques.

Unit-I

Introduction: Origin of Satellite Communication, Current state of Satellite Communication, Advantages of Satellite Communication, Active & Passive satellite, Orbital aspects of Satellite Communication, System Performance. Communication Satellite Link Design - Introduction, general link design equation, system noise temperature, C/N & G/T ratio, atmospheric & ionosphere effects on link design, complete link design, interference effects on complete link design, earth station parameters.

Unit-II

Satellite Analog & Digital Communication: Baseband analog(voice) signal, FDMA techniques, S/N ration, SCPC & CSSB systems, digital baseband signals & modulation techniques.

Multiple Access Techniques: TDMA frame structure, burst structure, frame efficiency, super frame, frame acquisition & synchronization, TDMA vs FDMA, burst time plan, beam hopping, satellite switched, Erlang call congestion formula, demand assignment ctrl, DA-FDMA system, DATDMA.

Unit-III

Laser & Satellite Communication: Link analysis, optical satellite link Transmitter & Receiver, Satellite, beam acquisition, tracking & pointing, cable channel frequency, head end equation, distribution of signal, n/w specifications and architecture, optical fiber CAT system.

Unit-IV

Satellite Applications: Satellite TV, telephone services via satellite, data Communication services, satellites for earth observation, weather forecast, military appliances, scientific studies.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

CO1	**BECE-4711.1**	Able to learn the dynamics of the satellite.
CO2	**BECE-4711.2**	Able to understand the communication satellite design.
CO3	**BECE-4711.3**	Able to understand how analog and digital technologies are used for satellite communication networks.
CO4	**BECE-4711.4**	Able to learn the design of satellite links.
CO5	**BECE-4711.5**	Able to study the design of Earth station and tracking of the satellites.

Recommended Books:

1. Timothy Pratt, 'Satellite Communication', John Wiley & Sons.
2. D.C. Aggarwal, 'Satellite Communication', Khanna Publishers. her. of a Voltage Controlled Oscillator

SUBJECT TITLE: SPEECH & IMAGE PROCESSING (DEPARTMENT ELECTIVE-2)
SUBJECT CODE: BECE-4712
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:
This course deals with the concept, knowledge and background required for better understanding of digital Image and speech Processing.

Unit No.	Content Detail	Contact Hours
1.	**Review of Filter design:** Linear phase FIR filters. Methods of FIR filter design. Methods of IIR filter design. Applications of FIR & IIR filters.	10 Hrs
2.	**Speech Processing:** Review of human speech and Acoustic theory, nature of sound, harmonics, resonance measurement, virtual display. Music theory, pitch, duration, intervals, rhythm. Human speech production, the vocal tract, the Larynx, the source filter. Speech signal processing. Elements of speech Synthesis-speech Recognition-speech in the computer-human interface	15 hrs
3.	**Image Processing:** Characterization of images as two-dimensional discrete fields, Digital Image Representation, Fundamental Steps in Image Processing, Elements of a Digital Image Processing System. Image Enhancement, Image Restoration, Image Segmentation, RGB Colour Coding Concepts, Representation and Object Recognition, Image Compression. Segmentation, edge detection, thresholding, textural properties, geometry and shape description.	15 Hrs

Course Outcomes:
On completion of this course, the students will be able to

CO1	**BECE-4712.1**	Review the fundamental concepts of a digital image processing system
CO2	**BECE-4712.2**	Evaluate the techniques for image enhancement, segmentation and image restoration.
CO3	**BECE-4712.3**	Evaluate the techniques for speech processing using different digital filters

Books Recommended:

1. Digital Signal Processing - by Proakis & Manolakis

2. Speech and Audio Processing for multimedia PC's - by Iain Murray

3. Digital Image Processing - by Keenneth R Castleman, Pearson Education Society.

4. Digital Image Processing - by Rafact Gonzalez and Richard E. Woods, Pearson Education Society.

SUBJECT TITLE: WIRELESS SENSOR NETWORKS (DEPARTMENT ELECTIVE-2)
SUBJECT CODE: BECE-4713
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Course Objectives:

1. This course introduces advances in wireless, sensor networks.

2. Wireless Sensor Networks provide opportunities even outside their usual application domain of environmental monitoring.

3. To track all activities, and check for errors that might occur in the process of handling and distributing goods.

Unit-I (12 Hrs.)

Introduction to Wireless Sensor Networks: Constraints and Challenges of sensor networks, Emerging technologies for wireless sensor networks, Node architecture, Hardware components overview, Energy consumption of Sensor nodes, Dynamic energy and power management on System level, some examples of Sensor nodes, Optimization goals and figures of merit, QOS, Energy Efficiency, scalability, robustness Advantages of sensor networks, Sensor network applications.

Unit-II (12 Hrs.)

Topology Control: Location driven, Geographic Adaptive Fidelity (GAF), Geographic Random Forwarding (GeRaF), GEAR, Connectivity driven, SPAN, ASCENT.

Unit-III (12 Hrs.)

WSN Sensors: Physical Layer Design, Transceiver Design, MAC Protocols for WSN, Low Duty Cycle Protocols &Wakeup Concepts, S-MAC, Mediation Device Protocol, Wakeup Radio Concepts, Address & Name management, Assignment of MAC Addresses, Routing Protocols, Energy Efficient Routing, Geographic Routing.

Unit IV (12 Hrs.)

WSN Platforms & Tools: Sensor Node Hardware, Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Course Outcomes:

On completion of this course, the students will be able to:

CO1	**BECE-4713.1**	Understand the existing applications of wireless sensor actuator networks.
CO2	**BECE-4713.2**	Understand the elements of distributed computing and network protocol design and will learn to apply these principles in the context of wireless sensor networks.
CO3	**BECE-4713.3**	Identify the various hardware, software platforms that exist for sensor networks.

Recommended Books:

1. Holger Karl & Andreas Willig, 'Protocols & Architectures for Wireless Sensor Networks', John Wiley.

2. Feng Zhao & Leonidas J. Guibas, 'Wireless Sensor Networks- An Information Processing Approach'.

3. WaltenegusDargie and Christian Poella Bauer, 'Fundamentals of Wireless Sensor Networks Theory and Practice', John Wiley and Sons.

4. Holger Karl and Andreas Willig, 'Protocols and Architectures for Wireless Sensor Networks', John Wiley and Sons.

SUBJECT TITLE: COMPUTER VISION (DEPARTMENT ELECTIVE-2)

SUBJECT CODE: BECE-4714
SEMESTER: 7

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
3	0	0	3

Internal Assessment: 40
End Term Exam: 60
Duration of Exam; 3 Hrs

Objectives:

This is an advanced course on Computer Vision. This will enable the students to learn concepts of image processing, computer vision and utilize these techniques to implement vision algorithms efficiently for use in research or industry.

Unit No.	Content Detail	Contact Hours
1.	Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality	**5**
2.	Image Formation Models : Monocular imaging system , Radiance, Irradiance, BRDF, coloretc, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Construction of 3D model from images	**5**
3.	Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete) , Edge detection	**5**
4.	Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier descriptors	**5**
5.	Object recognition : Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis , Shape priors for recognition	**5**
6.	Image Understanding : Pattern recognition methods, HMM, GMM and EM	**5**
7.	Applications: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians	**8**

Course Outcomes:
On completion of this course, the students will be able to:

CO1	**BECE-4714.1**	Understand image detection and analysis

CO2	**BECE-4714.2**	Identify features to recognize object , scene and categorization from images.
CO3	**BECE-4714.3**	Develop the skills necessary to build computer vision applications.

References:

1. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall
3. R. C. Gonzalez, R. E. Woods. Digital Image Processing. Addison Wesley Longman, Inc., 1992.
4. D. H. Ballard, C. M. Brown. Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
5. Richard Szeliski, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010
6. Image Processing, Analysis, and Machine Vision. Sonka, Hlavac, and Boyle. Thomson.
7. E. R. Davies, Computer & Machine Vision, Fourth Edition, Academic Press, 2012
8. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012
9. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.

SYLLABUS

SEMESTER-VIII

SUBJECT TITLE: INDUSTRIAL TRAINING
SUBJECT CODE: BECE-4871
SEMESTER: 8
CONTACT HOURS/WEEK:

Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
0	0	0	10

Internal Assessment: 250
End Term Exam: 250

In this the student has to do the industrial training and has to make a file for the same.

COURSE OUTCOMES: On completion of this course, the students will be able to

CO1	**BECE-4871.1**	To participate in ongoing and upcoming projects of the industry
CO2	**BECE-4871.2**	Determine the use of advanced techniques in communication systems
CO3	**BECE-4871.3**	Interact with industry personnel and follow the Engineering practices
C04	**BECE-4871.4**	Develop awareness about general workshop behavior and built a team skills