REGULATION 2018

COURSE STRUCTURE

SYLLABUS

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

GIET MAIN CAMPUS AUTONOMOUS, GUNUPUR

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS), GUNUPUR

Approved by AICTE, Govt. of Odisha and Affiliated to BPUT, Rourkela, Odisha

Accredited by NAAC with a CGPA of 3.28/4 at *A Grade* and Accredited by NBA

Gunupur - 765022, Dist. - Rayagada, Odisha, INDIA

www.giet.edu

UNDERGRADUATE DEGREE COURSE

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Regulation 2018-19

Choice Based Credit System

Outcome Based Assessment

I. Mission and Vision of the Institution

Mission statements are essentially the means to achieve the vision of the institution. Vision is a futuristic statement that the institution would like to achieve over a long period of time, and Mission is the means by which it proposes to move toward the stated Vision.

Vision of the Institution

To foster prosperity through technological development by means of education, innovation and collaborative research and emerge as a premier technical institute.

Mission of the Institution

To provide quality education of international standards for producing technocrats and future leaders in a disciplined and conducive environment as an integral part of our social commitment to promote education globally.

II. Mission and Vision of the Department

Vision statement typically indicates aspirations and Mission statement states the broad approach to achieve aspirations.

(Institute Vision and Mission statements have been consistency with the department Vision and Mission statements)

Vision of the Department

To develop globally accepted and technically competent Electronics & Communication engineers through quality education, innovation and collaborative research.

Mission of the Department

M1: Imparting quality education to the students for enhancing their skills and making them globally competent Electronics and Communication engineers.

M2: Maintaining state-of-art facilities to provide students and faculty members with opportunities to create interpret and disseminate knowledge.

M3: Association with reputed research organizations and educational institutions for excellence in teaching, research and consultancy practices.

III. Programme Educational Objectives (PEOs)

Programme educational objectives are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to achieve.

PEO1: To strengthen the knowledge of basic sciences and fundamental technical concepts in diversified areas such as communication systems, signal & image processing and allied fields to enhance the capabilities for the carrier.

PEO2: To enable the student to address the complexity of real life engineering problems and be able to formulate / design solutions which are technically advanced, economically feasible and environmentally sustainable that leads to professional growth of the society.

PEO3: To acquire adequate training for working as a team on projects with good technical skills, leadership qualities & professional ethics with social awareness and organizational context in which the engineering skills are utilized to take up life-long learning.

IV. Establish consistency of PEOs with Mission of the Department

PEO Statements	M1	M2	M3
PEO1: To strengthen the knowledge of basic sciences and fundamental technical concepts in diversified areas such as communication systems, signal & image processing and allied fields to enhance the capabilities for the carrier.	3	1	2
PEO2: To enable the student to address the complexity of real life engineering problems and be able to formulate / design solutions which are technically advanced, economically feasible and environmentally sustainable that leads to professional growth of the society.	2	3	2
PEO3: To acquire adequate training for working as a team on projects with good technical skills, leadership qualities & professional ethics with social awareness and organizational context in which the engineering skills are utilized to take up life-long learning.	2	1	3

V. Programme Outcomes (POs)

Programme Outcomes are narrower statements that describe what students are expected to know and be able to do upon the graduation. These relate to the skills, knowledge, and behaviour that students acquire in their matriculation through the programme.

Engineering Graduates will be able to:

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **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.

PO3 **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.

PO4 **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.

PO5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **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.

PO7 **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.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **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.

PO11 **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.

PO12 **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.

VI. Program Specific Outcomes (PSOs)

Program Specific Outcomes (PSOs) are what the graduates of a specific undergraduate engineering program should be able to do at the time of graduation. The PSOs are program specific. PSOs are written by the Department offering the program. PSOs should be two to four in number. A Department can differentiate its program through PSOs.

Engineering Graduates will be able to:

PSO1 Develop, analyze & solve real-time problems relating to communication systems along with allied engineering streams.

PSO2 Proficiency in use of hardware & software tools to design and analyze electronic systems to become professional technocrats.

VII. CO - PO & PSO matrices of Courses

Course Outcomes are narrower statements that describe what students are expected to know, and be able to do at the end of each course. These relate to the skills, knowledge, and behaviour that students acquire in their matriculation through the course.

Course Category		Course Title	Sem	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
SCIENCE	BS	Engineering Mathematics-I	I	1	2	-	-	-	-	-	-	-	-	-	-			
				2	3	-	-	-	-	-	-	-	-	-	-			
				1	3	-	-	-	-	-	-	-	-	-	-			
				2	3	-	-	-	-	-	-	-	-	-	-			

	BS	Engineering Physics	I / II	3	2	-	-	-	-	-	-	-	-	-	-			
				1	2	-	-	-	-	-	-	-	-	-	-			
				1	2	-	-	-	-	-	-	-	-	-	-			
				2	2	-	-	-	-	-	-	-	-	-	-			
				2	2	-	-	-	-	-	-	-	-	-	-			
	BS	Engineering Physics Laboratory	I / II	2	-	1	1	-	-	-	-	-	-	-	-			
				2	-	1	1	-	-	-	-	-	-	-	-			
				2	-	1	1	-	-	-	-	-	-	-	-			
				2	-	1	2	-	-	-	-	-	-	-	-			
	BS	Engineering Chemistry	I / II	2	2	-	-	-	-	-	-	-	-	-	-			
				3	1	-	-	-	-	1	-	-	-	-	-			
				3	1	-	-	-	-	-	-	-	-	-	1			
				2	1	-	-	-	-	1	-	-	-	-	-			
	BS	Engineering Chemistry Laboratory	I / II	1	-	1	2	-	-	-	-	-	-	-	-			
				1	-	2	2	-	-	-	-	-	-	-	-			
				-	-	2	2	-	-	1	-	-	-	-	-			
				1	-	1	-	-	-	-	-	-	-	-	3			
	BS	Engineering Mathematics-II	II	3	2	-	-	-	-	-	-	-	-	-	-			
				2	3	-	-	-	-	-	-	-	-	-	-			
				1	3	-	-	-	-	-	-	-	-	-	-			
				2	3	-	-	-	-	-	-	-	-	-	-			
	BS	Engineering Mathematics-III	III	3	-	-	-	2	-	1	-	-	-	-	-			
				2	2	-	-	1	-	-	-	-	-	-	-			
				2	-	-	-	1	-	-	-	-	-	-	2			
				2	-	-	-	2	-	-	-	-	-	-	2			
	BS	Environmental Engineering and Safety	III / IV	2	-	-	2	-	1	1	-	-	1	-	1			
				2	-	-	1	-	-	-	-	-	1	-	1			
				1	-	-	1	-	1	-	-	-	1	-	1			
				2	-	-	2	-	-	-	-	-	1	-	1			
ENGINEERING SCIENCE COURSES	ES	Basics of Mechanics	I / II	3	2	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
	ES	Basics of Thermodynamics	I / II	3	3	2	-	-	-	-	-	-	-	-	-			
				3	3	3	-	-	-	-	-	-	-	-	-			
				-	2	2	-	-	-	-	-	-	-	-	-			
				3	3	3	-	-	-	-	-	-	-	-	-			
	ES	Basics of Electronics	I / II	2	2	1	1	-	-	-	-	-	-	-	-			
				1	2	3	-	-	-	-	-	-	-	-	-			

				1	2	2	-	-	-	-	-	-	-	-	-			
				1	2	2	3	-	-	-	-	-	-	-	-			
	ES	Basics of Electronics Laboratory	I / II	1	1	1	-	-	-	-	-	-	-	-	-			
				-	2	2	-	-	-	-	-	-	-	-	-			
				-	1	2	-	-	-	-	-	-	-	-	-			
				-	2	2	-	-	-	-	-	-	-	-	-			
	ES	Basics of Electrical Engineering	I / II	2	1	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
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	ES	Basics of Electrical Engineering Laboratory	I / II	-	1	2	-	-	-	-	-	-	-	-	-			
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	ES	Programming for Problem Solving	I	3	2	1	-	-	-	-	-	-	-	-	-			
				3	3	2	-	-	-	-	-	-	-	-	-			
				3	3	2	-	-	-	-	-	-	-	-	-			
				3	3	2	-	-	-	-	-	-	-	-	-			
	ES	Programming for Problem Solving Laboratory	I	3	2	2	-	-	-	-	-	-	-	-	-			
				3	3	3	1	-	-	-	-	-	-	-	-			
				3	3	3	-	-	-	-	-	-	-	-	-			
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	ES	Engineering Drawing	I / II	3	-	-	1	-	-	-	-	-	1	3	-			
				1	-	1	3	-	-	-	-	-	2	1	-			
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	ES	Engineering Workshop	I / II	2	-	-	2	-	1	1	-	-	1	-	1			
				2	-	-	1	-	-	-	-	-	1	-	1			
				1	-	-	1	-	1	-	-	-	1	-	1			
				2	-	-	2	-	-	-	-	-	1	-	1			
	ES	Data Structures	II	2	2	3	-	-	-	-	-	-	-	-	-			
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				3	3	-	-	-	-	-	-	-	-	-	-			
				3	3	3	-	-	-	-	-	-	-	-	-			
	ES	Data Structures using ‘C++’ Laboratory	II	2	2	3	-	-	-	-	-	-	-	-	-			
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	ES	Object Oriented Programming through JAVA	III	3	1	-	-	-	-	-	-	-	-	-	-			
				3	2	2	-	-	-	-	-	-	-	-	-			
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	ES	JAVA Programming Laboratory	III	3	2	1	-	-	-	-	-	-	-	-	-			
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	ES	Semiconductor Devices	IV	3	3	-	-	-	-	-	-	-	-	-	-			
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	ES	Signals and Systems	IV	3	2	-	-	-	-	-	-	-	-	-	-			
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HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES	HS	Communicative English and Soft Skills	I	-	-	-	-	-	-	-	-	-	3	-	-			
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	HS	Communicative English and Soft Skills Laboratory	I	-	-	-	-	-	-	-	-	-	2	-	-			
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	HS	Communicative English and Technical Communication	II	-	-	-	-	-	-	-	-	-	2	-	-			
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	HS	Communicative English and Technical Communication Laboratory	II	-	-	-	-	-	-	-	-	-	2	-	-			
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	H	Engineering	III /	-	-	-	-	-	1	-	-	-	-	2	2			

	S	Economics and Costing	IV	-	-	-	-	-	1	-	-	-	-	3	1			
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PROFESSIONAL CORE COURSES	PC	Analog Electronic Circuits	III	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
				1	-	3	2	-	-	-	-	-	-	-	-	-	-	-
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				-	-	3	2	-	-	-	-	-	-	-	-	-	-	-
	PC	Analog Electronic Circuits Laboratory	III	2	-	-	-	-	-	-	-	-	-	-	-			
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	PC	Network Theory	III	2	2	1	-	-	-	-	-	-	-	-	-			
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	PC	Network and Devices Laboratory	III	2	1	2	-	-	-	-	-	-	-	-	-			
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	PC	Electrical and Electronic Measurements	III	3	1	-	2	-	-	-	-	-	-	-	-			
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				3	2	-	-	-	-	-	-	-	-	-	-			
	PC	Electrical and Electronic Measurements Laboratory	III	2	1	1	-	-	-	-	-	-	-	-	-			
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				2	1	2	-	-	-	-	-	-	-	-	-			
	PC	Electromagnetic Waves	IV	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
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				2	2	-	-	3	-	-	-	-	-	-	-	-	-	2
				-	-	2	-	-	-	-	-	-	-	-	-	-	-	1
	P	Electromag	IV	-	-	-	-	-	-	-	3	3	-	-	-			

	C	netic Waves Laboratory		-	-	-	-	-	-	-	3	3	-	-	-			
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	P C	Digital Electronics	IV	2	1	-	-	-	-	-	-	-	-	-	-			
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	P C	Digital Electronics Laboratory	IV	2	-	-	-	-	-	-	-	-	-	-	-			
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				2	1	1	-	-	-	-	-	-	-	-	-			
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	P C	Microprocessors and Microcontrollers	IV	3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	2	-	3	-	-	-	-	-	-	-			
				3	-	3	-	-	-	-	-	-	-	-	-			
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	P C	Microprocessors and Microcontrollers Laboratory	IV	-	-	-	-	-	-	-	1	2	2	-	-			
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	P C	Design and Simulation Laboratory	IV	-	3	-	-	-	-	-	-	-	-	-	-			
				-	-	1	2	2	-	-	-	-	-	-	-			
				-	-	-	-	3	-	-	-	-	-	-	-			
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	P C	Analog Communications	V	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
				-	3	-	-	-	-	-	-	-	-	-	-	1	-	2
				2	-	3	-	-	-	-	-	-	-	-	-	-	2	-
				2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
	P C	Analog Communication Techniques Laboratory	V	-	-	-	-	-	-	3	3	3	-	-	-			
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	P C	Digital Signal Processing	VI	3	1	2	-	-	-	-	-	-	-	-	-			
				1	3	2	3	-	-	-	-	-	-	-	-			
				-	2	1	1	-	-	-	-	-	-	-	-			
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	PC	Digital Signal Processing Laboratory	VI	-	-	-	-	-	-	3	2	-	-	-	-			
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				-	-	-	-	-	-	3	2	-	-	-	-			
				-	-	-	-	-	-	3	2	-	-	-	-			
	PC	Digital VLSI Design	VI	3	1	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				1	3	1	-	-	-	-	-	-	-	-	-			
				-	-	2	-	-	-	-	-	-	-	-	-			
	PC	Digital VLSI Design Laboratory	VI	-	-	-	-	-	-	3	3	-	-	-	-			
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				-	-	-	-	-	-	-	3	-	-	-	-			
	PC	Digital Communications	VI	3	3	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
	PC	Digital Communication Techniques Laboratory	VI	1	3	-	-	-	-	-	-	-	-	-	-			
				2	3	-	-	-	-	-	-	-	-	-	-			
				1	2	-	-	-	-	-	-	-	-	-	-			
				2	3	-	-	-	-	-	-	-	-	-	-			
	PC	Microwave Theory and Techniques	VI	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
				3	2	-	-	3	-	-	-	-	-	-	-	-	1	2
				3	-	2	-	-	-	-	-	-	-	-	-	-	1	1
				3	-	3	-	-	-	-	-	-	-	-	-	-	2	1
	PC	Microwave Techniques Laboratory	VI	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
				3	2	-	-	3	-	-	-	-	-	-	-	-	1	2
				3	-	2	-	-	-	-	-	-	-	-	-	-	1	1
				3	-	3	-	-	-	-	-	-	-	-	-	-	2	1
	PC	Control Systems	VI	2	2	-	-	-	-	-	-	-	-	-	-			
				2	3	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
	PC	Control Systems Laboratory	VI	2	2	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				2	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			

				2	2	-	-	-	-	-	-	-	-	-	-			
	PC	Advanced Laboratory-I	VI	-	-	-	-	-	-	1	1	1	-	-	-			
				-	-	-	-	-	-	2	1	1	-	-	-			
				-	-	-	-	-	-	1	1	1	-	-	-			
				-	-	-	-	-	-	1	1	1	-	-	-			
	PC	Computer Networks	VII	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
				3	2	-	-	3	-	-	-	-	-	-	-	-	1	2
				3	-	2	-	-	-	-	-	-	-	-	-	-	1	1
				3	-	3	-	-	-	-	-	-	-	-	-	-	2	1
	PC	Computer Networks Laboratory	VII	3	2	1	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	3	3	-	-	-	-	-	-	-	-	-			
	PC	Advanced Laboratory-II	VII	1	-	-	-	-	-	-	-	-	-	-	-			
				1	2	-	-	3	-	-	-	-	-	-	-			
				1	1	2	-	-	-	-	-	-	-	-	-			
				2	1	3	-	-	-	-	-	-	-	-	-			
PROFESSIONAL ELECTIVE COURSES	PE	Fiber Optic Communications	V	3	3	1	1	-	-	-	-	-	-	-	-			
				3	1	1	-	-	-	-	-	-	-	-	-			
				1	2	-	-	-	-	-	-	-	-	-	-			
				3	1	-	-	-	-	-	-	-	-	-	-			
	PE	Electronic Devices and Modeling	V	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
				3	3	-	-	-	-	-	-	-	-	-	-	-	-	2
				3	3	-	-	-	-	-	-	-	-	-	-	-	-	1
	PE	Power Electronics	V	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
				3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
				2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
				1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
	PE	Sensors and Transducers	V	2	2	-	-	-	-	-	-	-	-	-	-			
				-	1	-	-	-	-	-	-	-	-	-	-			
				2	-	-	1	-	-	-	-	-	-	-	-			
				2	-	3	-	-	-	-	-	-	-	-	-			
	PE	Information Theory and Coding	VI	3	3	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
				2	2	-	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
	PE	Nano Electronics	VI	3	1	-	-	-	-	-	-	-	-	-	-			
				3	2	-	3	-	-	-	-	-	-	-	-			

				1	2	3	1	-	-	-	-	-	-	-	-			
				-	3	2	1	-	-	-	-	-	-	-	-			
	P E	Biomedical Electronics	VI	3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
	P E	Internet of Things	VI	3	1	-	-	-	-	-	-	-	-	-	-			
				3	2	-	3	-	-	-	-	-	-	-	-			
				1	2	3	1	-	-	-	-	-	-	-	-			
				-	3	2	1	-	-	-	-	-	-	-	-			
	P E	Mobile Communications	VII	3	-	-	-	-	-	-	-	-	-	-	-			
				3	3	2	-	-	-	-	-	-	-	-	-			
				3	-	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
	P E	Antennas and Wave Propagation	VII	3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
				3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
				3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
				3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
	P E	Analog VLSI Design	VII	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
				2	-	-	3	-	-	-	-	-	-	-	-	1	2	-
				-	2	-	-	-	-	-	-	-	-	-	-	1	1	-
				-	3	-	-	-	-	-	-	-	-	-	-	2	1	-
	P E	Pattern Analysis and Machine Intelligence	VII	2	-	-	-	-	-	-	-	-	-	-	-			
				2	-	-	3	-	-	-	-	-	-	-	-			
				-	2	-	-	-	-	-	-	-	-	-	-			
				-	3	-	-	-	-	-	-	-	-	-	-			
	P E	Embedded Systems	VII	3	1	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				1	3	1	-	-	-	-	-	-	-	-	-			
				-	-	2	-	-	-	-	-	-	-	-	-			
	P E	Adaptive Signal Processing	VII	3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	3	-	-	-	-	-	-	-			
				3	-	2	-	-	-	-	-	-	-	-	-			
				3	-	3	-	-	-	-	-	-	-	-	-			
	P E	Advanced Control Systems	VII	3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	3	-	-	-	-	-	-	-			
				3	-	2	-	-	-	-	-	-	-	-	-			
				3	-	3	-	-	-	-	-	-	-	-	-			
	P	Industrial	VII	3	2	-	-	-	-	-	-	-	-	-	-			

	E	Electronics		3	2	-	-	-	-	-	-	-	-	-	-			
				3	-	-	-	-	-	-	-	-	-	-	-			
				3	-	-	-	-	-	-	-	-	-	-	-			
	P E	Speech and Audio Processing	VII	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
				3	2	3	-	3	-	-	-	-	-	-	-	-	1	-
				3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
				3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
	P E	Mixed Signal Design	VII	2	2	1	-	-	-	-	-	-	-	-	-			
				2	2	1	-	-	-	-	-	-	-	-	-			
				2	-	1	-	-	-	-	-	-	-	-	-			
				2	-	2	-	-	-	-	-	-	-	-	-			
	P E	Telecommunication System Modeling and Simulation	VII	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
				1	2	-	-	3	-	-	-	-	-	-	-	-	3	2
				1	-	2	-	-	-	-	-	-	-	-	-	-	-	1
				2	-	3	-	-	-	-	-	-	-	-	-	-	-	1
	P E	Fuzzy Logic and Neural Networks	VII	3	3	2	1	1	1	-	-	1	1	1	1			
				3	2	2	2	2	1	1	-	-	-	1	2			
				2	3	2	2	2	1	-	1	1	1	2	1			
				2	2	2	1	1	-	2	-	1	-	1	2			
	P E	Satellite CommunicationS	VIII	3	3	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	2	-	-	-	-	-	-	-	-	-			
				2	1	2	-	-	-	-	-	-	-	-	-			
	P E	Micro-Electro-Mechanical Systems	VIII	-	1	-	-	-	-	-	-	-	-	-	-			
				-	1	3	-	3	-	-	-	-	-	-	-			
				2	1	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
	P E	High Speed Electronics	VIII	3	1	1	-	-	-	-	-	-	-	-	-			
				3	1	1	-	-	-	-	-	-	-	-	-			
				3	1	1	-	-	-	-	-	-	-	-	-			
				3	2	2	-	-	-	-	-	-	-	-	-			
	P E	Wavelet Transforms	VIII	1	2	-	-	-	-	-	-	-	-	-	-			
				2	-	1	-	-	-	-	-	-	-	-	-			
				3	-	1	-	-	-	-	-	-	-	-	-			
				3	3	-	-	-	-	-	-	-	-	-	-			
	P E	Digital Image and Video Processing	VIII	3	3	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	2	-	-	-	-	-	-	-	-	-			
				2	1	2	-	-	-	-	-	-	-	-	-			

	PE	Error Correcting Codes	VIII	3	3	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	2	-	-	-	-	-	-	-	-	-			
				2	1	2	-	-	-	-	-	-	-	-	-			
	PE	Wireless Sensor Networks	VIII	3	2	-	-	-	-	-	-	-	-	-	-			
				3	2	-	-	-	-	-	-	-	-	-	-			
				3	-	-	-	-	-	-	-	-	-	-	-			
				3	-	-	-	-	-	-	-	-	-	-	-			
	PE	Cryptography and Network Security	VIII	1	-	1	-	-	-	-	-	-	-	-	-			
				1	2	1	-	3	-	-	-	-	-	-	-			
				1	1	1	-	-	-	-	-	-	-	-	-			
				2	1	2	-	-	-	-	-	-	-	-	-			
VII. PROJECT WORK, SEMINAR AND/OR INTERNSHIP IN INDUSTRY OR ELSEWHERE	EC	Skill Development Project and Hands on Training	V															
	EC	Summer Internship-I	V															
	EC	Soft Skill and Employability Skill	VI															
	EC	Mini Project / Projects on Internet of Things	VII															
	EC	Summer Internship-II	VII															
	EC	Major Project / Industrial Project / Startup Training cum Project	VIII															
	EC	Seminar and Technical Writing	VIII															
	EC	Comprehensive Viva-Voce	VIII															
MANDATORY COURSES	MC	NSS / NCC	I															
	MC	YOGA / Project Work	II															

CATEGORY OF COURSES

I. HUMANITIES, SOCIAL & MANAGEMENT STUDY COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred Semester
			L	T	P	C	
1	BBSHS1060	Communicative English and Soft Skills	2	0	0	2	I
2	BBSHS1160	Communicative English and Soft Skills Laboratory	0	0	2	1	I
3	BBSHS2060	Communicative English and Technical Communication	2	0	0	2	II
4	BBSHS2160	Communicative English and Technical Communication Laboratory	0	0	2	1	II
5	BMSHS3062	Engineering Economics and Costing	3	0	0	3	III/IV
TOTAL			**7**	**0**	**4**	**9**	

II. BASIC SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred Semester
			L	T	P	C	
1	BBSBS1010	Engineering Mathematics-I	3	1	0	4	I
2	BBSBS1021	Engineering Physics	3	0	0	3	I/II
3	BBSBS1121	Engineering Physics Laboratory	0	0	2	1	I/II
4	BBSBS1022	Engineering Chemistry	3	0	0	3	I/II
5	BBSBS1122	Engineering Chemistry Laboratory	0	0	2	1	I/II
6	BBSBS2010	Engineering Mathematics-II	3	1	0	4	II
7	BBSBS3010	Engineering Mathematics-III	3	1	0	4	III
8	BBSBS3061	Environmental Engineering and Safety	3	0	0	3	III/IV
TOTAL			**18**	**3**	**4**	**23**	

III. ENGINEERING SCIENCE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred Semester
			L	T	P	C	
1	BBSES1031	Basics of Mechanics	3	0	0	3	I/II
2	BBSES1032	Basics of Thermodynamics	3	0	0	3	I/II
3	BBSES1041	Basics of Electronics	3	0	0	3	I/II
4	BBSES1141	Basics of Electronics Laboratory	0	0	2	1	I/II
5	BBSES1042	Basics of Electrical Engineering	3	0	0	3	I/II
6	BBSES1142	Basics of Electrical Engineering Laboratory	0	0	2	1	I/II
7	BBSES1050	Programming for Problem Solving	3	0	0	3	I
8	BBSES1150	Programming for Problem Solving Laboratory	0	0	2	1	I
9	BBSES1171	Engineering Drawing	0	0	2	1	I/II
10	BBSES1172	Engineering Workshop	0	0	2	1	I/II
11	BBSES2050	Data Structures	3	0	0	3	II
12	BBSES2150	Data Structures using 'C++' Laboratory	0	0	2	1	II
13	BCSES3050	Object Oriented Programming through JAVA	3	0	0	3	III
14	BCSES3150	JAVA Programming Laboratory	0	0	2	1	III
15	BECES4040	Semiconductor Devices	3	0	0	3	IV
16	BECES4050	Signals and Systems	3	0	0	3	IV
TOTAL			**27**	**0**	**14**	**34**	

IV. PROFESSIONAL CORE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred Semester
			L	T	P	C	
1	BECPC3020	Analog Electronic Circuits	3	0	0	3	III
2	BECPC3120	Analog Electronic Circuits Laboratory	0	0	2	1	III
3	BELPC3030	Network Theory	3	0	0	3	III
4	BELPC3130	Network and Devices Laboratory	0	0	2	1	III

5	BEIPC3040	Electrical and Electronic Measurements	3	0	0	3	III
6	BEIPC3140	Electrical and Electronic Measurements Laboratory	0	0	2	1	III
7	BECPC4010	Electromagnetic Waves	3	1	0	4	IV
8	BECPC4110	Electromagnetic Waves Laboratory	0	0	2	1	IV
9	BECPC4020	Digital Electronics	3	0	0	3	IV
10	BECPC4120	Digital Electronics Laboratory	0	0	2	1	IV
11	BECPC4030	Microprocessors and Microcontrollers	3	0	0	3	IV
12	BECPC4130	Microprocessors and Microcontrollers Laboratory	0	0	2	1	IV
13	BECPC4140	Design and Simulation Laboratory	0	0	2	1	IV
14	BECPC5010	Analog Communications	3	1	0	4	V
15	BECPC5110	Analog Communication Techniques Laboratory	0	0	2	1	V
16	BECPC5020	Digital Signal Processing	3	0	0	3	V
17	BECPC5120	Digital Signal Processing Laboratory	0	0	2	1	V
18	BECPC5030	Digital VLSI Design	3	0	0	3	V
19	BECPC5130	Digital VLSI Design Laboratory	0	0	2	1	V
20	BECPC6010	Digital Communications	3	1	0	4	VI
21	BECPC6110	Digital Communication Techniques Laboratory	0	0	2	1	VI
22	BECPC6020	Microwave Theory and Techniques	3	0	0	3	VI
23	BECPC6120	Microwave Techniques Laboratory	0	0	2	1	VI
24	BECPC6030	Control Systems	3	0	0	3	VI
25	BECPC6130	Control Systems Laboratory	0	0	2	1	VI
26	BECPC6140	Advanced Laboratory-I	0	0	2	1	VI
27	BECPC7010	Computer Networks	3	0	0	3	VIII
28	BECPC7110	Computer Networks Laboratory	0	0	2	1	VII
29	BECPC7140	Advanced Laboratory-II	0	0	2	1	VII
TOTAL			**39**	**3**	**32**	**58**	

V. PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred Semester
			L	T	P	C	
1	BECPE5041	Fiber Optic Communications	3	0	0	3	V
2	BECPE5042	Electronic Devices and Modeling	3	0	0	3	V
3	BECPE5043	Power Electronics	3	0	0	3	V
4	BECPE5044	Sensors and Transducers	3	0	0	3	V
5	BECPE6041	Information Theory and Coding	3	0	0	3	VI
6	BECPE6042	Nano Electronics	3	0	0	3	VI
7	BECPE6043	Biomedical Electronics	3	0	0	3	VI
8	BECPE6044	Internet of Things	3	0	0	3	VI
9	BECPE7021	Mobile Communications	3	0	0	3	VII
10	BECPE7022	Antennas and Wave Propagation	3	0	0	3	VII
11	BECPE7023	Analog VLSI Design	3	0	0	3	VII
12	BECPE7024	Pattern Analysis and Machine Intelligence	3	0	0	3	VII
13	BECPE7031	Embedded Systems	3	0	0	3	VII
14	BECPE7032	Adaptive Signal Processing	3	0	0	3	VII
15	BECPE7033	Advanced Control Systems	3	0	0	3	VII
16	BECPE7034	Industrial Electronics	3	0	0	3	VII
16	BECPE7041	Speech and Audio Processing	3	0	0	3	VII
17	BECPE7042	Mixed Signal Design	3	0	0	3	VII
18	BECPE7043	Telecommunication System Modeling and Simulation	3	0	0	3	VII
20	BECPE7044	Fuzzy Logic and Neural Networks	3	0	0	3	VII
21	BECPE8011	Satellite Communications	3	0	0	3	VIII
22	BEIPE8012	Micro-Electro-Mechanical Systems	3	0	0	3	VIII
23	BECPE8013	High Speed Electronics	3	0	0	3	VIII
24	BECPE8014	Wavelet Transforms	3	0	0	3	VIII
25	BECPE8021	Digital Image and Video Processing	3	0	0	3	VIII
26	BECPE8022	Error Correcting Codes	3	0	0	3	VIII
27	BEIPE8023	Wireless Sensor Networks	3	0	0	3	VIII

28	BECPE8024	Cryptography and Network Security	3	0	0	3	VIII
TOTAL			**21**	**0**	**0**	**21**	

VI. OPEN ELECTIVE COURSES

Sl. No.	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**Preferred Semester**
			L	**T**	**P**	**C**	
1		Open Elective-I	3	0	0	3	V
2		Open Elective-II	3	0	0	3	VI
3		Open Elective-III	3	0	0	3	VII
4		Open Elective-IV	3	0	0	3	VIII
TOTAL			**12**	**0**	**0**	**12**	

VII. PROJECT WORK, SEMINAR AND/OR INTERNSHIP IN INDUSTRY OR ELSEWHERE

Sl. No.	**Course Code**	**Course Title**	**Hours per week**			**Credits**	**Preferred Semester**
			L	**T**	**P**	**C**	
1	BECEC5150	Skill Development Project and Hands on Training	0	0	2	1	V
2	BECEC5170	Summer Internship-I	0	0	2	1	V
3	BTPEC6160	Soft Skill and Employability Skill	0	0	2	1	VI
4	BECEC7150	Mini Project / Projects on Internet of Things	0	0	4	2	VII
5	BECEC7170	Summer Internship-II	0	0	2	1	VII
6	BECEC8150	Major Project / Industrial Project / Startup Training cum Project	0	0	10	5	VIII
7	BECEC8180	Seminar and Technical Writing	0	0	2	1	VIII
8	BECEC8190	Comprehensive Viva-Voce	0	0	2	1	VIII
TOTAL			**0**	**0**	**26**	**13**	

VIII. MANDATORY COURSES

Sl. No.	Course Code	Course Title	Hours per week			Credits	Preferred Semester
			L	T	P	C	
1	BBSHS1180	NSS	-	-	-	0	I
2	BBSHS2180	YOGA	-	-	-	0	II
TOTAL			**-**	**-**	**-**	**0**	

SEMESTER WISE COURSES

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

I SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	BS	BBSBS1010	Engineering Mathematics-I	3	1	0	4
2	BS	BBSBS1021	Engineering Physics	3	0	0	3
		BBSBS1022	Engineering Chemistry				
3	ES	BBSES1031	Basics of Mechanics	3	0	0	3
		BBSES1032	Basics of Thermodynamics				
4	ES	BBSES1041	Basics of Electronics	3	0	0	3
		BBSES1042	Basics of Electrical Engineering				
5	ES	BBSES1050	Programming for Problem Solving	3	0	0	3
6	HS	BBSHS1060	Communicative English and Soft Skills	2	0	0	2
PRACTICAL / SESSIONAL							
7	BS	BBSBS1121	Engineering Physics Laboratory	0	0	2	1
		BBSBS1122	Engineering Chemistry Laboratory				
8	ES	BBSES1141	Basics of Electronics Laboratory	0	0	2	1
		BBSES1142	Basics of Electrical Engineering Laboratory				
9	ES	BBSES1150	Programming for Problem Solving Laboratory	0	0	2	1
10	HS	BBSHS1160	Communicative English and Soft Skills Laboratory	0	0	2	1
11	ES	BBSES1171	Engineering Drawing	0	0	2	1
		BBSES1172	Engineering Workshop				
12	MC	BBSHS1180	NSS	-	-	-	0
TOTAL				**17**	**1**	**10**	**23**

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

II SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	BS	BBSBS2010	Engineering Mathematics-II	3	1	0	4
2	BS	BBSBS1021	Engineering Physics	3	0	0	3
		BBSBS1022	Engineering Chemistry				
3	ES	BBSES1031	Basics of Mechanics	3	0	0	3
		BBSES1032	Basics of Thermodynamics				
4	ES	BBSES1041	Basics of Electronics	3	0	0	3
		BBSES1042	Basics of Electrical Engineering				
5	ES	BBSES2050	Data Structures	3	0	0	3
6	HS	BBSHS2060	Communicative English and Technical Communication	2	0	0	2
PRACTICAL / SESSIONAL							
7	BS	BBSBS1121	Engineering Physics Laboratory	0	0	2	1
		BBSBS1122	Engineering Chemistry Laboratory				
8	ES	BBSES1141	Basics of Electronics Laboratory	0	0	2	1
		BBSES1142	Basics of Electrical Engineering Laboratory				
9	ES	BBSES2150	Data Structures using 'C++' Laboratory	0	0	2	1
10	HS	BBSHS2160	Communicative English and Technical Communication Laboratory	0	0	2	1
11	ES	BBSES1171	Engineering Drawing	0	0	2	1
		BBSES1172	Engineering Workshop				
12	MC	BBSHS2180	YOGA	-	-	-	0
TOTAL				**17**	**1**	**10**	**23**

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

III SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	BS	BBSBS3010	Engineering Mathematics-III	3	1	0	4
2	PC	BECPC3020	Analog Electronic Circuits	3	0	0	3
3	PC	BELPC3030	Network Theory	3	0	0	3
4	PC	BEIPC3040	Electrical and Electronic Measurements	3	0	0	3
5	ES	BCSES3050	Object Oriented Programming through JAVA	3	0	0	3
6	BS / HS	BBSBS3061	Environmental Engineering and Safety	3	0	0	3
		BMSHS3062	Engineering Economics and Costing				
PRACTICAL / SESSIONAL							
7	PC	BECPC3120	Analog Electronic Circuits Laboratory	0	0	2	1
8	PC	BELPC3130	Network and Devices Laboratory	0	0	2	1
9	PC	BEIPC3140	Electrical and Electronic Measurements Laboratory	0	0	2	1
10	ES	BCSES3150	JAVA Programming Laboratory	0	0	2	1
TOTAL				**18**	**1**	**8**	**23**

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

IV SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC4010	Electromagnetic Waves	3	1	0	4
2	PC	BECPC4020	Digital Electronics	3	0	0	3
3	PC	BECPC4030	Microprocessors and Microcontrollers	3	0	0	3
4	ES	BECES4040	Semiconductor Devices	3	0	0	3
5	ES	BECES4050	Signals and Systems	3	0	0	3
6	BS / HS	BBSBS3061	Environmental Engineering and Safety	3	0	0	3
		BMSHS3062	Engineering Economics and Costing				
PRACTICAL / SESSIONAL							
7	PC	BECPC4110	Electromagnetic Waves Laboratory	0	0	2	1
8	PC	BECPC4120	Digital Electronic Laboratory	0	0	2	1
9	PC	BECPC4130	Microprocessors and Microcontrollers Laboratory	0	0	2	1
10	PC	BECPC4140	Design and Simulation Laboratory	0	0	2	1
TOTAL				**18**	**1**	**8**	**23**

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

V SEMESTER [THIRD YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC5010	Analog Communications	3	1	0	4
2	PC	BECPC5020	Digital Signal Processing	3	0	0	3
3	PC	BECPC5030	Digital VLSI Design	3	0	0	3
4	PE	BECPE5041	Fiber Optic Communications	3	0	0	3
		BECPE5042	Electronic Devices and Modeling				
		BECPE5043	Power Electronics				
		BECPE5044	Sensors and Transducers				
5	OE		Open Elective-I *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
6	PC	BECPC5110	Analog Communication Techniques Laboratory	0	0	2	1
7	PC	BECPC5120	Digital Signal Processing Laboratory	0	0	2	1
8	PC	BECPC5130	Digital VLSI Design Laboratory	0	0	2	1
9	EC	BECEC5150	*Skill Development Project and Hands on Training	0	0	2	1
10	EC	BECEC5170	^Summer Internship-I	0	0	2	1
TOTAL				**15**	**1**	**10**	**21**

*College should conduct at least one NSDC program under this category.

^ Four (4) weeks duration summer internship either in industry or in an R&D organization, including educational institutes with excellent research culture. The student is expected to submit a formal report at the end of the programme.

- On-line MOOC courses may contribute upto 20% of the credits, with in-house examination being conducted.

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

VI SEMESTER [THIRD YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC6010	Digital Communications	3	1	0	4
2	PC	BECPC6020	Microwave Theory and Techniques	3	0	0	3
3	PC	BECPC6030	Control Systems	3	0	0	3
4	PE	BECPE6041	Information Theory and Coding	3	0	0	3
		BECPE6042	Nano Electronics				
		BECPE6043	Biomedical Electronics				
		BECPE6044	Internet of Things				
5	OE		Open Elective-II *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
6	PC	BECPC6110	Digital Communication Techniques Laboratory	0	0	2	1
7	PC	BECPC6120	Microwave Techniques Laboratory	0	0	2	1
8	PC	BECPC6130	Control Systems Laboratory	0	0	2	1
9	PC	BECPC6140	Advanced Laboratory-I	0	0	2	1
10	EC	BTPEC6160	#Soft Skill and Employability Skill	0	0	2	1
TOTAL				**15**	**1**	**10**	**21**

#To be conducted by the Training & Placement Department of the College.

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VII SEMESTER [FOURTH YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC7010	Computer Networks	3	0	0	3
2	PE	BECPE7021	Mobile Communications	3	0	0	3
		BECPE7022	Antennas and Wave Propagation				
		BECPE7023	Analog VLSI Design				
		BECPE7024	Pattern Analysis and Machine Intelligence				
3	PE	BECPE7031	Embedded Systems	3	0	0	3
		BECPE7032	Adaptive Signal Processing				
		BECPE7033	Advanced Control Systems				
		BECPE7034	Industrial Electronics				
4	PE	BECPE7041	Speech and Audio Processing	3	0	0	3
		BECPE7042	Mixed Signal Design				
		BECPE7043	Telecommunication System Modeling and Simulation				
		BECPE7044	Fuzzy Logic and Neural Networks				
5	OE		Open Elective-III *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
6	PC	BECPC7110	Computer Networks Laboratory	0	0	2	1
7	PC	BECPC7140	Advanced Laboratory-II	0	0	2	1
8	EC	BECEC7150	Mini Project / Projects on Internet of Things	0	0	4	2
10	EC	BECEC7170	^Summer Internship-II	0	0	2	1
TOTAL				**15**	**0**	**10**	**20**

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VIII SEMESTER [FOURTH YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PE	BECPE8011	Satellite Communications	3	0	0	3
		BEIPE8012	Micro-Electro-Mechanical Systems				
		BECPE8013	High Speed Electronics				
		BECPE8014	Wavelet Transforms				
2	PE	BECPE8021	Digital Image and Video Processing	3	0	0	3
		BECPE8022	Error Correcting Codes				
		BEIPE8023	Wireless Sensor Networks				
		BECPE8024	Cryptography and Network Security				
3	OE		Open Elective-IV *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
4	EC	BECEC8150	Major Project / Industrial Project / Startup Training cum Project	0	0	10	5
5	EC	BECEC8180	Seminar and Technical Writing	0	0	2	1
6	EC	BECEC8190	Comprehensive Viva-Voce	0	0	2	1
TOTAL				**9**	**0**	**14**	**16**

SCHEME OF INSTRUCTION SUMMARY

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

SL. NO.	COURSE WORK - SUBJECTS AREA	CREDITS / SEMESTER								TOTAL CREDITS	%
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities and Social Sciences including Management Courses	3	3	-	3	-	-	-	-	**9**	**5**
2	Basic Science Courses	8	8	7	-	-	-	-	-	**23**	**14**
3	Engineering Science Courses including workshop, drawing, basics of electrical / mechanical / computer etc.	12	12	4	6	-	-	-	-	**34**	**20**
4	Professional Core Courses	-	-	12	14	13	14	5	-	**58**	**34**
5	Professional Elective Courses relevant to chosen specialization / branch	-	-	-	-	3	3	9	6	**21**	**12**
6	Open subjects - Electives from other technical and/or emerging Subjects	-	-	-	-	3	3	3	3	**12**	**7**
7	Project work, Seminar and Internship in industry or elsewhere	-	-	-	-	2	1	3	7	**13**	**8**
8	Mandatory Courses [Environmental Sciences, Induction Training, Indian Constitution, Essence of Indian Traditional Knowledge]	-	-	-	-	-	-	-	-	**0**	**0**
	TOTAL	**23**	**23**	**23**	**23**	**21**	**21**	**20**	**16**	**170**	**100**

END SEMESTER EXAMINATION QUESTION PATTERN

Question Pattern	1 Mark	2 Marks	5 Marks	10 Marks	15 Marks	16 Marks	20 Marks	Total
A	10	15 (out of 20)	6 (out of 8)		2 (out of 4)			100
B		10	6 (out of 8)		4 (either or type)			100
C							1 compulsory & 4 either or type	100
D	10	15			4 (either or type)			100
E	10	10	6 (out of 8)	4 (either or type)				100
F		10					4 (either or type)	100
G		10				1 compulsory & 4 either or type		100
H	10	10					4 (either or type)	100

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

I SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	BS	BBSBS1010	Engineering Mathematics-I	3	1	0	4
2	BS	BBSBS1021	Engineering Physics	3	0	0	3
		BBSBS1022	Engineering Chemistry				
3	ES	BBSES1031	Basics of Mechanics	3	0	0	3
		BBSES1032	Basics of Thermodynamics				
4	ES	BBSES1041	Basics of Electronics	3	0	0	3
		BBSES1042	Basics of Electrical Engineering				
5	ES	BBSES1050	Programming for Problem Solving	3	0	0	3
6	HS	BBSHS1060	Communicative English and Soft Skills	2	0	0	2
PRACTICAL / SESSIONAL							
7	BS	BBSBS1121	Engineering Physics Laboratory	0	0	2	1
		BBSBS1122	Engineering Chemistry Laboratory				
8	ES	BBSES1141	Basics of Electronics Laboratory	0	0	2	1
		BBSES1142	Basics of Electrical Engineering Laboratory				
9	ES	BBSES1150	Programming for Problem Solving Laboratory	0	0	2	1
10	HS	BBSHS1160	Communicative English and Soft Skills Laboratory	0	0	2	1
11	ES	BBSES1171	Engineering Drawing	0	0	2	1
		BBSES1172	Engineering Workshop				
12	MC	BBSHS1180	NSS	-	-	-	0
TOTAL				**17**	**1**	**10**	**23**

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

II SEMESTER [FIRST YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	BS	BBSBS2010	Engineering Mathematics-II	3	1	0	4
2	BS	BBSBS1021	Engineering Physics	3	0	0	3
		BBSBS1022	Engineering Chemistry				
3	ES	BBSES1031	Basics of Mechanics	3	0	0	3
		BBSES1032	Basics of Thermodynamics				
4	ES	BBSES1041	Basics of Electronics	3	0	0	3
		BBSES1042	Basics of Electrical Engineering				
5	ES	BBSES2050	Data Structures	3	0	0	3
6	HS	BBSHS2060	Communicative English and Technical Communication	2	0	0	2
PRACTICAL / SESSIONAL							
7	BS	BBSBS1121	Engineering Physics Laboratory	0	0	2	1
		BBSBS1122	Engineering Chemistry Laboratory				
8	ES	BBSES1141	Basics of Electronics Laboratory	0	0	2	1
		BBSES1142	Basics of Electrical Engineering Laboratory				
9	ES	BBSES2150	Data Structures using 'C++' Laboratory	0	0	2	1
10	HS	BBSHS2160	Communicative English and Technical Communication Laboratory	0	0	2	1
11	ES	BBSES1171	Engineering Drawing	0	0	2	1
		BBSES1172	Engineering Workshop				
12	MC	BBSHS2180	YOGA	-	-	-	0
TOTAL				**17**	**1**	**10**	**23**

Course Title						
Course Code	**ENGINEERING MATHEMATICS-I**	L	T	P	C	QP
BBSBS1010		**3**	**1**	**0**	**4**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To find critical points, and use them to locate maxima and minima.

CEO2: To provide the standard methods for solving differential equations.

CEO3: To study Fourier series and to express a function in Fourier series.

CEO4: To use matrices, determinants and techniques for solving systems of linear equations in the different areas of Linear Algebra.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Implement the engineering problems using the concept of Partial differentiation and series and to understand its application.
CO2	Solve the initial value and boundary value problem of ODE related to Electrical circuit.
CO3	Execute the technique of Fourier series for applying in Engineering applications.
CO4	Find the Eigen value and vector of a matrix by using properties of linear algebra.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	-	-	-	-	-	-	-	-	-	-			
CO2	2	3	-	-	-	-	-	-	-	-	-	-			
CO3	1	3	-	-	-	-	-	-	-	-	-	-			
CO4	2	3	-	-	-	-	-	-	-	-	-	-			
Avg.	1.5	2.75	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT-I (13 Hours)

MULTI-VARIABLE CALCULUS

Partial differentiation, Euler's theorem, Total derivative, Taylor's theorem for function of two variable (without proof), Maxima and Minima for function of two variables, Differentiation under integral sign (Leibnitz rule).

UNIT- II (12 Hours)

DIFFERENTIAL EQUATIONS-I

Ordinary differential Equations: First order and first degree differential equations and their method of solving, Application to Electrical circuits and heat conduction.

DIFFERENTIAL EQUATIONS-II

Linear differential equations of higher order and their different methods of solutions (operator methods). Second order linear differential equations and their solutions: Euler Cauchy equation, solution by undermined coefficient method and variation of parameters. Simple application to electrical circuits.

UNIT -III (10 Hours)

FOURIER SERIES

Fourier expansion of functions of arbitrary period, Even and odd functions, Half Range Expansion.

UNIT -IV (15 Hours)

LINEAR ALGEBRA:

Matrices, Types of matrices, Rank of matrix, Eigen values and Eigen vectors, Cayley – Hamilton theorem (without proof), system of linear equations, Orthogonal matrices, Complex matrices, Hermitian and skew-Hermitian matrices, Unitary matrices, similarity of matrices. Quadratic forms and Canonical forms.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Advanced Engineering Mathematics by E. Kreyszig, Tenth Edition, Willey
2. Differential Calculus by Santi Narayan and Mittal, S.Chand Publications

Reference Books:

1. Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
2. Higher Engineering Mathematics by B.V.Ramana, McGraw Hills Education
3. Advanced Engineer methods by N. P. Bali & Manish Goyal.

Course Title						
Course Code	**ENGINEERING PHYSICS**	L	T	P	C	QP
BBSBS1021		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Providing fundamental knowledge about the oscillations and waves.

CEO2: To familiar with structure and properties of materials.

CEO3: Providing knowledge of mathematical concepts to solve electromagnetic problems and fundamental information about Quantum mechanics with applications.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand and analyze the concept of oscillation and wave mechanics.
CO2	Describe the principle of lasing and optoelectronics devices in communication system.
CO3	Explain the ideas of crystal structure, crystal diffraction and classification of materials.
CO4	Interpret the fundamentals of electromagnetism and deduce the electromagnetic wave equations.
CO5	Express the basics of quantum mechanics and illustrate the quantum mechanics problems.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	1	2	-	-	-	-	-	-	-	-	-	-			
CO3	1	2	-	-	-	-	-	-	-	-	-	-			
CO4	2	2	-	-	-	-	-	-	-	-	-	-			
CO5	2	2	-	-	-	-	-	-	-	-	-	-			
Avg.	1.8	2	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT: 01 (12 Hours)

Interaction of Wave and Matter

Simple Harmonic Oscillator, Damped harmonic oscillator and Forced harmonic oscillator, and coupled oscillator, Waves and its Characteristics, Superposition of Waves, Interference by division of wavefront (Bi-prism experiment) and division of amplitude (Newton's Ring experiment). Introduction to Diffraction, types of diffraction.

LASER, spontaneous & stimulated emission, Einstein's relation, Ruby Laser and He-Ne Laser, Semiconductor laser, application of Laser. Optical fiber, Acceptance angle, Numerical aperture, Skip distance, Step index and Graded index fibers, Attenuations in optical fibers, applications of optical fiber in communication systems.

UNIT: 02 (12 Hours)

Physics of Materials

Introductions to materials, Crystallography, Crystal structure, crystal direction and plane, Miller indices, Inter planar spacings, Reciprocal Lattice and its characteristics, Reciprocal Lattice of SC, FCC and BCC, Brillouin Zone, Bragg's law.

Energy bands in solids (conduction band, valence band and Fermi level), Classification of materials on the basis of band theory.

Magnetic properties of Materials & their applications.

Nano materials and applications (particulates, thin films, nano structures, etc.)

UNIT: 03 (10 Hour)

Electromagnetic theory and wave

Review of grad, divergence and curl, Gauss divergence theorem and Stoke's theorem (no derivations), fundamental laws of electrostatics, magneto-statics and electromagnetism, displacement current and conduction current, Maxwell's equations.

Electromagnetic wave and its characteristics, electromagnetic wave equation for free space and in charge free conducting medium, electromagnetic energy, Poynting vector and Poynting theorem.

UNIT: 04 (12 Hours)

Quantum Mechanics

Introduction to dual nature: Black body radiation, photoelectric effect, Compton effect (qualitative idea only), de-Broglie's hypothesis, Heisenberg's uncertainty principle and its application to non-existence of electron inside the nucleus and ground state energy of one dimensional harmonic oscillator, Basic postulates of Quantum Mechanics, Wave function and its characteristics, probability density , normalization, eigen values, eigen functions and expectation values, Schrödinger's equation (time dependent and time independent). Application of Schrödinger equation to one dimensional potential well, potential step and potential barrier (qualitative ideas).

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Engineering Physics by D. K. Bhattacharya and Poonam Tanden, Oxford University Press.
2. Engineering Physics, H K Malik and A K Singh, Tata McGraw Hill, MGH.

Reference Books:

1. Materials Science & Engg., V. Raghvan, Prentice Hall of India.
2. Concepts of Modern Physics, A. Beiser, S. Mahajan, S.R. Choudhary, Tata McGraw Hill.
3. Lasers & Optical engineering, P Dass, Narosa Publishers, Springer Publisher.
4. Engineering Physics by B. B. Swain and P. K. Jena, Kitab Mahal,Cuttack
5. Quantum Mechanics by SatyaPrakash, Kitab Mohal, etc. Kedar Nath Ram Nath Publisher.

Course Title						
Course Code	**ENGINEERING CHEMISTRY**	L	T	P	C	QP
BBSBS1022		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To impart the knowledge of application of chemical sciences in the field of engineering.

CEO2: To focus on microscopic chemistry in terms of atomic and molecular levels.

CEO3: The course aims at elucidating principles of applied chemistry in water treatment.

CEO4: To give detailed account about the reactivity of metals w.r.t prevention of corrosion.

CEO5: To enlighten the students with the applications of polymers.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Analyze microscopic chemistry in terms of atomic and molecular orbital and Explain the ranges of the electromagnetic spectrum by electronic transition.
CO2	Identify water treatment techniques for domestic and industrial purposes.
CO3	Compare types of corrosion, and it's control measures.
CO4	Understand various types of polymers, their preparation along with applications.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	1	-	-	-	-	1	-	-	-	-	-			
CO3	3	1	-	-	-	-	-	-	-	-	-	1			
CO4	2	1	-	-	-	-	1	-	-	-	-	-			
Avg.	2.5	1.25	-	-	-	-	1	-	-	-	-	1			

SYLLABUS

UNIT-1 (12 Hours)

ATOMIC AND MOLECULAR STRUCTURE

Schrodinger's wave equation(no derivation), Significance of wave functions, Particle in a box, Application for conjugated molecule, Molecular Orbital theory and Energy level diagramfor Diatomic molecules,

Spectroscopic techniques and applications: Electronics spectroscopy, Vibrational and rotational spectroscopy of diatomic molecules.

UNIT-2(12 Hours)

WATER CHEMISTRY

Types of Hardness, Determination of Hardness by EDTA method, Treatment of water for Domestic use, Water softening processes Lime-soda process, Ion Exchange method, Boiler feed water, Scale and Sludge, Caustic embrittlement, Carbonate and phosphate conditioning, Colloidal conditioning, Calgon conditioning,

UNIT-3 (12 Hours)

CORROSION

Thermodynamic functions: Entropy, Freeenergy, Relation between E.M.F and free energy,The Nernst's equation and application,

Definition of corrosion, Types of corrosion: Dry corrosion and wet corrosion, Galvanic corrosion, Concentration cell corrosion, Factors influencing corrosion, Corrosion control: Cathodic protection (Sacrificial anodic protection and Impressed current cathodic protection), Inhibitors, Protective coatings: Galvanization and Tinning.

UNIT -4 (12 Hours)

POLYMER CHEMISTRY

Introduction, polymer, Classification of polymers, Plastics: Thermosetting and thermo plastic, PVC, PE,PS,PMMA, PTFE, Bakelite,Nylon-6,6,Nylon-6, Fiber reinforced plastic.

*ADD-ON COURSES: Conducting Polymer (Polyaniline, Polyacetylene), Bio-Degradable and Non-Bio Degradable polymer, Nano composite.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Engineering chemistry by Jain & Jain, Dhanpat Rai publishing company (p) Ltd.

Reference Books:

1. A Text Book of Engineering Chemistry by S.S.Dara,S Chand Publishers.
2. A Text Book of Engineering Chemistry by SashiChawla,DhanpatRai Publishing house.
3. Text Book of Engineering Chemistry, 2nd edition, by R.Gopalan,D.Venkapaya&SulochanaNagarajan, Vikas Publishing House Pvt.Ltd.
4. B. Tech Chemistry- I and II by P. K. Kar, S. Dash, B. Mishra kalyani publishers.
5. Physical Chemistry By P.W Atkins
6. Engineering Chemistry (NPTEL Web Book) by B . L Tembe, Kamaluddin and M.S. Krishna
7. Fundamentals of Molecular spectroscopy By C . N Banwell
8. University chemistry by B.H. Mahan

Course Title						
Course Code	**BASICS OF MECHANICS**	L	T	P	C	QP
BBSES1031		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Physics, Mathematics

Course Educational Objectives

CEO1: To apply the established engineering method to complex engineering problem.

CEO2: To understand the vectorial and scalar representation of forces and moments.

CEO3: To evaluate the different forces exhibit in truss member.

CEO4: To obtain the knowledge on kinematics and kinetics of particle to analyze simple and practical problems.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Determine the resultant force and moment for given force system.
CO2	Evaluate the forces in members of trusses, frames and problems related to friction.
CO3	Analyze the properties of surface in relation to centroid and moment of inertia.
CO4	Adapt the laws of motion, kinematics of motion and their interrelationship

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
Avg.	3	2.5	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **[16 Hours]**

STATICS OF PARTICLES

Fundamental concepts and principles of engineering mechanics. Resolution of forces Resultant of several concurrent forces Free body diagram. Principles of transmissibility. Moment of a force Varignon's theorem Equivalent system of forces, Types of supports and corresponding reactions.

UNIT:2 **[12 Hours]**

ANALYSIS OF TRUSSES AND FRICTION

Introduction to Truss Analysis of Trusses Method of joints, Method of sections.
Laws of Friction Angle of Friction Angle of Repose Ladder and Wedge Friction

UNIT:3 **[12 Hours]**

PROPERTIES OF SURFACES

Determination of first moment area of plane figures by integration – Determination of centroid of composite figures by using standard formula.
Determination of second moment area of plane figures by integration Parallel and perpendicular

axis theorems Determination of area moment of inertia of composite figures by using standard formula Polar moment of inertia Radius of gyration.

UNIT:4 **[10 Hours]**

DYNAMICS OF PARTICLES

Rectilinear motion: uniform velocity and uniformly accelerated motion Newton second law D'Alembert's principle and its applications work and energy equation Impulse and Momentum Impact of elastic bodies.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Timoshenko, and Young, "Engineering Mechanics", Tata Mc-Graw Hill Book Company.
2. S. S. Bhavikatti, "Engineering Mechanics", New Age International Publishers,

Reference Books:

1. Dr. Bansal.R.K, & Sanjay Bansal, "A Text book of Engineering Mechanics", Lakshimi publications.
2. A.K.Tayal, "Engineering Mechanics Statics And Dynamics", Umesh Publications
3. Rajasekaran.S, & Sankarasubramanian.G, "Engineering Mechanics", Vikas Publishing House Pvt Ltd, 2011.
4. Engineering Mechanics, (3ed edition) by Statics and Dynamics K.Vijaya Kumar Reddy and J Suresh Kumar, BS Publications.

Course Title						
Course Code	**BASICS OF THERMODYNAMICS**	L	T	P	C	QP
BBSES1032		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Physics, Chemistry and Mathematics

Course Educational Objectives

CEO1: Learn to classify the fundamentals of thermodynamics like pressure, temperature etc.

CEO2: Apply principle and law of thermodynamics to analysis of different systems.

CEO3: Become aware of relevance of environmental and social issues on the analysis process of systems.

CEO4: To understand the basics of properties of pure substance like steam and its conditions and Application of Thermodynamics in engineering practices.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Explain the basic concepts of system, control volume, thermodynamic properties, thermodynamic equilibrium, temperature, work and heat energy.
CO2	Apply the laws of thermodynamics to refrigerators, heat engines, heat pumps compressors and nozzles etc.
CO3	Interpret and apply the concept of entropy to thermodynamic systems.
CO4	Evaluate properties of pure substances, gases and their mixtures and to derive and apply to thermodynamic problems.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	-	-	-	-	-	-	-	-			
CO2	3	3	3	-	-	-	-	-	-	-	-	-			
CO3	-	2	2	-	-	-	-	-	-	-	-	-			
CO4	3	3	3	-	-	-	-	-	-	-	-	-			
Avg.	3	2.75	2.5	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT 1 **(15 Hours)**

Basic concepts & definition, scope of thermodynamics. Macroscopic & microscopic approach. Definition of fixed mass (closed) system & control volume (open) system, isolated system. Thermodynamic properties (extensive & intensive), state & its representation on a property diagram, process and its representation, cyclic process Characteristics of properties (point & path function), reversible & irreversible process, Quasistatic Process. Thermodynamic equilibrium. Pressure, Types of pressure, Zeroth law of thermodynamics & temperature scales, calibration of thermometers. Ideal gasses & their P V T relation. Energy transfer; Work transfer(definition & calculation), different modes of work Displacement work for various process, Free expansion work, Heat transfer; modes of heat transfer, basic laws in conduction, convection & radiation.

UNIT 2 **(13 Hours)**

First law of thermodynamics, formal statement (using cyclic process) first law for processes of fixed masses (closed system) Introduction of internal energy, enthalpy as thermodynamic properties Definition of sp.heats (C_p & C_v) and their use in calculation of internal energy & enthalpy with emphasis on ideal gas. Application of first law to control volume (Steady Flow); nozzle, diffuser, compressor, turbine, throttling device.

UNIT 3 **(12 Hours)**

Second law of thermodynamics, Kelvin Planck & Clausius statements, Carnot cycle. Reversible & irreversible engines and their efficiency (Thermal and maximum Efficiency)
Entropy concepts, Clausius inequality, Entropy Principle.

UNIT IV **(10 Hours)**

Properties of pure substance, P v, T s, h s diagram for steam, Steam properties, Introduction to steam table with respect to specific volume, pressure, temperature, enthalpy & entropy, Mollier Diagram. Application of thermodynamics: Steam power plant, Refrigerators and Heat Pump, I C Engines (working principle with schematic diagrams only)

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Engineering Thermodynamics by P.K.Nag, Publisher: TMH
2. Basic Engineering Thermodynamics by D S Kumar, Publisher: S K Kataria & Sons-New Delhi

Reference Books:

1. Fundamental of Engineering Thermodynamics by E. Rathakrishnan, publisher. PHI
2. Thermodynamics: An Engineering Approach by Yunus A. Cengel, Michael A. Boles Publisher: Mcgraw Hill Education
3. Thermal engineering by R.K.Rajput, Laxmi Publications Pvt. Ltd.
4. Steam Tables in SI Units by K. Ramalingam, Scitech Publications (P) Ltd.

Course Title						
Course Code	**BASICS OF ELECTRONICS**	L	T	P	C	QP
BBSES1041		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Identify the basic tools and test equipment used to construct, troubleshoot, and maintain standard electronic circuits and systems.

CEO2: Explain the construction and application of standard circuit configurations and identify the component types and connections used to build functioning electronic circuits.

CEO3: Design simple combinational and sequential logic circuits.

CEO4: Identify functions of digital multimeter, cathode ray oscilloscope and transducers in the measurement of physical variables

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Recognize different components such as transistors, resistors, capacitors and diodes which fit on a small chip with each leg of the chip connecting to a point within the circuit.
CO2	Apply modern modelling software for drafting different electronic circuits.
CO3	Analyze modern electronic circuits and systems.
CO4	Formulate mathematical descriptions and procedures in designing new electronic systems and technically present

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	1	-	-	-	-	-	-	-	-			
CO2	1	2	3	-	-	-	-	-	-	-	-	-			
CO3	1	2	2	-	-	-	-	-	-	-	-	-			
CO4	1	2	2	3	-	-	-	-	-	-	-	-			
Avg.	1.25	2	2	2	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT-1

Semiconductor Devices:- Classification of material, Energy band diagram, properties of semiconductors, Types of semiconductors, Semiconductor diode (no bias, forward, reverse),temperature effects, diode equivalent circuit, zener diode, LED , Half wave rectifier, full wave rectifier, clippers ,clampers.

UNIT-2

Bipolar Junction Transistors (BJTs):- Introduction, transistor operation, Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region, Common–Base configuration, Common–emitter configuration, Common-collector configuration Current-voltage characteristics of BJT, BJT as an amplifier and as a switch.

Field Effect Transistors (FETs):- Introduction, construction and characteristics of JFETs, transfer characteristics, D-MOSFET, E –MOSFET.

UNIT-3

Communication Systems: -Analog and digital signals, block diagram of basic communication system, need for modulation, methods of modulation,AM/FM transmitters & receivers (Block diagram description only)

Electronic Instruments:- Basic principle of Oscilloscope, Function of the sweep generator, Block diagrams of oscilloscope, Measurement of frequency and phase by Lissajous method, Application of oscilloscope for measurement of voltage, period and frequency, Block diagram of standard signal generator, AF sine and square wave generator, and Function generator.

UNIT-4

Digital Systems and Binary Numbers:-Digital systems, Binary numbers, number system conversion, octal &hexa decimal number, 1's& 2's compliments, signed binary numbers, binary codes, binary logic.

Logic Gates and Boolean Algebra:- The inverter, The AND, OR, NAND NOR, Exclusive-OR and Exclusive-NOR gate, Boolean operations and expressions, Laws and Rules of Boolean algebra, DeMorgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table Combinational Logic and Their Functions: Basic combinational logic circuits, Implementation of combinational logic, The universal properties of NAND and NOR gates, Basic adders.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092 (Selected Portions).
2. Digital Fundamentals (Eighth Edition), Thomas L. Floyd and R.P. Jain, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.
3. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books:

1. Microelectronic Circuits (Fifth Edition), Adel S. Sedra and Kenneth C. Smith, Oxford University Press, YMCA Library Building Jai Singh Road, New Delhi – 110 001.
2. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky, Pearson Education, 482 FIE, Patparganj, Delhi – 110 092.
3. Electronics Principles (7th Edition), Albert Malvono and David J. Bates, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Course Title						
Course Code	**BASICS OF ELECTRICAL ENGINEERING**	L	T	P	C	QP
BBSES1042		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

CEO2: This course provides comprehensive idea about DC & AC circuit analysis, magnetic circuit analysis, working principles of machines and common measuring instruments.

CEO3: Emphasize the effects of electric shock and precautionary measures. Improve the ability to function on multi-disciplinary teams.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand basics of Electrical Engineering and to solve complex electrical networks mathematically.
CO2	Demonstrate basic laws and techniques to develop a working knowledge of the network theorems of analysis used.
CO3	Understand elementary knowledge of electromagnetism.
CO4	Differentiate between DC and AC circuits and analyse them.
CO5	Understand the elementary knowledge of Electrical machines.
CO6	Extrapolate on basic laws and techniques to develop a working knowledge on generating stations and measuring instruments.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
CO4	2	2	-	-	-	-	-	-	-	-	-	-			
CO5	2	1	-	-	-	-	-	-	-	-	-	-			
Avg.	2.5	1.83	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

Unit – I : ***DC Circuits*** ***(8 hours)***

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Unit - II: ***AC Circuits*** ***(8 hours)***

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Unit – III: Transformers **(6 hours)**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Unit – IV: ***Electrical Machines*** ***(8 hours)***

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Unit – V: ***Power Converters*** ***(6 hours)***

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Unit – VI: ***Electrical Installations*** ***(6 hours)***

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books & Reference Books: :

1. *D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.*
2. *D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.*
3. *L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011.*
4. *E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.*
5. *V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.*

Course Title						
Course Code	**PROGRAMMING FOR PROBLEM SOLVING**	L	T	P	C	QP
BBSES1050		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To formulate algorithm, translate into program and then execute the programs for verifying its correctness.

CEO2: To analyze a problem for knowing its efficiency and decompose it into functions using divide and conquer approach.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	To formulate simple algorithms for arithmetic and logical problems and translate into programs.
CO2	To develop programs, understand and analyze its complexity.
CO3	To understand and develop programs using functions and recursions
CO4	To develop programs using pointers and structures and understand their functionality.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-			
CO2	3	3	2	-	-	-	-	-	-	-	-	-			
CO3	3	3	2	-	-	-	-	-	-	-	-	-			
CO4	3	3	2	-	-	-	-	-	-	-	-	-			
Avg.	3	2.75	1.75	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT- I **(11 Hours)**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)
Idea of Algorithm: Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo-code with examples.
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code
Arithmetic expressions and precedence. Conditional Branching. Writing and evaluation of conditionals and consequent branching.

UNIT- II **(11 Hours)**

Loops: writing programs and evaluation of loops
while, do-while and for loop, break, continue, nested loop
Arrays: Arrays (1-D, 2-D)
Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection),

Finding roots of equations, notion of order of complexity through example programs (no formal definition required)
UNIT- III **(11 Hours)** **Character arrays and Strings:** String handling operations, programs on strings, string handling functions. **Functions:** Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. **Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series
UNIT- IV **(11 Hours)** **Pointers:** Idea of pointers, Defining pointers, dynamic memory allocation, Use of Pointers in self-referential structures, notion of linked list (no implementation) **Structure:** Structures, Defining structures and Array of Structures.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books: *1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill* 2. *E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill*
Reference Books: *1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India*

Course Title						
Subject Code	**COMMUNICATIVE ENGLISH AND SOFT SKILLS**	L	T	P	C	QP
BBSHS1060		**2**	**0**	**0**	**2**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To promote communication skills and soft skills.

CEO2: To enhance the employability and entrepreneurial skills.

CEO3: To motivate the students to participate in group discussions without stage fear.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand the importance of effective communication for professional development.
CO2	Application of vocabulary and grammar for effective communication.
CO3	Application of Information and Communication Technology (ICT) for career development.
CO4	Nurture and motivate positive attitude towards placements.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	-	3	-	-			
CO2	-	-	-	-	-	-	-	-	-	3	-	-			
CO3	-	-	-	-	-	-	-	-	-	3	-	-			
CO4	-	-	-	-	-	-	-	-	-	3	-	-			
Avg.	-	-	-	-	-	-	-	-	-	3	-	-			

SYLLABUS

UNIT -1 Importance of English for Communication in the 21st Century (9 hours)

1.1 Role of English in enhancing employability and entrepreneurial skills (1)

1.2 The Nature and Scope of Communication (1)

1. 3 Objectives of Communication: Information, advice, suggestion, order, motivation, persuasion, warning, negotiation, decision-making, etc. through English Language skills, i.e., LSRW skills (1 + 1)

1.4 The process of communication and factors that influence communication: Sender, receiver, channel, code, topic, message, context, feedback, noise, filters and barriers (steps such as Ideation, Encoding, Transmission, Decoding, etc. need to be dealt with); Audience and purpose (1 + 1+ 1)

1.5 Types of Communication: General and Professional Communication; Formal and Informal Communication; Verbal and Non-verbal communication; Intrapersonal and Interpersonal communication; Written communication and Spoken communication. (1 + 1)

UNIT -2. English Vocabulary, Grammar & Usage (8 hours)

2.1 Synonyms and Antonyms 1

2.2 Words often confused 1
2.3 Technical terms and one word substitutes 1
2.4 Idioms and Phrasal Verbs 1
2.5 Identify common errors in English. 1+1
2.6 Communicative use of the Passive Voice 1
2.7 Difference between American, British and Indian English (Vocabulary based) 1

UNIT- 3. Introduction to Corporate Communication (10 hours)

3.1 Seven C's communication 1
3.2. Ten C's of Non-communication. 1
3.3 Corporate Communication – Direction of Communication: Downward Communication, Upward Communication, Horizontal/Lateral Communication, Diagonal Communication 1 + 1
3.4 Communication challenges in today's work place: Advances in technology; culturally diverse workforce; Team-based organizational Settings; how to overcome these challenges 1 + 1
3.5 Information and Communication Technology (ICT) and the corporate world, Power point presentation using multimedia; Internet and Intranet; Fax; Teleconferencing; Videoconferencing; 1+1
3.6 Corporate/Business etiquette: Good listening skills, proper dressing and grooming; proper handshake, mobile etiquette, table manners 1 + 1

UNIT- 4 Soft skills Development. (9 hrs)

4. 1 Importance of soft skills in personal and professional life 1
4.2 Are we hardwired for success? 1
4.3 Importance of developing a positive attitude 1+1
4.4 Leadership skills. 1+1
4.5 Teamsmanship. 1
4.6. Lateral thinking 1
4.7 Emotional Intelligence. 1

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. An Introduction to Professional English and Soft Skills by B. K. Das et al., Cambridge University Press.
2. Communicative English for Engineers and Professionals by Nitin Bhatnagar and Mamta Bhatnagar. Published by DK/Pearson.
3. Practical English Usage. Michael Swan, OUP,1995.

Reference Books:

1. Form and Finesse, Business Communication and Soft skills by Shruti Das, Published by Orient Black Swan.
2. Technical Communication , Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press
3. Business Communication Today by Bovee, Courtland L., Thill, John V. Prentice Hall.
4. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy

Ramesh and Mahadevan Ramesh. Pearson.
5. Oxford Guide to English Grammar by John Easthood. Oxford University Press.
6. 365 Ways to Change Your World by Norman Vincent Peale by Orient Paperbacks.

Course Title						
Course Code	**ENGINEERING PHYSICS LABORATORY**	L	T	P	C	QP
BBSBS1121		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Providing fundamental information on basic instruments and their uses.

CEO2: To familiarize with different apparatus and applications to different experiments.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand the concepts of oscillation and waves through experimental observation.
CO2	Study and explain the experimental observation of interference and diffraction pattern.
CO3	Interpret the fundamental characteristics of various materials and semiconductor materials through experiments.
CO4	Analyze the quantum concept of light by experimental observation.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	1	1	-	-	-	-	-	-	-	-			
CO2	2	-	1	1	-	-	-	-	-	-	-	-			
CO3	2	-	1	1	-	-	-	-	-	-	-	-			
CO4	2	-	1	2	-	-	-	-	-	-	-	-			
Avg.	2	-	1	1.25	-	-	-	-	-	-	-	-			

SYLLABUS

LIST OF EXPERIMENTS

1. Study of frequency of an electric tuning fork by meld's experiment.
2. Study of the acceleration due to gravity by using Bar/Kater's pendulum.
3. Study of the law of transverse vibration by using sonometer.
4. Study of wavelength of light by Newton's Rings apparatus.
5. Study of wavelength of light by Fresenel's bi-prism/Michelson inter ferometer.
6. Study of grating element of a plane diffraction grating.
7. Study of double slit interface due to He-Ne laser.
8. Study of monochromaticity and divergence of the given laser beam
9. Study of reflection and total internal reflection by optical fibers
10. Study of Hall-coefficient of a semiconductor
11. Study of dielectric constant of given solid by Leacher wire method.
12. Study of the resistivity of a semiconductor with temperature by four- probe method.

13. Study of band gap energy of PN junction (Ge/Si) diode.
14. Study of plank's constant using photo-voltaic cell.
15. Study of B-H curve of ferromagnetic substance.
16. Study of magnetic susceptibility of solods.

Course Title						
Course Code	**ENGINEERING CHEMISTRY LABORATORY**	L	T	P	C	QP
BBSBS1122		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To train the students about the applications of chemical sciences in the field of engineering and technology.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand the basic methods of chemical analysis and instrumentations involved.
CO2	Standardize of Chemicals.
CO3	Estimate the hardness, ions in salts and compositions in ores estimation appropriate consideration for the public health and safety and environmental consideration.
CO4	Synthesizes the drugs and know about their applications.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	1	2	-	-	-	-	-	-	-	-			
CO2	1	-	2	2	-	-	-	-	-	-	-	-			
CO3	-	-	2	2	-	-	1	-	-	-	-	-			
CO4	1	-	1	-	-	-	-	-	-	-	-	3			
Avg.	0.75	-	1.5	1.5	-	-	0.25	-	-	-	-	0.75			

SYLLABUS

LIST OF EXPERIMENTS

1. Determination of amount of OH- and CO32-present in supplied water sample.
2. Determination of total hardness of water.
3. Standardization of KMnO4 using sodium oxalate.
4. Determination of ferrous ion in Mohr's salt by standardized KMnO4.
5. Determination of percentage of dissolved oxygen in given water sample.
6. Estimation of available chlorine in bleaching powder/ chloride content.
7. Determination of rate constant of acid catalyzed hydrolysis of ester.
8. Preparation of drug (aspirin).
9. Adsorption of acetic acid by charcoal.
10. Acid value of oil.
11. Determination of strength of HCl and CH3COOH acid from the mixture of acids using NaOH by Conductrometry.
12. Determination moisture and ash content of coal.
13. Determination of partition coefficient of iodine in benzene and water.
14. Preparation and determination of pH of buffer solution.
15. Determination of viscosity of supplied sample.

Course Title						
Course Code	**BASICS OF ELECTRONICS LABORATORY**	L	T	P	C	QP
BBSES1141		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To provide students engineering skills by way of bread board circuit design with electronic devices and components.

CEO2: To design and analyze various Electronic circuits such as multivibrators, applications of operational amplifiers, RC coupled amplifiers, oscillators, digital circuits etc. so that students are able to understand the practical aspects of basic electronics theory.

CEO3: To enable the students to simulate and test the Analog, Digital and mixed Electronics circuits.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Generate sine, square and triangular waveforms with required frequency & amplitude using function generator.
CO2	Demonstrate introductory knowledge of software for schematic capture, circuit simulation, and circuit board layout.
CO3	Analyze the characteristics of different electronic devices and circuits such as diodes, transistors, rectifiers, amplifiers etc.,
CO4	Plan new electronic systems and technically present them

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	1	-	-	-	-	-	-	-	-	-			
CO2	-	2	2	-	-	-	-	-	-	-	-	-			
CO3	-	1	2	-	-	-	-	-	-	-	-	-			
CO4	-	2	2	-	-	-	-	-	-	-	-	-			
Avg.	1	1.5	1.75	-	-	-	-	-	-	-	-	-			

SYLLABUS

EXPERIMENTS: 1 Familiarization of electronic components and devices (Testing of semiconductor diodes and transistors using digital multi meter)

EXPERIMENTS: 2 Study and use of Oscilloscope, signal generator to view waveforms and measure amplitude and frequency of a given waveform.

EXPERIMENTS: 3 V-I characteristics of semiconductor diode

EXPERIMENTS: 4 Studies on half-wave and full-wave rectifier circuits without and with capacitor filter; recording of the waveforms and measurement of average and rms values of the rectifier output.

EXPERIMENTS: 5 Studies on clipper circuit.
EXPERIMENTS: 6 Studies on clamper circuit.
EXPERIMENTS: 7 V-I characteristic of an n-p-n or p-n-p transistor, DC biasing the transistor in common-emitter configuration and determination of its operating point (i.e., various voltages and currents).
EXPERIMENTS: 8 MOSFET I-V characteristics
EXPERIMENTS: 9 Studies on Logic gates (Truth table verification of various gates).
EXPERIMENTS: 10 Studies and experiments using Adder Circuits ICs

Course Title						
Course Code	**BASICS OF ELECTRICAL ENGINEERING LABORATORY**	L	T	P	C	QP
BBSES1142		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Illustrate the transformers and single-phase motors constructional features
CO2	Analyse various electrical quantities with combination of loads
CO3	Examine the characteristics of AC and DC machines
CO4	Distinguish the methods of speed control of DC motors

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	2	-	-	-	-	-	-	-	-	-			
CO2	-	2	2	-	-	-	-	-	-	-	-	-			
CO3	-	1	2	-	-	-	-	-	-	-	-	-			
CO4	-	2	2	-	-	-	-	-	-	-	-	-			
Avg.	-	1.5	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
4. Transformers: Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
7. Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.

8. Demonstration of cut-out sections of machines: DC machine (commutator- brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
9. Torque Speed Characteristic of separately excited dc motor.
10. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
11. Torque-Slip Characteristic of an induction motor.
12. Generator operation of an induction machine driven at super synchronous speed.
13. Synchronous Machine operating as a generator: stand-alone operation with a load Control of voltage through field excitation.
14. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Course Title						
Subject Code	**PROGRAMMING FOR PROBLEM SOLVING LABORATORY**	L	T	P	C	QP
BBSES1150		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To develop programs for problems on different applications of array, functions, pointers and structure.

CEO2: To analyze different problems by comparing and implementing in programming.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	To understand operating system and its simple commands, writing programs, compilation, debug and execution process.
CO2	To develop programs using loop controls, arrays and understand the complexity using different programs.
CO3	To develop programs using functions and recursive function by decomposing a problem and analyze them.
CO4	To understand numerical problems, develop programs using pointers , structures and understand their functionality.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	-	-	-	-	-	-	-	-	-			
CO2	3	3	3	1	-	-	-	-	-	-	-	-			
CO3	3	3	3	-	-	-	-	-	-	-	-	-			
CO4	3	3	3	1	-	-	-	-	-	-	-	-			
Avg.	3	2.5	2.75	1	-	-	-	-	-	-	-	-			

SYLLABUS

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

1) Introduction to OS: Before starting experiments explain the facilities and operations of OS.

2) Introduction to the C compiler, Compilation and Execution Process & writing simple programs.

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

1) WAP to input radius of a circle and Find the area, perimeter of it.

2) WAP to input two numbers and swap them without using intermediate variable.

3) Write a program to accept Fahrenheit and calculate its equivalent Celsius.

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

1) Write a program to input principle amount, no. of terms and rate of interest. Find simple interest.

2) WAP to input three unequal numbers and find the greatest using conditional operator.

3) Write a program to input a float value and display its integer part & fractional part separately.

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

1) Write a program to find the real roots of a quadratic equation when three co-efficient values are given.

2) Write a program to input a lower case alphabet and test whether it is vowel or consonant.

3) Write a program to find the greatest among three numbers.

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

1) Write a program to generate Fibonacci series of N numbers.

2) Write a program to find the greatest common divider of two positive numbers given.

3) Write a program to accept a positive integer and test it for palindrome or not.

4) Write a program to calculate the following sum:
Sum = 1-(x^2)/2! +(x^4)/4! – (x^6)/6! + (x^8)/8! – (x^10)/10!

5) Write a program to generate the following pyramid.

```
        1
      1 2 3
    1 2 3 4 5
  1 2 3 4 5 6 7
```

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

1) Write a program to accept 10 integers in to an array and find largest and smallest integers present in them.
2) Write a program to apply binary search on an array having elements in sorted order.
3) Write a program to accept 10 numbers in to an array and sort it using insertion sort in ascending order.

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

1) Write a program to input elements 4x4 matrix. Find the principal diagonal of them.
2) Write a program to input values into two matrices A(3x4), B(4x3). Perform matrix multiplication and display the resultant matrix.
3) Write a program to accept a string and test whether it is palindrome or not using string handling functions.

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

1) Write a C program which contains three UDF's namely add(), subtract() and multiply(). Each function accepts two integers as their arguments and calculate and return the results

2) Write a program to create an UDF and test a number is prime or not.

3) Write a program to find the factorial of a given number using UDF.

Tutorial 8: Recursion, structure of recursive calls

Lab 8: Recursive functions

1) Write a program to find greatest common divisor of two integers using recursive functions.

2) Write a program to accept 10 elements into an integer array. Find the largest element present using recursive function.

3) Write a program to generate Fibonacci series using a recursive function.

Tutorial 9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 9: Programming for solving Numerical methods problems

1) Write a program to implement Newton-Raphson Method.
2) Write a program to implement Euler's method.

Tutorial 10: Pointers, structures and dynamic memory allocation

Lab 10: Pointers and structures

1) Write a program to create user defined function called swap having two integer pointers as its arguments and it has no return value. Call this function using call-by-address.

2) Write a program to store 'n integers using dynamic memory allocation. Find the average value of the integers using a user defined function.

3) Write a program to input 11 cricket players' details using a structure array having member's player name, team name, batting average. Create a function which will display the player name whose batting average is >=30.

4) Write a program to create a structure for product having members like product code, price and quantity. Store N product details using dynamic memory and display them.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

4. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
5. *E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill*

Reference Books:

7. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Title						
Subject Code	**COMMUNICATIVE ENGLISH AND SOFT SKILLS LABORATORY**	L	T	P	C	QP
BBSHS1160		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To develop the vocabulary and usage skills of students by practice.

CEO2: To develop the communication skills of the students, especially the Listening and Speaking skills.

CEO3: To enable students to participate in group discussions through proper listening and speaking.

CEO4: To enable students eliminate grammatical mistakes in speech and writing.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Build up a good range of vocabulary and know proper usage.
CO2	Become active listeners with good comprehension, participation, and evaluation.
CO3	Use grammar for effective speaking in GD and other formats of speaking.
CO4	Develop active listening and speaking skill in different real life situation
CO5	Eliminate stage fear and disfluencies.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	-	2	-	-			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	-	2	-	-			
CO5	-	-	-	-	-	-	-	-	-	2	-	-			
Avg.	-	-	-	-	-	-	-	-	-	2	-	-			

SYLLABUS

Phonetics & Listening Skills 16 hours = 8 classes [2 listening tests x 10 marks = 20 marks]

Vowels, diphthongs, consonants, consonant clusters; The International Phonetic Alphabet (IPA); phonemic transcription; Problem sounds; Syllable division and word stress; Sentence rhythm and weak forms; Contrastive stress in sentences to highlight different words; Intonation: falling, rising, and falling-rising tunes; Listening to Newspaper reading/Video, etc.

Listening with a focus on pronunciation (ear-training): segmental sounds, stress, weak forms, intonation & Listening for comprehension. Reading of English daily newspapers and self-development books be integrated listening and speaking activities.

Speaking skills 16 hours = 8 classes [4 speaking tests x 10 = 40 marks]

- Topics for 1 minute, 2 minutes, and 5 minutes speaking
- Pictures, Quotations, Attitude-testing Questions may be used.
- Summarizing/responding to handouts, articles, books, magazines and newspapers.
- Individual/Group presentations/discussion on given topics

Soft skills development 14 hours = 7 classes [4 assignments x 10 = 40 marks]

- Positive thinking (Teachers to engage game/activity-oriented classes)

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text / Reference Books:

1. Form and Finesse, Business Communication and Soft skills by Shruti Das, Published by Orient Black Swan.
2. Business and Corporate Soft skills developed by Rai Tech. University (PDF available)
3. *Spoken English* (with CD). Sasikumar V and P V Dhamija. New Delhi: Tata McGraw-Hill Education Pvt. Ltd. (2nd Ed.)

Course Title						
Subject Code	**ENGINEERING DRAWING**	L	T	P	C	QP
BBSES1171		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To enable students to acquire and use engineering drawing skills as a means of accurately and clearly communicating ideas, information and instructions.

CEO2: To enable students to acquire requisite knowledge, techniques and attitude required for advanced study of engineering drawing.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Demonstrate the views of different solid object.
CO2	Construct projection of plane surface and solids.
CO3	Develop Sections of various Solids surface.
CO4	Identify the projection in isometric scale.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	1	-	-	-	-	-	1	3	-			
CO2	1	-	1	3	-	-	-	-	-	2	1	-			
CO3	-	-	-	1	-	-	-	-	-	3	-	-			
CO4	-	-	-	1	-	-	-	-	-	3	-	-			
Avg.	2	-	1	1.5	-	-	-	-	-	-	2	-			

SYLLABUS

Unit 1

1. Introduction: Introduction to Standards for Engineering Drawing practice, Line work and Dimensioning. [1 – Sheets]
2. Co ordinate system and reference planes: Definitions of HP, VP, RPP & LPP. Selection of drawing size and scale. Representation of point and line. [1 – Sheets]

Unit 2

3. Orthographic Projections : Introduction, Definitions Planes of projection, reference line, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only),True and apparent lengths, True and apparent inclinations to reference planes. [1 – Sheets]
4. Orthographic Projections of Plane Surfaces (First Angle Projection Only): Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, hexagon and circle. [1 – Sheets]
5. Projections of Solids (First Angle Projection Only): Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, cylinders and cones in different positions. [1 sheet]

Unit 3

6. Sections and Development of Lateral Surfaces of Solids : Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. [2 – Sheets]

Unit 4

7. Isometric Projection (Using Isometric Scale Only): Introduction, Isometric scale, Isometric projection of tetrahedron, cones and spheres. [1 – Sheets]

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Engineering Drawing N.D. Bhatt & V.M. Panchal, Charotar Publishing House, Gujarat.
2. Computer Aided Engineering Drawing S. Trymbaka Murthy, I.K. International Publishing House Pvt. Ltd., New Delhi
3. Engineering Drawing by N. S. Parthasarathy and Vela Murali Oxford University Press.

Course Title						
Subject Code	**ENGINEERING WORKSHOP**	L	T	P	C	QP
BBSES1172		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To enable students to work on different trades like Fitting, Carpentry, Black smithy etc… which makes the students to learn how various joints are made using wood and other metal pieces.

CEO2: To familiarize with the basic manufacturing processes and to study the various tools and equipment used, hands on training is given in different sections.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Explain various safety precaution and use of various hand tools.
CO2	Demonstrate the process configuration and basic mechanism of different machines like Lathe, Shaper and Milling machine.
CO3	Identify and apply suitable tools for machining processes including turning, thread cutting, facing, knurling and drilling.
CO4	Practice on manufacturing of components using workshop trades including fitting and welding.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	2	-	1	1	-	-	1	-	1			
CO2	2	-	-	1	-	-	-	-	-	1	-	1			
CO3	1	-	-	1	-	1	-	-	-	1	-	1			
CO4	2	-	-	2	-	-	-	-	-	1	-	1			
Avg.	1.75	-	-	1.5	-	1	1	-	-	1	-	1			

SYLLABUS

Unit 1

1. Safety Precaution: To study the various Safety precautions in workshop.
2. Fitting :

(i) Study of different hand tools and Machine tools used in fitting.
(ii) Preparation of a male and female fitting job by using different hand tools.

Unit 2

3. Machining:

(i) Study of various components and working principle of lathe machine
(ii) Preparation of a cylindrical job by lathe (turning, Thread cutting, knurling)
(iii) Study on Shaper and Milling Machine

Unit 3

4. Welding Practice :

(i) Hand on practice on Electric Arc Welding to prepare Lap Joint, Butt Joint, T Joint and Corner Joint.

(ii) Study of Oxyacetylene Gas welding and Gas cutting.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Elements of Workshop Technology, Vol. I and II by Hajra choudhary, Khanna Publishers
2. Workshop Technology by WAJ Chapman, Viva Books
3. Workshop Manual by Kannaiah / Narayana, Scitech Publicaitons(P) Ltd.

Course Title						
Subject Code	**ENGINEERING MATHEMATICS-II**	L	T	P	C	QP
BBSBS 2010		**3**	**1**	**0**	**4**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To focus on partial derivative and its methods.

CEO2: To make them understand about laplace and fourier transform.

CEO3: To calculate the gradients and directional derivatives of functions of several variables.

CEO3: To introduce the concept of Vector differentiation and integration that finds applications in various fields like solid mechanics, fluid flow, heat problems and potential theory.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	To know how to solve the partial differential equation by suitable method.
CO2	I. To Solve Ordinary differential and integral equation by using Laplace transform, II. Execute the technique of Fourier Integral and transform for learning in advanced Engineering Mathematics.
CO3	To relate gradient, curl and divergence and its application in fluid dynamics.
CO4	To evaluate multiple integrals by using Green's, Stokes' and divergence theorem to give physical interpretation of the curl and divergence of a vector field .

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	2	3	-	-	-	-	-	-	-	-	-	-			
CO3	1	3	-	-	-	-	-	-	-	-	-	-			
CO4	2	3	-	-	-	-	-	-	-	-	-	-			
Avg.	2	2.75	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT - I (07 Hours)

Introduction of Partial Differential Equations: Formation of Partial differential equations, Linear partial differential equation of first order:Lagrange's linear differential equation, Non-Linear partial differential equation of first order by Charpit's method.

UNIT-II(20 Hours)

Laplace Transforms: Definition, existence of Laplace Transforms, Properties of Laplace Transforms, Evaluation of integrals by Laplace Transforms, Inverse transforms, convolution theorem, transforms of unit step function, unit impulse function, periodic function. Simple application to ordinary differential equations by Laplace Transform method, Definition of Fourier Integral and Fourier transform

UNIT - III (10 Hours)

Vector Differential Calculus: vector and scalar functions and fields, Derivatives, Curves, tangents and arc Length, gradient, divergence, curl and their simple application.

UNIT - IV (13 Hours)

Vector Integral Calculus: Definition and evaluation of double integration and triple integration, Evaluation of line integral, Surface integral and volume integral and their applications, Transformations theorems- Green's Theorem in plane, Stoke's Theorem,Gauss Divergence Theorem and their applications.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Advanced Engineering Mathematics by E. Kreyszig, John Willey & Sons Inc. 10th Edition

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana , Mc Graw Hill Education.
2. Higher Engineering Mathematics by BS Grewal : Khanna Publishers, New Delhi.
3. Advanced Engineering mathematics by H. K. Dass.

Course Title						
Subject Code	**DATA STRUCTURES**	L	T	P	C	QP
BBSES2050		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Understand the object oriented concepts and to develop C++ programs for performing different operations on arrays, stack, Queue, linked list. Analyze the difference between them and understand different applications.

CEO2: Understand different searching and sorting methods and compare them in terms of performance and applications.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Develop algorithms for performing different operations on 1D array, matrix, stack, Queue, analyze the difference between them and understand different applications.
CO2	Understand different searching and sorting methods, Linked lists and them compare them in terms of performance and applications.
CO3	Understand the Binary Tree and its memory representation; analyze Binary search Tree and its applications, compare the BST with AVL Tree and examine the advantages.
CO4	Design Heap Tree, observe its applications in sorting. Understand the memory representation of graph; analyze traversal methods and applications of graph. Analyze the Hashing techniques in compare with other sorting techniques.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	3	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	3	-	-	-	-	-	-	-	-	-			
Avg.	2.75	2.5	3	-	-	-	-	-	-	-	-	-			

SYLLABUS

Unit I **[12 hours]**

Basic concepts: Data abstraction, Algorithm specification, Memory Representation of 1D and 2D Array. Stack: Introduction to stack, basic operations and implementation of stack using arrays Queue: Introduction to linear queue, basic operations and implementation of linear queue using arrays, circular queue, basic circular queue operations& Representation of Double ended Queue. Applications on stack – Recursion, infix to postfix conversion, Evaluation of postfix

Unit II **[12 hours]**

Searching: Linear search and Binary search using linear array

Sorting: Bubble sort, Insertion sort, Selection sort, Quick sort, Bucket Sort using linear array.

Linked Lists: Basic operations of singly, doubly and circular linked lists, implementation of stack and queue using singly linked list.

Unit III **[12 hours]**

Trees: Introduction, Terminology, Binary Trees, Representation of Binary Trees using arrays and linked lists, Binary tree traversals, Creation of binary tree from in-order & pre-order sequences - Creation of binary tree from in-order & post-order

Binary Search Trees: definition, basic operations of BST (Searching, Insertion and deletion)

Introduction to AVL trees, Height of an AVL Tree, Balancing AVL tree by rotations after insertions and deletions of a data node.

Unit IV **[12 hours]**

Heaps: Introduction to binary heaps, definition of a Max-heap, Min-heap, creating Max-Heap, Applications: Heap sort, Priority queue.

Graphs: Definitions, Graph representation - Adjacency matrix, Incidence Matrix, adjacency lists, Graph Traversals (BFS & DFS), Single source shortest path algorithm (Dijkstra's Algorithm) Topological Sorting.

Hashing: Hashing Functions, Open hashing (chaining), closed hashing (Open addressing – linear probing, quadratic probing, double hashing), rehashing.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Gilberg and Forouzan: "Data Structure- A Pseudo code approach with C" by Thomson Publication.
2. "Data structure in C" by Tanenbaum, PHI publication / Pearson publication.
3. Pai:"Data Structures & Algorithms; Concepts, Techniques & Algorithms" Tata McGraw Hill.

Reference Books:

1. "Fundamentals of data structure in C" Horowitz, Sahani & Freed, Computer Science Press.
2. "Fundamental of Data Structure" (Schaums Series) Tata-McGraw-Hill.

Course Title						
Subject Code	**COMMUNICATIVE ENGLISH AND TECHNICAL COMMUNICATION**	L	T	P	C	QP
BBSHS2060		**2**	**0**	**0**	**2**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To develop the communication skills and soft skills of the students	
CEO2: To enhance the ability of the students to develop employability and entrepreneurial skills	
CEO3: To enable students to successfully participate in GDs and PIs	
CEO4: To make students communicate effectively using technologies and techniques	
CEO5: To inculcate a sense of professionalism in students	

Course Outcomes

At the end of this course students will be able to demonstrate the ability to	
CO1	Understand the importance of technology in communication.
CO2	Develop career conscious leading to preparation for career.
CO3	Inculcate a positive attitude towards people, organization, and life.
CO4	Understand the nature and scope of corporate communication and try to be industry-ready.
CO5	Learn practical application of concepts and tools of communication.
CO6	Prepare professional documents for career needs (e.g. Job application letter, résumé) and professional needs (e.g., Memo and E-mail writing)

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	-	2	-	-			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	1			
CO4	-	-	-	-	-	-	-	-	-	2	-	-			
CO5	-	-	-	-	-	-	-	-	-	2	-	-			
CO6	-	-	-	-	-	-	-	-	-	2	-	-			
Avg.	-	-	-	-	-	-	-	-	-	2	-	1			

SYLLABUS

UNIT 1 Introduction to Technical Communication 7 hours

1.1 Essence of Technical Communication 1

1.2 Nature and Scope of Technical Communication: 1 +1 +1

Technical Communication -- Interactive and Adaptable; Technical Communication -- Reader Centered; Technical Communication and teamwork; Technical Communication Has Ethical, Legal, and Political Dimensions; Technical Communication – its International and Cross-Cultural nature; Technical communication and use of ICT.

1.3 Need of Technical communication for career development 1

1.4 Computer Assisted Language Learning (CALL) – Self learning through use of technology, Effectiveness of CALL for developing English Language Skills; Use of Internet 1 +1

UNIT 2 Career Communication 17 hours

2.1. Career making: Setting Goals, SWOT analysis 1

2.3 Preparing a Résumé: Elements of a Résumé; Types of Résumés: Chronological Résumé, Functional Résumé; Use of job portals 1 +1 +1

2.4 Effective Job Application Letter/Cover letter 1 +1

2.5 Group Discussion 1 +1

2.6 Job Interview 1 +1 +1+1 +1

2.7 Effective Oral Presentation 1+1

2.7 Handling a Meeting 1+1

UNIT 3 Technical Approach to Reading 8 Hours

3.1 Know your Reading speed; Advantages of speed reading 1

3.2 SQ4R Techniques of Reading 1+1

3.3. Techniques of Rapid reading: skimming, scanning 1+1

3.4 Understanding coherence and cohesion 1

3.5 Note taking, Mind maps 1+1

UNIT 4 Technical Writing 14 hours

4.1 Writing a technical paper 1+1

4.2 Writing business letters – significance, purpose, structure and elements, layout; types of business letters 1+1+1+1

4.3 Memos 1+1

4.4 Business Reports and Technical proposals 1+1+1+1

4.5 Using the Social media for better communication 1+1

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Form and Finesse, Business Communication and Soft skills by Shruti Das, Published by Orient Black Swan.
2. *Business Communication Today* by Bovee, Courtland L., Thill, John V. Prentice Hall.
3. *Technical Communication Today* by Richard Johnson-Sheehan. Edition 5. Pearson.
4. *Communicative English for Engineers and Professionals* by Nitin Bhatnagar and Mamta Bhatnagar. Published by DK/Pearson.

Reference Books:

1. *Basic Communication Skills for Technology* by Andre J. Rutherford, Pearson Education Asia, Patparganj, New Delhi.
2. *Business Communication* by Varinder Kumar and Bodh Raj. Kalyani Publishers.
3. *A Textbook of English Phonetics for Indian Students* by T. Balasubramanian
4. *Technical Communication , Principle and Practice* by Meenakshi Raman &Sangeeta Sharma, Oxford University Press
5. *How to Read better and Faster* by Norman Lewis. 4th Edition. Publisher: Crowell.

Course Title						
Subject Code	**DATA STRUCTURES USING 'C++' LABORATORY**	L	T	P	C	QP
BBSES2150		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Develop algorithms for performing different operations on arrays, stack, Queue, linked list. Analyze the difference between them and understand different applications.

CEO2: Understand different searching and sorting methods and compare them in terms of performance and applications. Understand and analyze Binary search Tree, AVL Tree, Heap Tree and their applications.

CEO3: Understand the memory representation of graph, its traversal methods and applications. Analyze the Hashing techniques in compare with other sorting techniques.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand and implement the object oriented concepts by in developing the programs for different operations.
CO2	Develop programs for performing different operations on 1D array, matrix, stack, Queue, analyze the difference between them and understand their applications.
CO3	Design code for different searching and sorting methods and analyze their performance.
CO4	Develop the codes for different operations on Linked lists and compare with other data structures.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	3	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	3	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	3	-	-	-	-	-	-	-	-	-			
Avg.	2.75	2.5	3	-	-	-	-	-	-	-	-	-			

SYLLABUS

Lab1: Introduction to OOPs (C++ features), cin, cout, object, class, Simple programs.

Lab2: Access Specifiers, inline, private, public, arrays of objects, programs on them.

Lab3: Experiment No.1

Write a C++ program to create a class called student to store your rollno, name, age. Create an array of object to input 5 students data and then display where age>=20.

Write a C++ program to create a class having methods for operations insertion, deletion and display to perform operations on 1D array of elements.

Lab4: Experiment No.2

Write a C++ program to create a class having methods: insertion, multiply and display for

performing multiplication on a matrix of elements.
Lab5: Experiment No.3 Write a program using C++ to create a stack using class and perform: (i) push operation (ii) pop operation (iii) display operation
Lab6: Experiment No.4 Write a C++ program that uses Stack operations to converting an infix expression into equivalent postfix expression.
Lab7: Experiment No.5 Write a C++ program to create a linear queue and perform the following operations: (i) insertion ii) deletion and iii) Traversal
Lab8: Experiment No.6 Write C++ programs that use both recursive and non-recursive functions to perform the linear & binary searchoperation for a Key value in a given list of integers.
Lab9: Experiment No.7 Write a C++ menu driven program to implement bubble sort, selection sort and insertion sort for a given list of integers in increasing order.
Lab10: Experiment No.8 Write a C++ program to implement quick sort to a given list of integers to sort in ascending order.
Lab11: Experiment No.9 Write a C++ program that uses functions to perform the following operations on linear linked list: i) Creation ii) Insertion iii) Deletion iv) Traversal
Lab12: Experiment No.10 Write a C++ program that uses functions to perform the following operations on Double linked list: i) Creation ii) Insertion iii) Deletioniv) Traversal.

Course Title						
Subject Code	**COMMUNICATIVE ENGLISH AND TECHNICAL COMMUNICATION LABORATORY**	L	T	P	C	QP
BBSHS2160		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To enable students to successfully participate in GDs and PIs

CEO2: To make students communicate effectively by classroom practice.

CEO3: To inculcate a sense of professionalism in students

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Prepare professional documents for career needs (e.g. Job application letter, résumé) and professional needs (e.g., Memo and E-mail writing)
CO2	Effectively participate in GD and PI.
CO3	Emerge as an effective presenter/public speaker
CO4	Understand the practical needs at workplace (e.g., organize a meeting)

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	-	-	2	-	-			
CO2	-	-	-	-	-	-	-	-	-	2	-	-			
CO3	-	-	-	-	-	-	-	-	-	2	-	-			
CO4	-	-	-	-	-	-	-	-	-	2	-	-			
Avg.	-	-	-	-	-	-	-	-	-	2	-	-			

SYLLABUS

1. Writing an Effective Job Application Letter/Cover letter 4 hours
2. Writing a winning resume and posting in job portals 4 hours
3. Group Discussion 8 hours
4. Job Interview 8 hours
5. Oral presentation 6 hours
6. Organizing a Meeting 4 hours
7. Note making and Note taking 4 hours
8. Memo writing 2 hours
9. Profiling a company 4 hours
10. 10. Summarizing books/research paper/news report 2 hours

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Form and Finesse, Business Communication and Soft skills by Shruti Das, Published by

Orient Black Swan.
2. *Business Communication Today* by Bovee, Courtland L., Thill, John V. Prentice Hall.
3. *Technical Communication Today* by Richard Johnson-Sheehan. Edition 5. Pearson.
4. *Communicative English for Engineers and Professionals* by Nitin Bhatnagar and Mamta Bhatnagar. Published by DK/Pearson.

Reference Books:

1. *Basic Communication Skills for Technology* by Andre J. Rutherford, Pearson Education Asia, Patparganj, New Delhi.
2. *Business Communication* by Varinder Kumar and Bodh Raj. Kalyani Publishers.
3. *A Textbook of English Phonetics for Indian Students* by T. Balasubramanian
4. *Technical Communication , Principle and Practice* by Meenakshi Raman &Sangeeta Sharma, Oxford University Press
5. *How to Read better and Faster* by Norman Lewis. 4th Edition. Publisher: Crowell.

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

III SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	BS	BBSBS3010	Engineering Mathematics-III	3	1	0	4
2	PC	BECPC3020	Analog Electronic Circuits	3	0	0	3
3	PC	BELPC3030	Network Theory	3	0	0	3
4	PC	BEIPC3040	Electrical and Electronic Measurements	3	0	0	3
5	ES	BCSES3050	Object Oriented Programming through JAVA	3	0	0	3
6	BS / HS	BBSBS3061	Environmental Engineering and Safety	3	0	0	3
		BMSHS3062	Engineering Economics and Costing				
PRACTICAL / SESSIONAL							
7	PC	BECPC3120	Analog Electronic Circuits Laboratory	0	0	2	1
8	PC	BELPC3130	Network and Devices Laboratory	0	0	2	1
9	PC	BEIPC3140	Electrical and Electronic Measurements Laboratory	0	0	2	1
10	ES	BCSES3150	JAVA Programming Laboratory	0	0	2	1
TOTAL				**18**	**1**	**8**	**23**

Course Title							
Subject Code	**ENGINEERING MATHEMATICS-III**	L	T	P	C	QP
BBSBS3010		**3**	**1**	**0**	**4**	**H**

Pre-Requisites (If any):

Course Educational Objectives

CEO1: Apply the fundamental concepts of Ordinary Differential Equations and Partial Differential Equations and the basic numerical methods for their resolution. 2. 3.

CEO2: Solve the problems choosing the most suitable method.

CEO3: Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution.

CEO4: Use computational tools to solve problems and applications of Ordinary Differential Equations and Partial Differential Equations.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	To execute the technique of series for solving ordinary differential equation.
CO2	To Evaluate a contour integral using Cauchy's integral formula and to Compute singularities and also the residues.
CO3	To apply numerical methods in Engineering Mathematical Problems.
CO4	Partial differential equations and their applications.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	2	-	1	-	-	-	-	-			
CO2	2	2	-	-	1	-	-	-	-	-	-	-			
CO3	2	-	-	-	1	-	-	-	-	-	-	2			
CO4	2	-	-	-	2	-	-	-	-	-	-	2			
Avg.	2.25	2	-	-	2.5	-	1	-	-	-	-	2			

SYLLABUS

Unit:1 SPECIAL FUNCTIONS : (12 hours)

Beta and Gamma functions, relation between Beta and Gamma functions, Error function, Series solution of differential equations (up to second order), Legendre equation, Legendre polynomials and their properties, Bessel's function.

Unit:2 Complex Analysis: (12 hours)

Analytic function, Cauchy-Riemann equations, Laplace equation, Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

Unit:3 (12 hours)

Taylor's series, Laurent's series, Singularities and zeros, Residue integration, evaluation of real integrals.

Unit:4 Numerical methods: (14 Hours)

Approximation and round of errors, Roots of equation: fixed point iteration, the Newton-Raphson method. Interpolation: Lagrange Interpolation,Newton divided difference interpolation, Newton's forward and backward interpolation. Numerical Differentiation, Numerical integration:

The trapezoidal rule, The Simpson's rules, Ordinary differential equation: Euler's method, modified Euler's method.
Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.
Text Books: 1. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India 2. Numerical method for Engineers by M. K. Jain and Iyenger.
Reference Books: 1. Higher Engineering Mathematics by B S Grewal : Khanna Publishers, New Delhi. 2. Numerical Analysis by Dutta and Jena

Course Title						
Subject Code	**ANALOG ELECTRONIC CIRCUITS**	L	T	P	C	QP
BECPC3020		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: A student should have basic idea on electronic components and also should have clear concept on KCL & KVL.

Course Educational Objectives

CEO1: Prepare the students to perform the analysis of analog electronic circuits.

CEO2: Empower the students to understand the design and working of different types of amplifiers.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand and analyze the mathematical models of the transistor for circuits.
CO2	Design and analyze various amplifier circuits.
CO3	Calculate the effect of low & high frequency response and gain-bandwidth relationship of amplifier circuits.
CO4	Design and examine various oscillators.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	1	-	3	2	-	-	-	-	-	-	-	-			
CO3	2	2	-	-	-	-	-	-	-	-	-	-			
CO4	-	-	3	2	-	-	-	-	-	-	-	-			
Avg.	2	2	3	2	-	-	-	-	-	-	-	-			

SYLLABUS

MODULE-I **(12 Hours)**

1. **Biasing of BJTs:** Introduction; Operating Point; Fixed Bias; Emitter Bias; Voltage-Divider Bias; DC Bias with Voltage Feedback; Miscellaneous Bias Configurations; Design Operations; Bias Stabilization. (4 Hours)
2. **Field-Effect Transistors:** Introduction; Basic Construction, Operation and Characteristics of JFETs and MOSFETs; CMOS. (4 Hours)
3. **Biasing of FETs:** Fixed-Bias Configuration; Self-Bias Configuration; Voltage-Divider Biasing; Design. (4 Hours)

MODULE-II **(12 Hours)**

4. **Small Signal Analysis of BJTs:** BJT Transistor Modeling; The re Transistor model; The Hybrid Equivalent Model: Small-Signal Analysis of CE, CB, and CC Amplifiers; Emitter Follower Configuration; Effect of RL and RS; Two-Port Systems Approach; Cascaded Systems; Darlington Connection; Current Mirror Circuits. (6 Hours)
5. **Small Signal Analysis of FETs:** FET Small-Signal Model, Small-Signal Analysis of CS, CD, CG Amplifiers. Effect of RL and Rsig; Cascade Configuration. (6 Hours)

MODULE-III **(5 Hours)**

3. **Frequency Response of BJTs and FETs:** Low and High Frequency Response of BJTs and FETs; Frequency Response of CE Amplifier; Frequency Response of CS Amplifier; Miller Effect Capacitance; Multistage Frequency Effects; Square Wave Testing. (5 Hours)

MODULE-IV **(12 Hours)**

7. **Operational Amplifiers:** Differential Amplifier Circuit; Op-Amp Basics; Practical Op-Amp Circuits; Op-Amp Parameters; Op-Amp Applications; Instrumentation Amplifier; Active Filters. (5 Hours)
8. **Power Amplifiers:** Classifications; Class-A and Class-B Amplifier Circuits, Transfer Characteristics, Power Dissipation and Conversion Efficiency of Power Amplifiers.(3 Hours)
9. **Feedback Amplifiers and Oscillators:** Feedback Concepts; Feedback Connection Types; Practical Feedback Circuits; Feedback Amplifier Stability using Nyquist Plot; Basic Principle of Sinusoidal Oscillator; Phase-Shift, Wien-Bridge and Crystal Oscillator. (4 Hours)

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books :

1. Electronic Devices and Circuit Theory, R. L. Boylestad and L. Nashelsky, Pearson Education, New Delhi, 9th/10th Edition, 2013. (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14)
2. Milliman's Electronics Devices and Circuits, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2nd Edition, 2008.
3. Microelectronics Circuits, 5th Edition, International Student Edition Sedra and Smith, Oxford University Press, New Delhi.

Reference Books:

1. Electronic Devices and Circuits, 3rd Edition, Jimmie J. Cathey adapted by Ajay Kumar Singh, Tata McGraw Hill Publishing Company Ltd., New Delhi.
2. Electronics Circuits Analysis and Design, 3rd Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Microelectronic Circuits: Analysis and Design, India Edition, M.H. Rashid, PWS Publishing Company, a division of Thomson Learning Inc.

Course Title						
Subject Code	**NETWORK THEORY**	L	T	P	C	QP
BELPC3030		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Prepare the students to have a basic knowledge in the analysis of Electric Networks.

CEO2: Solve the given circuit with various theorems and methods.

CEO3: Analyse the various three phase circuit's star and delta connections.

CEO4: Distinguish between tie set and cut set methods for solving various circuits.

CEO5: Design various types of filters.

CEO6: Relate various two port parameters and transform them.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Articulate in working of various components of a circuit.
CO2	Familiar with ac and dc circuits solving.
CO3	Ready with the most important concepts like mesh and nodal analysis.
CO4	Solve Circuits using Tree, Node, Branch, Cut set, Tie Set Methods.
CO5	Measure Three phase voltages and current, active, reactive powers.
CO6	Convert Three phase Star to Three phase Delta circuits and Vice-Versa.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	-	-	-	-	-	-	-	-	-			
CO2	2	2	1	-	-	-	-	-	-	-	-	-			
CO3	2	2	1	-	-	-	-	-	-	-	-	-			
CO4	1	1	2	-	-	-	-	-	-	-	-	-			
CO5	1	1	2	-	-	-	-	-	-	-	-	-			
CO6	1	1	1	-	-	-	-	-	-	-	-	-			
Avg.	1.5	1.5	1.33	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **11 Hours**

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's Theorem, Reciprocity Theorem, Maximum Power transfer theorem, Tellegen's theorem, Millman's theorem, Compensation theorem.

Coupled Circuits: Coupled Circuits, Dot Convention for representing coupled circuits, Coefficient of coupling. Resonance: Band Width and Q-factor for series and parallel resonant circuits.

UNIT:2 **09 Hours**

Laplace Transform & its Application: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Application of Laplace transform: Circuit Analysis (Steady State and Transient).

Two Port Network Functions& Responses: z, y, ABCD and h-parameters, Reciprocity and Symmetry, Interrelation of two-port parameters, Interconnection of two-port networks. Network Functions: Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time

domain behavior from Pole-Zero plots.

UNIT:3 Fourier Series **08 Hours**

Fourier Series& its Application: Fourier series, Fourier analysis and evaluation of coefficients, Steady state response of network to periodic signals, Fourier transform and convergence, Fourier transform of some functions.

Passive Filter: Brief idea about network filters (Low pass, High pass, Band pass and Band elimination) and their frequency response

UNIT:4 **10 Hours**

Network Synthesis: Realizability concept, Hurwitz property, positive realness, properties of positive real functions, Synthesis of R-L, R-C and L-C driving point functions in Foster and Cauer forms.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Fundamentals of Electric Circuits – Alexander & Sadiku – Tata McGraw Hil, 5th Editionl.
2. Circuits & Networks: Analysis, Design and Synthesis- Sukhija & Nagsarkar- Oxford

Reference Books:

1. *Network Analysis – M E Van Valkenburg – Pearson Education, 3rd Edition.*
2. *Network Synthesis – M E Van Valkenburg – Pearson Education.*
3. *Network Analysis and Synthesis – Franklin F. Kuo – Wiley Student Edition.*
4. *Linear Circuits Analysis and Synthesis – A Ramakalyan – Oxford University Press.*
5. *Problems & Solutions in Electric Circuit Analysis – Sivananda & Deepa – JaicoBook.*
6. *Theory and problem of electrical circuits, Schaum's Outline Series, TMH – Joseph A.Edminister, MahmoodMaqvi.*
7. *Electric Circuits – David A.Bell – Oxford, 7th Edition, 2015.*

Course Title						
Subject Code	**ELECTRICAL AND ELECTRONIC MEASUREMENTS**	L	T	P	C	QP
BEIPC3040		**3**	**0**	**0**	**0**	**H**

Pre-requisites *(if any)*: Measurement, instruments and fundamental electrical parameters.

Course Educational Objectives

CEO1: To impart students the skill technically employing different types of meter.

CEO2: To prepare students for monitoring, analyzing and calibrating any physical system.

CEO3: To provide students knowledge of practicing modern tools for implementing electrical and electronics projects.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define the various performance characteristics and find electrical phenomena's like R, L and C of a measurement system.
CO2	Demonstrate the operation and utilization of various electrical instruments.
CO3	Evaluate and experiment with the flow of current, power & electrical energy consumption, frequency and power factor for any physical system.
CO4	Classify and analyze different kinds of transformers and analyzers.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	2	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	1	-	2	-	-	-	-	-	-	-	-			
CO4	3	2	-	-	-	-	-	-	-	-	-	-			
Avg.	3	1.75	-	2	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(11 Hours)**

INTRODUCTION: Measurement, Static characteristics- Accuracy, Precision, Significant Figures, Resolution, sensitivity, linearity and error, Types of Errors. Classification of Standards, IEEE Standards.

MEASUREMENT OF RESISTANCE: Measurement of Low Resistance by Kelvin's Double Bridge, Measurement of Medium Resistance by Wheatstone bridge, ammeter-voltmeter and substitution method, Measurement of High Resistance by loss of charge and Megger method, Measurement of Insulation Resistance when Power is ON, Measurement of Resistance of Earth Connections.

MEASUREMENT OF INDUCTANCE: Measurement of Self Inductance by Ammeter and Voltmeter method and AC Bridges(Maxwell's, Hay's, & Anderson Bridge), Measurement of Mutual Inductance by Felici's Method, and as Self Inductance.

MEASUREMENT OF CAPACITANCE*:* Measurement of Capacitance by Ammeter and Voltmeter and AC Bridges (Owens's, Schering), Wein's bridge, Screening of Bridge Components and Wagner Earthing Device.

UNIT:2 **(15 Hours)**

GALVANOMETER: Construction, Theory, Principle of operation and constants of D'Arsonval

galvanometer, Influence of Resistance on Damping, Logarithmic decrement Construction, Theory and Principle of operation of Vibrational galvanometer, Construction, theory, Principle of operation and calibration of Ballistic Galvanometer, Measurement of Flux.
AMMETER and VOLTMETER: Construction, Theory, Principle of operation of PMMC, MI (attraction and repulsion types), Electro Dynamometer.
POTENTIOMETER: Construction, Theory and Principle of operation of DC Potentiometer (Crompton), Construction, Theory and Principle of operation of AC Potentiometer (Drysdale-Tinsley)

UNIT:3 **(8 Hours)**
MEASUREMENT OF POWER: Measurement of single phase and three phase power by wattmeter, Construction, Theory and Principle of operation of Electro-Dynamometer and Induction type Watt meters.
MEASUREMENT OF ENERGY: Single Phase Watt-hour meter.
MEASUREMENT OF FREQUENCY: Electrical resonance and ratio meter type frequency meter.
MEASUREMENT OF POWER FACTOR: Single Phase power factor meter.

UNIT:4 **(6 Hours)**
CURRENT TRANSFORMER and POTENTIAL TRANSFORMER: Construction, Theory, Characteristics of CT, PT, Q-meter.
COUNTERS & ANALYZERS: Introduction to Wave, Harmonic Distortion and Spectrum Analyzers, Frequency Counters, Testing an Audio Amplifier.

Teaching Methods: Chalk & Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Electrical Measurements and Measuring Instruments – Golding &Widdis – 5th Edition, Reem Publication.
2. Modern Electronic Instrumentation and Measurement Techniques – Helfrick& Cooper – Pearson.

Reference Books:

1. A Course in Electrical and Electronic Measurements and Instrumentation – A K Sawhney – Dhanpat Rai & Co.
2. Electronic Instrumentation – H C Kalsi – 2nd Edition, Tata McGraw Hill.

Course Title						
Subject Code	**OBJECT ORIENTED PROGRAMMING THROUGH JAVA**	L	T	P	C	QP
BCSES3050		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism

CEO2:Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections

CEO3: How to take the statement of a business problem and from this determines suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.

CEO4: How to test, document and prepare a professional looking package for each business project using javadoc.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Students will be able to map real world problems into the Programming language with oop features and Implement object oriented principles for reusability.
CO2	Students will be able to write programs using basic data types and strings, using loops, Array.
CO3	Student will be able to Assign priorities and resolve run-time errors with Multithreading and Exception Handling techniques
CO4	Students will be able to Interpret Events handling techniques for interaction of the user with GUI and Develop client/server applications using socket programming

Course Outcomes

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	2	-	-	-	-	-	-	-	-	-			
CO3	2	2	2	-	-	-	-	-	-	-	-	-			
CO4	2	1	2	-	-	-	-	-	-	-	-	-			
Avg.	2.5	2.5	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(12 Hours)**

An introduction Object Oriented Programming, Features of Object Oriented Programming Introduction to Java. Difference between C/C++ and Java, Features of Java, First Java Program, Writing the java program, Compiling the program, JVM and its significance in executing a program?, Architecture of JVM. Understanding, Java Tokens, Datatypes, Operators, Control Structures and Arrays, Conditional Statements, Loops/ Iterators, Jumping Statements, Java Arrays, Multidimensional Arrays, Taking Input from keyboard, Command Line Arguments, Using Scanner Class, Using Buffered Reader class.

UNIT:2 **(14 Hours)**

Introduction to Classes and Objects. Constructors, static Keyword, this Keyword, Array of Objects, Access Modifiers (Public, Private, Protected, Default). Inheritance, Types of Inheritance

and Java supported Inheritance, super, Polymorphism, Method Overloading, Constructor Overloading, Method Overriding, Dynamic Method Dispatching. String Manipulations. Wrapper classes, Auto boxing and unboxing. Abstract classes, Interfaces, Multiple Inheritance Using Interfaces,

Java API Packages, User-Defined Packages, Accessing Packages, Error and Exception Handling, Types of exceptions Hierarchy of Exception classes, try, catch, finally, throw, throws, Commonly used Exceptions and their details ,User defined exception classes.

UNIT:3 (**14 Hours**)

Multithreading, Thread in Java, Thread execution prevention methods. (yield(), join(), sleep()), Concept of Synchronization, Inter Thread Communication, Basics of Deadlock, Demon Thread, Improvement in Multithreading, Inner Classes, Introduction, Member inner class, Static inner class, Local inner class, Anonymous inner class.

IO Streams (java.io package) , Byte Stream and Character Stream, Files and Random Access Files, Serialization, Collection Frame Work (java.util), Util Package interfaces, List, Set, Map.

UNIT:4 **(14 Hours)**

Applet Introduction, Life Cycle of an Applet, GUI with an Applet, Abstract Window Toolkit (AWT), Introduction to GUI, Description of Components and Containers, Component/Container hierarchy, Understanding different Components/Container classes and their constructors, Event Handling, Different mechanisms of Event Handling, Listener Interfaces, Adapter classes.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Programming in Java. Second Edition. Oxford Higher Education. (Sachin Malhotra/ Saurav Choudhary)
2. Core Java For Beginners. (Rashmi Kanta Das), Vikas Publication

Reference Books:

1. JAVA Complete Reference (9th Edition) Herbalt Schelidt

Course Title						
Subject Code	**ENVIRONMENTAL ENGINEERING AND SAFETY**	L	T	P	C	QP
BBSBS3061		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1	The course introduces the students to the environmental consequences of industries
CEO2	To provide minimization of their impacts through technology and legal systems.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Students will understand the ecological system of environment.
CO2	They will learn about treatment of water/waste water
CO3	Students should know about cause and remedies of environment pollution and technological approaches
CO4	They will understand the importance of environmental safety.

CO - PO & PSO Matrix

CO	PROGRAMME OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	2	-	1	1	-	-	1	-	1			
CO2	2	-	-	1	-	-	-	-	-	1	-	1			
CO3	1	-	-	1	-	1	-	-	-	1	-	1			
CO4	2	-	-	2	-	-	-	-	-	1	-	1			
Avg.	1.75	-	-	1.5	-	1	1	-	-	1	-	1			

SYLLABUS

UNIT :1 **(10 Hours)**

Ecological Concepts: Biotic components, Ecosystem Process: Energy, Food Chain, Water cycle, Oxygen cycle, Nitrogen cycle etc., Environmental gradients, Tolerance levels of environment factors, Indian Environmental Law. Chemistry in Environmental Engineering: Atmospheric chemistry, Soil chemistry. Biodiversity and its conservation

UNIT:2 **(12 Hours)**

Water Treatment: water quality standards and parameters, DO and BOD of water. Water treatment processes: Pre-treatment of water, Conventional process, and Advanced water treatment process.

Waste Water Treatment: pretreatment, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.

Air Pollution: Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change –greenhouse gases, non-criteria pollutants, Air pollution meteorology, and Atmospheric dispersion. Industrial Air Emission and Control. Flue gas desulphurization, NOx removal, Fugitive emissions. Noise pollution- Noise standards, measurement and control.

UNIT:3 **(10 Hours)**

Solid Waste Management: Source, classification and composition of MSW, Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous Waste Management: Hazardous waste and their generation, Treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing.

UNIT:4 **(12 Hours)**

Occupational Safety and Health Acts, Safety procedures, Type of Accidents, Chemical and Heat Burns, Prevention of Accidents involving Hazardous substances, Human error. Hazard Control Measures in steel industry, Petroleum Refinery, Pharmaceutical industry. Fire Prevention - Detection, Extinguishing Fire safety, Handling and Storage of Hazardous Materials. Personal Protective Equipments.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Book:

1. Environmental Engineering, Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack
3. Environmental Engineering and Safety, Raut & Sen Scientific Publishers.
4. Industrial Safety ,Desmukh

Reference Books:

1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
2. Hill International Edition, 2004
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. Industrial Safety Management and Technology, Colling. D A – Prentice Hall, New Delhi.

Course Title						
Subject Code	**ENGINEERING ECONOMICS AND COSTING**	L	T	P	C	QP
BMSHS3062		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To impart the knowledge of economic principles and engineering principles to solve engineering problems

CEO2: To make proficient in the evaluation of engineering proposals in terms of worth and cost

CEO3: To convey various economics concepts and theories towards making rational economic decision

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Explain the basic economic concepts on micro economics in terms of the law of demand and supply and price determination in the market.
CO2	Outline the various theories of productions in short run as well as in long run
CO3	Evaluate and appraise the tool of break even analysis to make production decisions of the firm and make use of depreciation calculations
CO4	Formulate and apply interest factors to real life engineering problems and evaluate engineering alternatives with the help of economic analytical techniques
CO5	Understand the financial structure of Indian economy, measuring national income, and measures of control of inflation

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	1	-	-	-	-	2	2			
CO2	-	-	-	-	-	1	-	-	-	-	3	1			
CO3	-	-	-	-	-	1	-	-	-	-	3	2			
CO4	-	-	-	-	-	2	-	-	-	-	3	1			
CO5	-	-	-	-	-	2	-	-	-	-	3	2			
Avg.	-	-	-	-	-	1.4	-	-	-	-	2.8	1.6			

SYLLABUS

UNIT:1 (No of Hours):12hrs

Engineering Economics –

Meaning, Nature, Scope, Basic problems of an economy, Micro economics and Macro Economics.

Demand and Supply Analysis -

Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Elasticity of demand &its measurement (Simple numerical problems to be solved)

Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to be solved).

Theory of Production -Production function, Laws of returns: Law of variable proportion, Law of returns to scale.

UNIT:2 (No of Hours):10hrs

Cost and revenue concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into Fixed and variable costs. Basic understanding of different market structures, Price and output Determination under perfect competition (Simple numerical problems to be solved),

Break Even Analysis -

Linear approach (Simple numerical problems to be solved). Depreciation-Depreciation of capital assert, Causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method)

UNIT:3 (No of Hours):12hrs

Time value of money -

Interest Analysis - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects-

Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for public projects. Sensitivity Analysis, Replacement Analysis-Determination of economic life of an asset, Replacement of existing asset with a new asset.

UNIT:4 (No of Hours):10 hrs

Overview of Indian financial system. Commercial bank, Functions of commercial bank, Credit creation, Central bank, Functions of Central Bank. Inflation-

Meaning of inflation, types, causes, measures to control inflation.

National Income - Definition, Concepts of national income, Method of measuring national income

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Vengedasalam, Deviga. Madhavan, Karunagaran, Principles of Economics, Oxford University Press.
2. R. Paneer Seelvan, " Engineering Economics", PHI
3. Ahuja,H.L., "Principles of Micro Economics" , S.Chand & Company Ltd
4. Riggs,J.L., Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India
5. Paul, R.R., Money, Banking and International Trade, Kalyni Publishers.

Reference Books:

1. Park, Chan.S, "Fundamental of Engineering Economics", Pearson.
2. Engineering Economy by William G.Sullivan, Elin M.Wicks, C. Patric Koelling, Pearson
3. Thuesen, G.J.,Fabrycky,. Engineering Economy, PHI.
4. Jhingan,M.L., "Macro Economic Theory", Vrinda Publications Ltd

Course Title						
Subject Code	**ANALOG ELECTRONIC CIRCUITS LABORATORY**	L	T	P	C	QP
BECPC3120		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*: A student should have basic idea on electronic components.

Course Educational Objectives

CEO1: To illustrate the students different electronic circuit and their application in practice..

CEO2: To impart knowledge on assessing performance of electronic circuit through monitoring of sensitive parameters

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define the VI characteristics of biasing circuits using project boards
CO2	Identify different analog circuits and their behaviours.
CO3	Compare the practical results with the assumed data values.
CO4	Design and test of different amplifier and oscillator circuits

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	-	-	-	-	-	-	-	-	-			
CO2	-	2	2	-	-	-	-	-	-	-	-	-			
CO3	1	-	3	-	-	-	-	-	-	-	-	-			
CO4	-	2	1	-	-	-	-	-	-	-	-	-			
Avg.	1.5	2	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

List of Experiments

(At least 10 out of 12 experiments should be done)

1. BJT Bias Circuit - design, assemble and test.
2. JEET/MOSFET Bias Circuit - design, assemble and test.
3. Design, assemble and test of BJT Common-Emitter Circuit: DC and AC performance.
4. Study of Darlington Connection and Current Mirror Circuits.
5. Design, assemble and test of JFET/MOSFET Common-Source Circuit: DC and AC performance.
6. Frequency Response of a Common-Emitter Amplifier: low frequency, high frequency and mid frequency response.
7. Differential Amplifiers Circuit: DC bias and AC operation without and with current source.
8. Op-Amp Frequency Response and Compensation.
9. Application of Op-Amp as differentiator, integrator, square wave generator.
10. Square wave testing of an amplifier.
11. R-C Phase Shift oscillator/Wien-Bridge Oscillator using OP-Amp/Crystal Oscillator.
12. Class A and Class B Power Amplifier.

Course Title						
Course Code	**NETWORK AND DEVICES LABORATORY**	L	T	P	C	QP
BELPC3130		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Verification of Network Theorems.

CEO2: Study of resonance in R-L-C circuits using oscilloscope.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Design a circuit with various theorems and methods.
CO2	Determine open circuit and short circuit parameters.
CO3	Design different filter circuits.
CO4	Examine transient circuits with various loads
CO5	Design different R-L-C resonance circuits.
CO6	Design a circuit with various theorems and methods.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	2	-	-	-	-	-	-	-	-	-			
CO2	1	1	1	-	-	-	-	-	-	-	-	-			
CO3	2	1	2	-	-	-	-	-	-	-	-	-			
CO4	1	1	1	-	-	-	-	-	-	-	-	-			
CO5	1	1	2	-	-	-	-	-	-	-	-	-			
CO6	1	2	1	-	-	-	-	-	-	-	-	-			
Avg.	1.33	1.16	1.5	-	-	-	-	-	-	-	-	-			

SYLLABUS

List of Experiments

(Select any 8 experiments from the list of 10 experiments)

1. Verification of Network Theorems using AC circuits. (Superposition, Thevenin, Norton, Maximum Power Transfer).
2. Study of DC and AC Transients for R-L, R-C & R-L-C circuits using storage oscilloscope.
3. Determination of circuit parameters: Open Circuit and Short Circuit parameters.
4. Determination of circuit parameters: Hybrid and Transmission parameters.
5. Frequency response of Low pass and High Pass Filters.
6. Frequency response of Band pass and Band Elimination Filters.
7. Determination of self inductance, mutual inductance and coupling coefficient of a single phase two winding transformer representing a coupled circuit.
8. Study of resonance in R-L-C series circuit using oscilloscope.
9. Study of resonance in R-L-C parallel circuit using oscilloscope.
10. Spectral analysis of a non-sinusoidal waveform.

Course Title						
Subject Code	**ELECTRICAL AND ELECTRONIC MEASUREMENTS LABORATORY**	L	T	P	C	QP
BEIPC3140		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To impart students the skill of practically handling different types of meter.

CEO2: To prepare students for monitoring, analyzing and calibrating any physical instrument.

CEO3: To provide students knowledge of practicing modern tools for implementing electrical and electronics projects.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	State the construction and working of different mechanical instruments.
CO2	Recognize the different types of interferences, their causes and methods of reduction.
CO3	Employ various types of ac and dc bridges for measurement
CO4	Examine watt meters and energy meters to test their accuracy.
CO5	Collect different components and design of various ac & dc bridges.
CO6	Justify the validity of all kind of laboratory instruments in the field of measurement.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	-	-	-	-	-	-	-	-	-			
CO2	3	2	2	-	-	-	-	-	-	-	-	-			
CO3	3	2	1	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
CO5	3	1	3	-	-	-	-	-	-	-	-	-			
CO6	2	1	2	-	-	-	-	-	-	-	-	-			
Avg.	2.66	1.66	1.8	-	-	-	-	-	-	-	-	-			

SYLLABUS

LIST OF EXPERIMENTS

1. Measurement of Low Resistance by Kelvin's Double Bridge Method.
2. Measurement of Self Inductance by Anderson Bridge.
3. Measurement of capacitance using Schering Bridge.
4. Study of Galvanometer and Determination of Sensitivity and Galvanometer Constants.
5. Calibration of Voltmeters and Ammeters using Potentiometers.
6. Testing of Energy meters (Single phase type).
7. Measurement of Iron Loss from B-H Curve by using CRO.
8. Measurement of R, L, and C using Q-meter.
9. Measurement of Power in a single phase circuit by using CTs and PTs.
10. Measurement of Power and Power Factor in a three phase AC circuit by two-wattmeter method.
11. Study of Spectrum Analyzers.

Course Title						
Subject Code	**JAVA PROGRAMMING LABORATORY**	L	T	P	C	QP
BCSES3150		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To introduce the pure object-oriented concepts through Java programming.

CEO2: To enable a detailed insight into the Java programming concepts such as creating classes, Methods, Interfaces, Packages, Multithreaded Environment, String handling, Enumerations, Creating small Swing application.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Apply the object-oriented concepts through Java language.
CO2	Demonstrate the concepts of polymorphism and inheritance.
CO3	Write Java programs to implement error handling techniques using exception handling Employ various types of ac and dc bridges for measurement
CO4	Develop solution for a real problem using Java programming.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	3	-	-	-	-	-	-	-	-	-			
Avg.	3	2.5	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

JAVA Programs on:

1. Introduction, Compiling & executing a java program.
2. Data types & variables, decision control structures: if, nested if etc.
3. Loop control structures: do, while, for etc.
4. Classes and objects.
5. Data abstraction & data hiding, inheritance, polymorphism.
6. Threads, exception handlings and applet programs
7. Interfaces and inner classes, wrapper classes, generics

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

IV SEMESTER [SECOND YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC4010	Electromagnetic Waves	3	1	0	4
2	PC	BECPC4020	Digital Electronics	3	0	0	3
3	PC	BECPC4030	Microprocessors and Microcontrollers	3	0	0	3
4	ES	BECES4040	Semiconductor Devices	3	0	0	3
5	ES	BECES4050	Signals and Systems	3	0	0	3
6	BS / HS	BBSBS3061	Environmental Engineering and Safety	3	0	0	3
		BMSHS3062	Engineering Economics and Costing				
PRACTICAL / SESSIONAL							
7	PC	BECPC4110	Electromagnetic Waves Laboratory	0	0	2	1
8	PC	BECPC4120	Digital Electronics Laboratory	0	0	2	1
9	PC	BECPC4130	Microprocessors and Microcontrollers Laboratory	0	0	2	1
10	PC	BECPC4140	Design and Simulation Laboratory	0	0	2	1
TOTAL				**18**	**1**	**8**	**23**

Course Title						
Subject Code	**ELECTROMAGNETIC WAVES**	**L**	**T**	**P**	**C**	**QP**
BECPC4010		**3**	**1**	**0**	**4**	**H**

Pre-requisites *(if any)*: Engineering Mathematics-II

Course Educational Objectives

CEO1:To provide the basic idea of static electric and magnetic field

CEO2: To analyze the static electric and magnetic in different medium

CEO3: To ascertain the idea about time varying electric and magnetic waves

CEO4: To provide the practical implementation of transmission line and waveguides

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Relate the vector calculus with static electric and magnetic field.
CO2	Solve simple electrostatic and magnetostatics problems
CO3	Analyze the time varying electric and magnetic fields.
CO4	Solve the problems using Maxwell Formulae and analyze moving charges on Magnetic fields.

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	3	-	-	-	-	-	-	-	-	-	2
CO4	-	-	2	-	-	-	-	-	-	-	-	-	-	-	1
Avg.	1	1	1.25	-	0.75	-	-	-	-	-	-	-	-	-	1.5

SYLLABUS

UNIT:1 **(10 Hours)**

Cartesian, Cylindrical and Spherical Coordinate Systems; Scalar and Vector Fields; Line, Surface and Volume Integrals.

Coulomb's Law ; The Electric Field Intensity; Electric Flux Density and Electric Flux; Gauss's Law; Divergence of Electric Flux Density; Point Form of Gauss's Law; The Divergence Theorem; The Potential Gradient; Energy Density; Poisson's and Laplace's Equations.

Ampere's Magnetic Circuital Law and its Applications; Curl of H; Stokes's Theorem; Divergence of B; Energy Stored in the Magnetic Field.

UNIT:2 **(8 Hours)**

The Continuity Equation; Faraday's Law of Electromagnetic Induction; Conduction Current; Point Form of Ohm's Law, Convention Current; The Displacement Current.

Maxwell's Equations in Differential Form; Maxwell's Equations in Integral Form; Maxwell's Equations for Sinusoidal Variation of Fields with Time; Boundary Conditions; The Retarded Potential; The Poynting Vector; Poynting Vector for Fields Varying Sinusoidally with Time.

UNIT:3 **(8 Hours)**

Solution of the One-Dimension Wave Equation; Solutions of Wave Equation for Sinusoidally Time-Varying Fields; Wave propagation through dielectrics, free space and good conductors; Loss tangents; Electrostatics and Magneto statics boundary condition.

UNIT:4 **(8 Hours)**

Types of Two-Conductor Transmission Lines; Circuit Model of an Uniform Two-Conductor Transmission Line; The Uniform Ideal Transmission Live; Wave Reflection at a Discontinuity in an Ideal Transmission Line; Matching of Transmission Lines with Load. Formulation of Field Equations; Wave Types; the Parallel-Plate Waveguide; the Rectangular Waveguide.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

TEXT & REFERENCE BOOKS

1. Engineering Electronics, William H. Hayt& J. Buck, Tata McGraw Hill Publishing Company Ltd., New Delhi, 7th Edition, 2006.
2. Electronics, Joseph A. Edminister , adapted by Vishnu Priye, Tata McGraw Hill Publishing Company Ltd., New Delhi , 2nd Edition.
3. Fundamentals of Electromagnetic for Engineering, First Impression, N. N. Rao, Pearson Education, New Delhi ,2009.
4. Fields and Waves in Communication Electronics, Simon Ramo, Wiley Publication 3rd Edition, 2007.
5. Electromagnetic Field Theory, Bhag Sing Guru, Cambridge Publication, 3rd Edition, 2011.

Course Title						
Subject Code	**DIGITAL ELECTRONICS**	L	T	P	C	QP
BECPC4020		**3**	**1**	**0**	**4**	**H**

Pre-requisites *(if any)*: A student should have basic idea on logic gates.

Course Educational Objectives

CEO1: To acquire the basic knowledge of digital logic levels and implements it in digital electronics.

CEO2: Prepare the students to perform the analysis and design of various digital electronic circuits.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define and analyze Number System, Boolean Algebra, Binary Codes and Logic Gates.
CO2	Apply different minimization methods to design Combinational Logic Circuits.
CO3	Understand the concept of Sequential Logic Circuits to model different Registers and design Counters.
CO4	Explain, analyze and design Memories, PLDs and Converters.
CO5	Define and elaborate IC Logic Families.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	-	-	-	-	-	-	-	-			
CO2	1	2	3	-	-	-	-	-	-	-	-	-			
CO3	1	2	3	1	-	-	-	-	-	-	-	-			
CO4	1	1	1	-	-	-	-	-	-	-	-	-			
CO5	1	1	-	-	-	-	-	-	-	-	-	-			
Avg.	1.2	1.4	2.33	1	-	-	-	-	-	-	-	-			

SYLLABUS

MODULE-I **8 Hours**

1. **Number Systems and Codes:** Binary, Octal, Hexadecimal and Decimal Number System and their Conversion; Representation of Signed Binary and Floating Point Number; Binary Arithmetic using 1's and 2's Complements, Binary Codes - BCD Code, Gray Code, ASCII Character Code. (5 Hours)
2. **Boolean Algebra and Logic Gates**: Axioms and Laws of Boolean Algebra; Reducing Boolean Expressions; Logic levels and Pulse Waveforms; Logic Gates; Boolean Expressions and Logic Diagrams. (3 Hours)

MODULE-II **9 Hours**

3. **Gate-level Minimization:** Canonical and Standard Forms; K-maps - Two, Three and Four Variable K-maps, Don't-Care Conditions; NAND and NOR Implementation; Other Two-Level Implementations, Exclusive-OR Function. (4 Hours)

4. **Combinational Logic:** Combinational Circuits; Analysis Procedure; Design Procedure; Adders; Subtractors; Parallel Binary Adders; Binary Adder-Subtractor; Binary Multiplier; Magnitude Comparator; Decoders; Encoders, Multiplexers; De-multiplexers. (5 Hours)

MODULE-III **14 Hours**

5. **Synchronous Sequential Logic:** Sequential Circuits; Latches, Flip-Flops; Master-Slave Flip-Flop; Conversion of Flip-Flops; Analysis of Clocked Sequential Circuits; Mealy and Moore Models of Finite State Machines. (6 Hours)
6. **Registers and Counters:** Shift Registers; Data Transmission in Shift Registers; SISO, SIPO, PISO and PIPO Shift Registers; Counters; Asynchronous Counters; Design of Asynchronous Counters; Synchronous Counters; Design of Synchronous Counters; Ring Counter. (8 Hours)

MODULE-IV **14 Hours**

7. **Memory and Programmable Logic:** Introduction; Random-Access Memory; Memory Decoding; Error Detection and Correction; Read-Only Memory; Programmable Logic Array; Programmable Array Logic; Sequential Programmable Devices. (5 Hours)
8. **Analog-to-Digital and Digital-to-Analog Converters:** Digital-to-Analog Converters - R-2R Ladder D/A Converter, Weighted Resistor D/A Converter; Analog-to-Digital Converters - Counter-type A/D Converter, Parallel Comparator A/D Converter, Dual-Slope A/D Converter, Successive-Approximation A/D Converter, A/D Converter using Voltage-to-Frequency. (5 Hours)
9. **IC Logic Families:** Special Characteristics; RTL, DTL, TTL, ECL, IIL, MOS and CMOS Logic Circuits. (4 Hours)

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Digital Design, 3rd Edition, M. Morris Mano, Pearson Education.
2. Fundamentals of Digital Circuits, 8th Edition, A. Anand Kumar, PHI.
3. Digital Fundamentals, 5th Edition, T. L. Floyd and R. P. Jain, Pearson Education, New Delhi.

Reference Books:

1. Digital Systems – Principles and Applications, 10th Edition, Ronald J. Tocci, Neal S. Widemer and Gregory L. Moss, Pearson Education.
2. A First Course in Digital System Design: An Integrated Approach, India Edition, John P. Uyemura, PWS Publishing Company, a division of Thomson Learning Inc.
3. Digital Design, Robert K. Dueck, CENGAGE Learning.
4. Digital Principles and Applications, 6th Edition, Donald P. Leach, Albert Paul Malvino and Goutam Saha, Tata McGraw Hill Publishing Company Ltd., New Delhi.

Course Title						
Subject Code	**MICROPROCESSORS AND MICROCONTROLLERS**	L	T	P	C	QP
BECPC4030		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: The students should have good background on digital circuits.

Course Educational Objectives

CEO1: To Develop assembly language programs and basic concepts of the microprocessor and microcontroller

CEO2: To provide solid foundation on interfacing the external devices to the microprocessor & microcontroller according to the user requirements in order to create novel products and solutions for the real time problems

CEO3: To Familiar and Design of any type of embedded systems related to industrial and real time applications by knowing the concepts of Microprocessor and Microcontrollers.

CEO4: To assist the students with an academic environment aware of excellence guidelines and lifelong learning needed for a successful professional carrier in the field embedded systems.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Explain the basic architecture of 8085 and 8086 microprocessor and list its features
CO2	Develop the assembly language program for 8085 ,8086 microprocessor and 8051 microcontroller and identify the addressing mode of the instructions
CO3	Analyze the working of different peripheral devices to develop a microprocessor system and analyze the memory interfacing concept
CO4	Explain the 8051 Microcontroller architecture and compare the use of microprocessor and microcontroller in various application

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	2	-	3	-	-	-	-	-	-	-			
CO3	3	-	3	-	-	-	-	-	-	-	-	-			
CO4	3	-	-	-	-	-	-	-	-	-	-	-			
Avg.	3	2	2.5	-	3	-	-	-	-	-	-	-			

SYLLABUS

UNIT: 1

Introduction to 8 bit Microprocessor **10 Hours**

Introduction to 8085 microprocessor, Architecture, Signal Descriptions, Buses-Address bus, data bus and control Bus ,Instruction format ,Instruction sets ,addressing Modes, Assembly Language Programming, Timing diagram, stack and sub routine, Data Transfer Schemes, Memory Interfacing and 8085 interrupts.

UNIT:2

Advanced Microprocessor **12 Hours**

Introduction to 8086 microprocessor, 8086 Architecture, Register Organization, signal descriptions, Memory Segmentation. Physical memory organization. Addressing Modes, instruction Set .Minimum and Maximum mode operation, Bus Cycle of minimum mode and maximum mode. Interrupts of 8086, Memory interfacing & Assembly Language Program.

UNIT:3

Peripheral Devices **10 Hours**

Programmable Peripheral Interface (8255), Programmable Interval Timer (8254) Programmable Interrupt Controller (8259A) - Programmable DMA Controller (8257), Programmable Communication Interface (8251A) – Programmable Keyboard and Display Controller (8279).

UNIT:4

8051 Microcontroller **12 Hours**

Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, Addressing modes, data transfer instructions, Logical instructions, Arithmetic instructions, Branching (Jump & Call) instructions, Bit addressable instructions and special instructions, Interrupts and interrupt handler sub routines (Interrupt Service Routines).Assembly language program.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Microprocessor Architecture, Programming and application with 8085,R.S. Gaonkar, PRI Penram International publishing PVT. Ltd., 5thEdition
2. Advanced Microprocessors and Peripherals - A. K. Ray and K.M. Bhurchandani, TMH, 2nd edition 2006.
3. The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D.M C Kinlay, Pearson Education, Second Edition, 2008.

Reference Books:

1. Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096, Krishna Kant, PHI Publication, 2007.
2. Microprocessors and Interfacing, Programming and Hardware,Douglas V Hall, TMH Publication, 2006.
3. Microprocessors and Interfacing, N. Senthil Kumar, M. Saravanan, S. Jeevananthan and S.K. Shah, Oxford University Press.

Course Title						
Subject Code	**SEMICONDUCTOR DEVICES**	L	T	P	C	QP
BECES4040		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: The students should have good background knowledge on semiconductor and its properties.

Course Educational Objectives

CEO1: To gain basic knowledge on quantum theory of solids and flow mechanism in semiconductor.

CEO2: Provide students the insight for understanding new semiconductor devices and technologies.

CEO3: To provide the students a solid platform on semiconductor devices which can help them to work upon on real field applications like High frequency communications, optical communications etc.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define the basics of quantum theory of solids and flow mechanism in semiconductor
CO2	Describe the details of semiconductor devices and their working.
CO3	Demonstrate the application of semiconductor devices to various fields.
CO4	To compare working threshold of different semiconductor devices.
CO5	Formulate and construct devices with higher performances based upon the requirement.
CO6	To justify the preference of devices based on their advantages and disadvantages for various on field applications.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	3	-	-	-	-	-	-	-	-	-	-			
CO4	3	2	-	-	-	-	-	-	-	-	-	-			
CO5	3	3	-	-	-	-	-	-	-	-	-	-			
CO6	2	2	-	-	-	-	-	-	-	-	-	-			
Avg.	2.83	2.66	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT: 1 **12 HOURS**

Introduction to the quantum theory of solids: Formation of energy bands, The k-space diagram (two and three dimensional representation), conductors, semiconductors and insulators.

Electrons and Holes in semiconductors: Silicon crystal structure, Donors and acceptors in the band model, electron effective mass, Density of states, Thermal equilibrium, Fermi-Dirac distribution function for electrons and holes, Fermi energy. Equilibrium distribution of electrons & holes: derivation of *n* and *p* from D(E) and f(E), Fermi level and carrier concentrations, The *np* product and the intrinsic carrier concentration. General theory of *n* and *p*, Carrier concentrations at extremely high and low temperatures: complete ionization, partial ionization and freeze-out. Energy-band diagram and Fermi-level, Variation of E_F with doping concentration and temperature.

UNIT: 2 **12 HOURS**

Motion and Recombination of Electrons and Holes: Carrier drift: Electron and hole motilities, Mechanism of carrier scattering, Drift current and conductivity. Carrier diffusion: diffusion current, total current density, relation between the energy diagram and potential, electric field. Einstein relationship between diffusion coefficient and mobility. Electron-hole recombination, Thermal generation.

PN Junction: Building blocks of the pn junction theory: Energy band diagram and depletion layer of a pn junction, Built-in potential; Depletion layer model: Field and potential in the depletion layer, depletion-layer width; Reverse-biased PN junction; Capacitance-voltage characteristics; Junction breakdown: peak electric field. Tunneling breakdown and avalanche breakdown; Carrier injection under forward bias-Quasi-equilibrium boundary condition; current continuity equation; Excess carriers in forward-biased pn junction; PN diode I-V characteristic, Charge storage.

UNIT: 3 **10 HOURS**

The Bipolar Transistor: Introduction, Modes of operation, Minority Carrier distribution, Collector current, Base current, current gain, Base width Modulation by collector current, Breakdown mechanism, Equivalent Circuit Models - Ebers -Moll Model.

Metal-Semiconductor Junction: Schottky Diodes: Built-in potential, Energy-band diagram, I-V characteristics, Comparison of the Schottky barrier diode and the pn-junction diode. Ohmic contacts: tunneling barrier, specific contact resistance**.**

UNIT: 4 **8 HOURS**

MOS Capacitor: The MOS structure, Energy band diagrams, Flat-band condition and flat-band voltage, Surface accumulation, surface depletion, Threshold condition and threshold voltage, MOS C-V characteristics, Q_{inv} in MOSFET.

MOS Transistor: Introduction to the MOSFET, Complementary MOS (CMOS) technology, V-I Characteristics, Surface motilities and high-mobility FETs, JFET, MOSFET V_t, Body effect and steep retrograde doping, pinch-off voltage,

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Semiconductor Physics and Devices, 3rd Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Modern Semiconductor Devices for Integrated Circuits, Chenming Calvin Hu, Pearson Education/Prentice Hall, 2009.

Reference Books:

1. Solid State Electronics Devices, 6th Edition, Ben. G. Stretman and Sanjay Banarjee, Pearson Education, New Delhi.
2. Physics of Semiconductor Devices, 3rd Edition, S.M. Sze and Kwok K. Ng, Wiley India Pvt. Limited, New Delhi.

Subject Code	Title of the Course	L	T	P	C	QP
BECES4050	**SIGNALS AND SYSTEMS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Fundamental Mathematics, Analytical Skill

Course Educational Objective

CEO1: Familiar about basic signal and system modelling concept and understanding of the fundamental properties of linear systems and time invariant system.

CEO2: To provide a thorough understand of continuous-time signals and discrete-time signals

CEO3: To analyze application of understand linear time-invariant systems theory and applications for continuous and discrete time signal in time and frequency domain.

CEO4: Knowledge about the concept of signal processing, representation and its application in various domains.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Represent, Classify Signals & Systems
CO2	Perform mathematical operation on both continuous &discrete signal.
CO3	Apply the concept of Fourier series, Fourier transform, Laplace transform & Z transform to continuous & discrete signal
CO4	Analyze the stability of systems, response of the LTI system

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	1	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	-	-	-	-	-	-	-	-	-	-	-			
Avg.	2.5	2	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT-01 12 Hours

CONTINUOUS TIME SIGNALS AND SYSTEMS:- Elementary signals, Classification of continuous time signal-Deterministic and Nondeterministic signal, Periodic and Non periodic signal ,Even and Odd signal, Energy and Power signal, Causal and Non causal signal, Mathematical Operations on continuous time signals, Continuous Time System-Block diagram representation ,classification –static and dynamic, time variant and time invariant ,linear and nonlinear ,stable and unstable, Interconnection of continuous time system. Convolution and Unit step response.

DISCRETE TIME SIGNALS AND SYSTEMS :- Representation of discrete time signal, Elementary signals, Classification of discrete time signal-Deterministic and Nondeterministic signal, Periodic and Non periodic signal ,Even and Odd signal, Energy and Power signal, Causal and Non causal signal, Mathematical Operations on discrete time signals, Discrete Time System-Block diagram representation ,Classification –static and dynamic, time variant and time invariant ,linear and nonlinear ,stable and unstable, Interconnection of discrete time system. Convolution and Unit step response

UNIT - 02 12 Hours

FOURIER SERIES AND FOURIER TRANSFORM OF CONTINUOUS TIME SIGNALS:- Trigonometric form of Fourier series, Properties of Fourier series, Gibbs Phenomenon. Fourier

Transform–unit impulse signal, unit step signal, Signumfunction, exponential signal, sinusoidal and co-sinusoidal signal, properties of Fourier transform. FOURIER SERIES AND FOURIER TRANSFORM OF DISCRTETE TIME SIGNALS :- Definition of discrete time Fourier series, properties of discrete time Fourier series, Fourier transform-Definition, Inverse discrete time Fourier transform, properties of discrete time Fourier transform
UNIT: 03 08 Hours LAPLACE TRANSFORM: Introduction, Region of Convergence, Properties of Laplace Transform, Inverse Laplace Transform-partial fraction method, convolution theorem, Transfer function and impulse Response, Pole-zero location, stability in S-domain.
UNIT 4: 10 Hours Z-TRANSFORM: Introduction, Region of Convergence, Properties of Z-Transform, Inverse Z-Transform-Long division method, partial fraction method, , Transfer function and impulse Response, Pole-zero location, causality and stability . Unilateral Z-transform, Time shifting property, Application of Unilateral Z-transform
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1. Signals and Systems – A NagoorKani, TMH. 2. Digital Signal Processing – Principles, Algorithms and Applications, John. G. Proakis and Dimitris. G. Manolakis, 4th Edition, Pearson. 3. Signals and Systems –A. Anand Kumar, 3rd Edition PHI Learning Pvt. Ltd
Ref. Books 1. Signals and Systems - P. Ramakrishna. Rao, TMH. 2.Signals and Systems, Chi-Tsong Chen, Oxford 3. Principles of Signal Processing and Linear Systems,B.P. Lathi, Oxford. 4. Signal & Systems by Tarun Kumar Rawat, Oxford University Press.

Course Title						
Subject Code	**ELECTROMAGNETIC WAVES LABORATORY**	**L**	**T**	**P**	**C**	**QP**
BECPC4110		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1:

CEO2:

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define the E Field and H Field
CO2	Explain the patch antenna
CO3	Demonstrate the simulation of patch antenna
CO4	Calculate the error of S--Parameter

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	3	3	-	-	-			
CO2	-	-	-	-	-	-	-	3	3	-	-	-			
CO3	-	-	-	-	-	-	-	3	2	-	-	-			
CO4	-	-	-	-	-	-	-	-	3	-	-	-			
Avg.	-	-	-	-	-	-	-	2.25	2.75	-	-	-			

SYLLABUS

List of Experiment

1. Wave--Propagation in conductors and dielectric using HFSS.
2. To design a rectangular patch antenna using HFSS.
3. To design circular patch angina using HFSS.
4. To design and simulate Probe Feed patch antenna using HFSS.
5. To design slot coupled patch antenna using HFSS.
6. To design the CPW feed patch antenna by using HFSS.
7. To design and simulate a Half--Wave Dipole Antenna using HFSS.
8. To design and simulate a Half--Wave Dipole Antenna which will resonate at 2.4GHz frequency.

Course Title						
Subject Code	**DIGITAL ELECTRONICS LABORATORY**	L	T	P	C	QP
BECPC4120		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: Sequential design techniques using state tables and state diagrams.

CEO2: The use of serial and parallel interfaces in computer system.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	List the truth tables of all the Logic Gates and their behaviours / Boolean expression.
CO2	Explain all the combinational logic circuits and verification of their truth tables.
CO3	Demonstrate different types of memory elements.
CO4	Differentiate different types of flipflops.
CO5	Simulate the logic circuits using VHDL and Verilog HDL.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	-	-	-	-	-	-	-	-	-			
CO2	1	1	-	-	-	-	-	-	-	-	-	-			
CO3	2	1	1	-	-	-	-	-	-	-	-	-			
CO4	1	1	1	-	-	-	-	-	-	-	-	-			
CO5	2	1	-	-	-	-	-	-	-	-	-	-			
Avg.	1.60	1	1	-	-	-	-	-	-	-	-	-			

SYLLABUS

List of Experiments

(At least 10 experiments should be done, Experiment No. 1 and 2 are compulsory and out of the balance 8 experiments at least 3 experiments has to be implemented through both Verilog/VHDL and hardware implementation as per choice of the student totaling to 6 and the rest 2 can be either through Verilog/VHDL or hardware implementation.)

1. Digital Logic Gates: Investigate logic behavior of AND, OR, NAND, NOR, EX-OR, EXNOR, Invert and Buffer Gates, use of Universal NAND/NOR Gate.
2. Gate-Level Minimization: Two level and multi level implementation of Boolean functions.
3. Combinational Circuits: Design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segment displays.
4. Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number of Gates.
5. Design with Multiplexers and De-multiplexers.
6. Flip-Flop: Assemble, test and investigate operation of SR, D & JK flip-flops.

7. Shift Registers: Design and investigate the operation of all types of shift registers with parallel load.
8. Counters: Design, assemble and test various ripple and synchronous counters -decimal counter, Binary counter with parallel load.
9. Memory Unit: Investigate the behavior of RAM unit and its storage capacity – 16×4 RAM: testing, simulating and memory expansion.
10. Clock-Pulse Generator: Design, implement and test.
11. Parallel Adder and Accumulator: Design, implement and test.
12. Binary Multiplier: Design and implement a circuit that multiplies 4-bit unsigned numbers to produce an 8-bit product.
13. Verilog/VHDL simulation and implementation of Experiments listed at Sl. No. 3 to 12.

Course Title						
Subject Code	**MICROPROCESSORS AND MICROCONTROLLERS LABORATORY**	L	T	P	C	QP
BECPC4130		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*: The students should have good background on digital circuits.

Course Educational Objectives

CEO-1: Developing of assembly level programs and providing the basics of the processors

CEO-2: To assist the students with an academic environment aware of excellence guidelines and lifelong learning needed for a successful professional carrier.

CEO-3:To provide solid foundation on interfacing the external devices to the processor according to the user requirements to create novel products and solutions for the real time problems

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand and apply the fundamentals of assembly level programming of microprocessors and microcontroller.
CO2	An in depth knowledge of applying the concept of real time application.
CO3	Troubleshoot interactions between software and hardware;
CO4	Analyze abstract problems and apply a combination of hardware and software to address the problem.
CO5	Use standard test and measurement equipment to evaluate digital interfaces.
CO6	Design circuits for various applications using microprocessor & microcontroller.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	1	2	2	-	-			
CO2	-	-	-	-	-	-	-	-	-	-	-	-			
CO3	-	-	-	-	-	-	-	-	2	1	-	-			
CO4	-	-	-	-	-	-	-	-	2	-	-	-			
CO5	-	-	-	-	-	-	-	2	-	2	-	-			
CO6	-	-	-	-	-	-	-	-	2	-	-	-			
Avg.	-	-	-	-	-	-	-	1.5	2	1.67	-	-			

SYLLABUS

LIST OF EXPERIMENTS

1. Write a program for addition of two 8 –bit and 16 bit numbers.
2. Write a program for addition of series of numbers.
3. Subtraction of two 8 bit and 16 bit numbers.
4. Write a program for finding the larger between two numbers.
5. Write a program to find the smallest from an array of numbers.
6. Arrange a series of numbers in ascending order.
7. Multiplication and division of two 8 bit numbers.
8. Demonstrate the generation of square wave using PPI
9. Write a program to interface ADC and DAC with 8085.

10. Write a program to interface stepper motor with 8085.
11. Write a program to interface traffic light control with 8085.
12. Teaching Method(s): Marker & Board/ PPT/ Demonstration.

Course Title						
Course Code	Title of the Course	L	T	P	C	QP
BECPC4140	**DESIGN AND SIMULATION LABORATORY**	0	0	2	1	-

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1	To impart the fundamental knowledge of using various software tools for designing and simulating technical systems.
CEO2	To impart the knowledge of using the tools in industries for solving real time problems.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand various software tools.
CO2	Utilize the tools in projects involving design and simulation.
CO3	Apply the tools in solving real time problems.
CO4	Handle and solve industrial problems successfully.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	3	-	-	-	-	-	-	-	-	-	-			
CO2	-	-	1	2	2	-	-	-	-	-	-	-			
CO3	-	-	-	-	3	-	-	-	-	-	-	-			
CO4	-	-	-	-	2	-	-	-	-	-	-	-			
Avg.	-	3	1	2	2.3	-	-	-	-	-	-	-			

SYLLABUS

EXPERIMENT LIST

Lab#1 Passive and Active Filters (6 hours)

At the end of this project, the students will be able to do the following:

- Fourier/LaPlace transform and filter design review
- Use of circuit simulation software (LTspice) to analyze performance
- Setup hardware (ADALM1000) needed in the experiment
- Record measurement using ALICE software
- Perform demo in lab using lab equipment
- Compare and analyze theoretical, simulated, and experimental results
- Draw conclusions from analysis

Lab#2 Diodes and Application (6 hours)

At the end of this project, the students will be able to do the following:

- Use LT Spice to simulate diode I-V curves and interpret results
- Analyze a diode based regulator/reference voltage source and simulate using LTSpice
- Analyze and simulate diode based rectifier circuits

- Setup hardware (ADALM1000) needed in the experiment
- Record measurement using ALICE software
- Perform demo in lab using lab equipment
- Compare and analyze theoretical, simulated, and experimental results
- Draw conclusions from analysis

Lab#3 MOS Transistors and MOS applications (12 hours)

At the end of this Lab, the students will be able to do the following:

1. Obtain and investigate MOS I-V characteristics and obtain key MOS parameters from the IV characteristics.
2. Analyze, simulate Build CMOS logic circuits verify the logic function, and measure the propagation delay, noise margin, and power dissipation using an oscilloscope, function generator, and power supply. Compare with expected results
3. Analyze, simulate, and build MOS amplifiers.
4. Record measurement using ALICE software. Analyze results compare DC bias point, gain, input/output resistances with the theoretical values, and impact of nonlinearity and feedback.
5. Perform demo in lab using lab equipment
6. Analyze and verify the operation MOS as a variable resistor.
7. Design and build a voltage controlled potentiometer.

Lab #4 BJT and BJT Amplifiers (6 hours)

At the end of this lab, the students will be able to do the following:

1. Obtain and investigate BJTI-V characteristics and obtain key BJT parameters from the IV characteristics.
2. Analyze, simulate, and build BJT amplifiers.
3. Record measurement using ALICE software. Analyze results compare DC bias point, gain, input/output resistances with the theoretical values, and impact of nonlinearity and feedback.
4. Perform demo in lab using lab equipment

Project (9 hours)

At the end of this project, the students will be able to do the following:

1. Circuit design using nonlinear circuit elements.
2. Making and justifying design choices based on requirements.
3. Simulate design using LT Spice. Record results and verify design specifications are met.
4. Bench test using lab equipment. Record results verify design specifications are met.

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

V SEMESTER [THIRD YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC5010	Analog Communications	3	1	0	4
2	PC	BECPC5020	Digital Signal Processing	3	0	0	3
3	PC	BECPC5030	Digital VLSI Design	3	0	0	3
4	PE	BECPE5041	Fiber Optic Communications	3	0	0	3
		BECPE5042	Electronic Devices and Modeling				
		BECPE5043	Power Electronics				
		BECPE5044	Sensors and Transducers				
5	OE		Open Elective-I *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
6	PC	BECPC5110	Analog Communication Techniques Laboratory	0	0	2	1
7	PC	BECPC5120	Digital Signal Processing Laboratory	0	0	2	1
8	PC	BECPC5130	Digital VLSI Design Laboratory	0	0	2	1
9	EC	BECEC5150	*Skill Development Project and Hands on Training	0	0	2	1
10	EC	BECEC5170	^Summer Internship-I	0	0	2	1
TOTAL				**15**	**1**	**10**	**21**

*College should conduct at least one NSDC program under this category.

^ Four (4) weeks duration summer internship either in industry or in an R&D organization, including educational institutes with excellent research culture. The student is expected to submit a formal report at the end of the programme.

On-line MOOC courses may contribute upto 20% of the credits, with in-house examination being conducted.

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
BECPC5010	**ANALOG COMMUNICATIONS**	**3**	**1**	**0**	**4**	**H**

Pre -Requisite: Knowledge of electronic devices, circuits and mathematical analysis.

Course Educational Objectives

CEO1: Introduce the concepts of analogue communication systems
CEO 2: To equip students with various issues related to analogue communication such as modulation, demodulation, transmitters and receivers and noise performance.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Define different types of signal and its mathematical analysis.
CO2	Describe energy and power spectral density of the signal.
CO3	Illustrate various methods of generation and detection of amplitude modulation and angle modulation.
CO4	Distinguish between different types of modulation techniques based on bandwidth Occupied and power transmitted

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	1	-	2
CO3	2	-	3	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	2	-	-
Avg.	2.33	3	3	-	-	-	-	-	-	-	-	-	1.66	2	2

SYLLABUS

UNIT:1 (8hrs)

SIGNALS AND SPECTRA: An Overview of Electronic Communication Systems, Signal and its Properties, Fourier series Expansion and its Use, The Fourier Transform & its Properties.

RANDOM VARIABLES AND PROCESSES: Probability, Random variables, Useful Probability Density functions, Useful Properties and Certain Application Issues.

UNIT:2 (15hrs)

AMPLITUDE MODULATION SYSTEMS: Introduction to amplitude Modulation, Double Side Band with Carrier DSB-C, DSB-SC, Single Sideband Modulation (SSB), VSB

ANGLE MODULATION: General equation of Angle Modulation, Modulation index, Types of FM, FM Modulators and Demodulators.

PULSE MODULATION : Analog to Digital (Noisy Channel and Role of Repeater), Sampling Theorem, Nyquist Rate, Generation & Detection of Pulse Amplitude Modulation and Concept of Time division multiplexing, PAM, PWM:

UNIT:3 (10hrs)

MATHEMATICAL REPRESENTATION OF NOISE: Sources of Noise, Frequency-domain Representation of Noise, Superposition of Noises, Linear Filtering of Noise: Ideal LPF,RC-Filter, Band pass filter.

NOISE IN AMPLITUDE MODULATION SYSTEM: Introduction to Amplitude demodulation, Single Sideband Suppressed Carrier (SSB-SC), Double Sideband Suppressed Carrier (DSB-SC), Double Sideband with Carrier (DSB-C).Calculation of figure of merit.

UNIT:4 (7 hrs) NOISE IN FREQUENCY MODULATION SYSTEM: An FM Receiving System, Calculation of Signal to Noise Ratio, Comparison of FM and AM, Pre emphasis and De-emphasis and SNR Improvement.
Teaching Method(s): Chalk & Board/ PPT/ Demonstration/Video lectures.
Text Books 1.Principles of Communication System, H. Taub, D. L Schilling, G. Saha, Tata McGraw Hill, 3rd Edition, 2008. 2.Modern Digital and Analog Communication Systems, B.P. Lathi, Zhi Ding, Oxford University Press, 4th edition 2010 3. Communication System ,Sanjay Sharma,2nd edition
Reference Books 1. Communication System Engineering, MasoudSalehi, John G. Proakis, PHI, Pearson Education, Second Edition 2002. 2. Analog Communication, V. Chandra Sekar, Oxford University Press 2010. 3. Communication Systems S.Haykin, john Wiley& sons 4th edition 2001. 4. R.P Singh and S.D Sapre, COMMUNICATION SYSTEMS Analog & Digital, 2nded. New Delhi, India: Tata McGraw Hill Education Private Limited, 2009

SUBJECT CODE	COURSE TITLE	L	T	P	C	QP
BECPC5020	**DIGITAL SIGNAL PROCESSING**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Fundamental of Signal & System, Fundamental of Communication and Mathematics

Course Educational Objectives

CEO1	To introduce discrete time signals, systems, time and frequency domain representation concepts.
CEO2	To provide a thorough understanding and working knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.
CEO3	To analyze its wide application in MATLAB as well as in audio, Image, telecommunication and real world.
CEO4	Familiar about the concept of signal processing and its application in real world.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Recall the concepts of discrete signal representation, its operation and discrete time systems.
CO2	Convert the time domain signal analysis to frequency domain analysis using various transform.
CO3	Capable of understanding Digital Signal Processing Applications using z transform and DFT.
CO4	Apply Fast Fourier Transform (FFT) Algorithms for faster realization of discrete signals and systems and analyze the response of filter.

CO - PO & PSO Matrix

	PROGRAMME OUTCOMES												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	2	-	-	-	-	-	-	-	-	-			
CO2	1	3	2	3	-	-	-	-	-	-	-	-			
CO3	-	2	1	1	-	-	-	-	-	-	-	-			
CO4	2	1	-	1	-	-	-	-	-	-	-	-			
Avg.	2	1.75	1.66	1.66	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **12 Hours**

The Discrete Fourier Transform: Its Properties and Applications

The Discrete Fourier Transform, Inverse Discrete Fourier Transform, the DFT as a Linear Transformation, Relationship of the DFT to z-Transforms, circular shifting, circular convolution –circle method, matrix method, DFT and IDFT method, Properties of the DFT: Linearity, circular time shift, circular frequency shift, complex conjugate, , Multiplication of Two DFTs, Circular Convolution and Parseval's relation, Filtering of Long Data Sequences-overlap save method and overlap add method.

UNIT:2 **10 Hours**

Efficient Computation of the DFT: Fast Fourier Transform Algorithms

Efficient Computation of the DFT: FFT Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms: Decimation-In-Time (DIT), Decimation-In-Time (DIF); Applications of FFT Algorithms: Efficient Computation of the DFT of two Real Sequences, Efficient Computation of

the DFT a 2N-Point Real Sequence

UNIT:3 **10 Hours**

DESIGN AND REALIZATION OF FIR FILTER

Structure for FIR Systems: Direct-Form Structure, Cascade-Form Structures, Linear Phase structure Frequency-Sampling Structures, Design of Linear-Phase FIR Filters by using Windows-Rectangular, Blackman, hamming, hanning and triangular. Design of Linear-Phase FIR Filters by the Frequency-Sampling Method.

UNIT:4 **10 Hours**

DESIGN AND REALIZATION OF IIR FILTER

Structure for IIR Systems: Direct-Form Structures, Signal Flow Graphs and Transposed Structures, Cascade-Form Structures, Parallel-Form Structures, Design of IIR Filters from Analog Filters: IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation. Warping effect.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Digital Signal Processing Principles, Algorithms an d Applications, J. G. Proakis and D. G. Manolakis, 4th Edition, Pearson.
2. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press.
3. Discrete-Time Signal Processing by A. V. Oppenheim and R. W. Schafer.
4. Digital Signal Processing in Communication Systems by Marvin E. Frerking.

Reference Books:

1. Digital Signal Processing: a Computer-Based Approach, Sanjit K. Mitra, TMH
2. Digital Signal Processing, S. Salivahan, A. Vallavraj and C. Gnanapriya, TMH.
3. Digital Signal Processing, Manson H. Hayes, Schaum's Outlines, TMH.
4. Digital Signal Processing: A Modern Introduction, Ashok K Ambardar, Cengage Learning.
5. Modern Digital Signal Processing, Roberto Cristi, Cengage Learning.
6. Digital Signal Processing: Fundamentals and Applications, Li Tan, Jean Jiang,
7. Academic Press, Elsevier.
8. Digital Signal Processing: A MATLAB-Based Approach,Vinay K. Ingle and John G.
9. Proakis, Cengage Learning.
10. Fundamentals of Digital Signal Processing using MATLAB, Robert J. Schilling and
11. Sandra L. Harris, Cengage Learning. PVT Ltd., 3rdEdition.

SUBJECT CODE	COURSE TITLE	L	T	P	C	QP
BECPC6030	**DIGITAL VLSI DESIGN**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Fundamental of Analogue Electronic Circuit, Digital Electronics Circuit, Physical Semiconductor Devices

Course Educational Objectives

CEO1	To make the students familiar with the basic concept of CMOS device and its manufacturing technology
CEO2	To have a complete knowledge of CMOS Logic circuits and their working principle.
CEO3	To analyse the noise margin, delay and power estimation of VLSI circuits.
CEO4	To familiar with various dynamic CMOS logic styles and testing mechanism.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Know the basic concepts of Semiconductor devices(MOSFETs) & fabrication processes
CO2	Understand the layout design process and VLSI Design Flow
CO3	Apply the concept of CMOS in designing static and dynamics circuits
CO4	Analyze the switching action, power dissipation & delay estimation of VLSI Circuit

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	1	3	1	-	-	-	-	-	-	-	-	-			
CO4	-	-	2	-	-	-	-	-	-	-	-	-			
Avg.	2.33	2	1.5	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **12 Hours**

1.Introduction: Historical Perspective, VLSI Design Methodologies, VLSI Design Flow, Design Hierarchy, Concept of Regularity, Modularity and Locality, VLSI Design Styles,

2. Fabrication of MOSFETs: Introduction, Fabrication Processes Flow – Basic Concepts The CMOS n-Well Process, Layout Design Rules, Stick Diagrams, Full-Customs Mask Layout Design.

3.MOS Transistor: The Metal Oxide Semiconductor (MOS) Structure, The MOS System under External Bias, Structure and Operation of MOS Transistor (MOSFET),
MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitance.

UNIT:2 **12 Hours**

4. MOS Inverters – Static Characteristics: Introduction, Resistive-Load Inverters, Inverters with n-Type MOSFET Load, CMOS Inverter.

5.MOS Inverters – Switching Characteristics and Interconnect Effects: Introduction, Delay-Time Definitions, Calculation of Delay-Times, Estimation of Interconnect Parasitic, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

6.Combinational MOS Logic Circuits: Introduction, MOS Logic Circuits with Depletion NMOS Loads, CMOS Logic Circuits, Complex Logic Circuits, CMOS Transmission Gates

(Pass Gates).

UNIT:3 **10 Hours**

7.Sequential MOS Logic Circuits: Introduction, Behavior of Bistable Elements, SR Latch Circuits, Clocked Latch and Flip-Flop Circuits, CMOS D-Latch and Edge-Triggered Flip-Flop.(Design with Verilog/VHDL/DSCH)

8.Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques, High Performance Dynamic CMOS Circuits

UNIT:4 **10 Hours**

9.Design for Testability: Introduction, Fault Types and Models, Ad Hoc Testable Design Techniques, Scan-Based Techniques, Built-In Self-Test (BIST) Techniques, Current Monitoring IDDQ Test.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. CMOS Digital Integrated Circuits: Analysis and Design, Sung-Mo Kang and Yusuf Leblebici, Tata McGraw-Hill Publishing Company Limited, 3rd Edn, 2003.

2.Principles of CMOS VLSI Design – a Systems Perspective, K. Eshraghian and N.H.E. Weste, Addison Wesley,2nd Edition, 1993.

Reference Books:

1. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, AnanthaChandrakasan, Borivoje Nikolic, PHI, 2nd Edn.
2. Modern VLSI Design System– on – Chip Design, Wayne Wolf, PHI, 3rd Edn.
3. VLSI Design, Debaprasad Das, Oxford University Press, New Delhi, 2010.
4. CMOS Logic Circuit Design, John P. Uyemura, Springer, 2001.
5. Digital Integrated Circuit Design, Ken Martin, Oxford University Press, 2000.
6. VLSI Design Technique forAnalog and Digital Circuits, R LGEIGER, TMH.
7. Algorithms for VLSI Physical Design Automation, Naveed SHERWANI, BSP BOOKS PVT Ltd., 3rdEdition.
8.Introduction to VLSI Systems a logic, Circuits and System, Ming BOL in, BSP BOOKS PVT LTD

SUBJECT CODE	COURSE TITLE	L	T	P	C	QP
BECPE5041	**FIBER OPTICS COMMUNICATIONS**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: A basic course on Electromagnetic Theory& physics.

Course Educational Objective

CEO1	The objective of this course is for students to learn modern experimental techniques in optics and photonics in the context of learning about optical fiber communication systems.
CEO2	To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define basics of optical communication and analyse geometry of ray propagation in optical fiber. Illustrate Attenuation and Dispersion in optical fiber and design Dispersion compensating fibers.
CO2	Explain Fiber Fabrication and calculate coupling losses in optical fiber. Illustrate and analyse different types of optoelectronic sources (LED, LASER).
CO3	Explain optoelectronic receivers (PIN, APD).Also estimate Responsivity, Bandwidth and Noise Gain of the receiver.
CO4	Describe and Analyse other optoelectronic devices like Optical Amplifier, Optical Modulator and WDM Components.

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	1	-	-	-	-	-	-	-	-			
CO2	3	1	1	-	-	-	-	-	-	-	-	-			
CO3	1	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	1	-	-	-	-	-	-	-	-	-	-			
Avg.	2.5	1.75	1	1	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **12 Hours**

Introduction to Optical Fiber Communications: Evolution of Fiber Optic Systems, Elements of an Optical Fiber Transmission Link.

Optical Fibers: Structures, Ray propagation through SI and GI fiber, V -number, Pulse broadening- multipath dispersion and material dispersion, Wave propagation in rectangular and circular waveguides, attenuation (absorption, scattering and bending)

UNIT:2 **11 Hours**

Fiber fabrication, Double crucible method, Fiber optic cables, Connector and splice. Losses during coupling between sources to fiber, fiber to fiber. Schemes for coupling improvement.

Optoelectronic Sources, LED, ILD, light source materials, Radiation Pattern, modulation capability.

UNIT:3 **10 Hours**

Optoelectronic Detector, PIN AND APD, Responsivity, Band width, Detector noise equivalent circuit and SNR calculation. WDM components-couplers, isolators, circulators, filters

UNIT:4 **10 Hours**
Optical Amplifier: Semiconductor optical Amplifier and Erbium Doped Fiber Amplifier.
Teaching Methods: Chalk& Board/ PPT/Video Lectures
Text Books:
1. G. Keiser, Optical Fiber Communications (4/e), TMH, 2008.
2. A. Ghatak& K. Thygarajan, Introduction to Fiber Optics, Cambridge, 1999
3. Fiber optics and Optoelectronics, R.P.Khare, Oxford University Press.
Reference Books
1. MMK. Liu, Principles and Applications of Optical Communications, TMH, 2010.
2. G.P. Agrawal, Fiber Optic Communication Systems, (3/e), Wiley, 2002.
3. J. Gowar, Optical Communication Systems, (2/e), PHI, 2001.

Subject Code	Title of the Subject	L	T	P	C	QP
BECPE5042	**ELECTRONICS DEVICES AND MODELING**	**3**	**0**	**0**	**3**	**H**

Pre-Requisites (If any) – Basic knowledge of electronic components and laws such as KCL, KVL, etc.

Course Educational Objectives

CEO1: To understand the performance of modern electronic devices using BSIMModel and compact modeling tools.

CEO2: To know the principles of SPICE3, HSPICE and PSPICE Models.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	To apply the principles of semiconductors devices
CO2	To apply basic principle of diode and understand its second and third approximation.
CO3	To analyze and study the various special purpose diodes such as zener diode, schottky diode, varactor diode and photo diode.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3		-	-	-	-	-	-	-	-	-	-	-	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	1
Avg.	3	3	-	-	-	-	-	-	-	-	-	-	-	-	1

SYLLABUS

UNIT:1 (10hrs)

PN–Junction Diode and Schottky Diode: DC Current-Voltage Characteristics, Static Model, Large-Signal Model, Small-Signal Model, Schottky Diode and its Implementation in SPICE2, Temperature and Area Effects on the Diode Model Parameters, SPICE3, HSPICE and PSPICE Models

UNIT:2 (10hrs)

Metal-Oxide-Semiconductor Transistor (MOST): Structure and OperatingRegions of the MOST, LEVEL1 Static Model, LEVEL2 Static Model, LEVEL1 and LEVEL2 Large-Signal Model, LEVEL3 Static Model, LEVEL3 Large-Signal Model, The Effect of Series Resistances, Small-Signal Models, The Effect of Temperature.

UNIT:3 (10hrs)

BJT Parameter Measurements: Introduction, Input and Model Parameters, Parameter Measurements.

MOST Parameter Measurements: LEVEL1 Model Parameters, LEVEL2 Model(Long-Channel) Parameters, LEVEL2 Model (Short-Channel) Parameters, LEVEL3 Model Parameters, Measurements of Capacitance, BSIM Model Parameter Extraction Noise and Distortions: Noise, Distortion.

UNIT:4 (10hrs) Bipolar Junction Transistor (BJT): Transistor Conversions and Symbols, Ebers-Moll Static Model, Ebers-Moll Large-Signal Model, Ebers-Moll Small-Signal Model, Gummel-Poon Static Model, Gummel-Poon Large-Signal Model, Gummel-Poon Small-Signal Model, Temperature and Area Effects on the BJT Model Parameters, Power BJT Model, SPICE3, HSPICE and PSPICE Models
Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ Invited Guest lecture/ Demonstration.
Textbooks 1.Semiconductor Device Modeling with SPICE, Giuseppe Massobrio and Paolo Antognetti, Tata McGraw-Hill Education, 2nd edition, 2010. 2. Semiconductor Physics and Devices, 3rd Edition, Donald A. Neamen, Tata McGraw Hill Publishing Company Limited, New Delhi.
Reference Books 1.Device Electronics for Integrated Circuits, Richard S. Muller, Theodore I. Kamins, and Mansun Chan, John Wiley and Sons, New York, 3rd edn.,2003. 2. Devices for Integrated Circuits: Silicon and III-V Compound Semiconductors, H. Craig Casey, John Wiley, New York, 1999. 3.Semiconductor Material and Device Characterization, Dieter K. Schroder, John Wiley and Sons, New York, 1990. 4.Fundamentals of Semiconductor Devices, M.K. Achuthan and K.N. Bhatt, Tata McGraw Hill Publishing Company Limited, New Delhi.

Subject Code	Name of the Subject	L	T	P	C	QP
BECPE5043	**POWER ELECTRONICS**	**3**	**0**	**0**	**4**	**H**

Course Educational Objectives

CEO1	To get knowledge about various power electronics devices
CEO2	To study about the operation of various converters
CEO3	To analyse the different control circuits

Course Outcomes: : ***Upon successful completion of this course, students should be able to:***

CO1	Understand the basic characteristics of Power Electronic devices
CO2	Analyse the AC to DC and AC to AC converter circuits with various loads
CO3	Evaluate the performance and operation of DC-DC converters with various applications
CO4	Analyse the operation of voltage source inverters.

CO-PO & PSO Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-
Avg.	2.25	1.75	-	-	-	-	-	-	-	-	-	-	1.5	-	-

SYLLABUS

Unit – I **[14Hrs]**

Power semiconductor devices:

Switching and V-I characteristic of devices: power diode, Thyristor family: SCR, TRIAC, GTO, Transistor Family: BJT, IGBT, and MOSFET, Series and parallel grouping of SCR.

Triggering Methods:

SCR: (Cosine Firing Scheme), BJT gate drive, IGBT gate drive, TRIAC firing circuit, Isolation of gate and base drive

Protection of Devices:

SCR: Over voltage, Over Current, dv/dt, di/dt, Gate Protection. Transistor: protection of power BJT, IGBT and power MOSFET, dv/dt& di/dt limitation.

Unit - II **[12Hrs]**

AC to DC converter:

Un-controlled Diode rectifier: Single phase half wave and full wave rectifiers with R-L and R - L-E load, 3 phase bridge rectifier with R-L and R-L-E load. Phase Controlled Converter: Principle of phase controlled converter operation, single phase full converter with R-L and R-L-E load,3 phase full converter with R-L and R-L-E load ,single phase semi converter with R-L and R-L-E load, 3 phase semi-converter with R-L and R-L-E load and effect of source inductance.

AC –AC converter:

AC voltage controller: Single phase bi-directional controllers with R and R-L load, single phase cycloconverters.

Unit – III **[14 Hrs.]**

DC to DC converter:

Classification: First quadrant, second quardrant, first and second quardrant, third and fourth quardrant, fourth quardrant converter. Switching mode regulators: Buck regulators, Boost regulators, Buck-Boost regulators, Cuk regulators, Isolated Types: Fly Back Converters, Forward converters, Push Pull Converters, Bridge Converter

Unit – IV **[8 Hrs.]**

DC to AC converter:
Inverters: Single phase Bridge Inverters, 3-Phase Inverters-1800 mode conduction, 1200 mode conduction. Voltage control of 3-Phase Inverters by Sinusoidal PWM, Current Source Inverter
Applications:

UPS, SMPS, Battery Chargers, SVC.

Teaching Methods: Chalk& Board/ PPT/Video Lectures

Text Books:

1. Power Electronics: Circuits, Devices and Applications by M H Rashid, 3rd Edition, Pearson
2. Power Electronics: By P. C. Sen, Tata McGraw Hill Education, 12th Edition
3. Power Electronics, V R Moorthi, Oxford University Press

Reference Books:

1. Power Electronics Converters, Applications & Design: by N. Mohan, 2nd Edition, John Wiley & Sons
2. Elements Of Power Electronics: Philip T. Krein, Oxford University Press
3. Power Converter Circuits: by W Shepherd and L Zhang, CRC, Taylor and Francis, Special Indian Edition

SUBJECT CODE	TITLE OF THE SUBJECT	L	T	P	C	QP
BECPE5044	**SENSORS AND TRANSDUCERS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: measurement system, calibration.

Course Educational Objectives

CEO1	To understanding the structural and functional principles of sensors and transducers used for various physical and nonelectric quantities.
CEO2	To forge the students about the use of sensors and transducers to measure the physical quantities.
CEO3	To explain the principles of operation of the sensor parameters and generators.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand and analyze the design of the measurement systems with the calibration procedure.
CO2	Describe the working of thermal, mechanical, electrical and optical sensors.
CO3	Design, construction and execution of an instrumentation measurement projects.
CO4	Use appropriate measurement methods for engineering tasks and scientific research.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	-			
CO2	-	1	-	-	-	-	-	-	-	-	-	-			
CO3	2	-	-	1	-	-	-	-	-	-	-	-			
CO4	2	-	3	-	-	-	-	-	-	-	-	-			
Avg.	2	1.5	3	1	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT I: **10 Hours**

Elements of a general measurement system: systematic characteristics, statistical characteristics, calibration, Dynamic characteristics of Measurement systems, transfer functions of typical sensing elements, step and frequency response of first and second order elements, and dynamic error in measurement systems.

UNIT II: **10 Hours**

Sensing elements: **Resistive sensing elements**: potentiometers, Resistance Temperature Detector (RTD), thermistors, strain gages. **Capacitive sensing elements**: variable separation, area and dielectric.

Inductive sensing elements: variable reluctance and LVDT displacement sensors.

UNIT III: **12 Hours**

Signal Conditioning Elements: Deflection bridges, design of resistive and reactive bridges, push-pull configuration for improvement of linearity and sensitivity

Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase sensitive demodulators and its applications in instrumentation.

UNIT IV: **8 Hours**

Thermoelectric sensing elements: laws, thermocouple characteristics, installation Problems, cold junction compensation.

IC temperature sensor Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text book: 1. Principles of Measurement Systems, J.P. Bentley, Pearson Education, New Delhi, 3rd Edition 2007. 2. Introduction to Measurement and Instrumentation, A.K. Ghosh , PHI Learning, 3rd Edition, 2009. 3. Transducers and Instrumentation, D.V.S. Murthy, PHI Learning, New Delhi, 2009.
Reference books: 1. Measurement Systems Application and Design, E.O. Doeblin, McGraw-Hill, 4th Edition. 2. Instrumentation for Engineering Measurements, J.W. Dally, W.F. Riley and K.G. McConnel , John Wiley, NY,2nd edition 2003. 3. Industrial Instrumentation, T.R. Padmanabhan, Springer, London, 2000.

Subject Code	Title of the Subject	L	T	P	C	QP
BECPC5110	**ANALOG COMMUNICATION TECHNIQUES LABORATORY**	**0**	**0**	**2**	**1**	**-**

Pre -Requisite: Knowledge of electronic devices, electronic circuits are required.

Course Educational Objective

CEO1	Understand all types of analog modulation / demodulation principles such as AM, DSB-SC, FM.
CEO2	Know the use of different transmission techniques used in communication system.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Design and simulate modulation and demodulation circuits such as AM, FM.
CO2	Illustrate the operation of TDM-PAM.
CO3	Examine the operation of Sample & hold circuit as PAM demodulator.
CO4	Evaluate analog modulated waveform in time /frequency domain and also find modulation index

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	3	3	3	-	-	-			
CO2	-	-	-	-	-	-	3	3	3	-	-	-			
CO3	-	-	-	-	-	-	3	2	3	-	-	-			
CO4	-	-	-	-	-	-	-	3	-	-	-	-			
Avg.	-	-	-	-	-	-	2.25	2.75	2.25	-	-	-			

SYLLABUS

List of Experiments

1. Analyze and plot the spectrum of following signals with aid of spectrum analyzer : sine wave , square wave , triangular wave, saw tooth wave of frequencies 1 KHz , 10 KHz , 50 KHz ,100 KHz , 1 MHz .
2. To generate of AM Modulator (DSB-C) and calculate modulation index.
3. Study and design of AM demodulator (DSB-C).
4. To generate frequency modulated signal by using FM modulator and calculate modulation index.
5. To generate original message by using Frequency Demodulation techniques.
6. To generate sampled output by using PAM.
7. To demonstrate Time Division Multiplexing and demultiplexing process using Pulse amplitude modulation signal.
8. To generate original message signal by using sample & hold circuit.
9. To demonstrate PPM and PWM signals.
10. Show the AM waveform of a sinusoidal signal in time domain and analyze its freq spectrum using MATLAB/SCILAB. Repeat the same for square, triangular and for other waveforms.
11. Show the FM waveform of a sinusoidal signal in time domain and analyze its freq spectrum using MATLAB/SCILAB. Repeat the same for square, triangular and for other waveforms.
12. Using LABVIEW software simulates AM modulation and demodulation system.

Subject Code	Title of the Subject	L	T	P	C	QP
BECPC5120	**DIGITAL SIGNAL PROCESSING LABORATORY**	**0**	**0**	**2**	**1**	**-**

Pre -Requisite:

Course Educational Objective

CEO1:	Familiar about the concept of MATLAB in various digital signal processing.
CEO2:	Design and develop new algorithm and basic model for digital signal processing.
CEO3:	Apply Novel method approach with MATLAB for analyzing various noisy signals.
CEO4:	Use the basic approach of digital signal processing in advanced concept of signal; processing like image processing, speech processing e.t.c.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Represent the discrete signal in frequency domain using MATLAB.
CO2	Understand the importance of random signal processing in DSP, and its application on statistical measures, prediction...
CO3	Verify the various signals processing technique, data modelling using MATLAB.
CO4	Analyze the concept of fast computation of signal processing in MATLAB.

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	3	2	-	-	-	-			
CO2	-	-	-	-	-	-	3	2	-	-	-	-			
CO3	-	-	-	-	-	-	3	2	-	-	-	-			
CO4	-	-	-	-	-	-	3	2	-	-	-	-			
Avg.	-	-	-	-	-	-	3	2	-	-	-	-			

SYLLABUS

1. Write a MATLAB programme for generation of different discrete signal.
2. Write a MATLAB program to perform circular convolution two discrete time sequences. Plot all the sequences. Verify the result by analytical calculation.
3. Write a MATLAB program to find the circular autocorrelation and circular cross correlation of sequences.
4. Write a MATLAB program to find Convolution of long duration sequences using overlap add Method.
5. Write a MATLAB program to find Convolution of long duration sequences using overlap save Method.
6. Write a MATLAB program to find the N Point DFT AND IDFT of a sequence
7. Write a MATLAB program to calculate the circular convolution two discrete time sequences using DFT and IDFT.
8. Write a MATLAB program to find the DIT -FFT of a sequence.
9. Write a MATLAB program to find the DIF- FFT of a sequence
10. Generation of various types of waveforms (sine, cosine, square, triangular etc.) using TMS 320C6XXX DSP kit.
11. .Design and implementation of FIR (lowpass and highpass) Filters using windowing techniques (rectangular window, triangular window and Kaiser Window) in MATLAB and DSP kit.
12. Design and implementation of IIR (lowpass and highpass) Filters (Butterworth and

13. Chebyshev) in MATLAB and DSP kit.
14. Computation of the power spectral density of a sequence using MATLAB also
15. Implementing the same in a DSP kit.
16. Write a MATLAB program to illustrate adaptive filtering using the LMS algorithms

Teaching Methods: LCD/SYSTEM / PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. Digital Signal Processing: WITH DSP Laboratory Using MATLAB: A Computer-Based Approach (McGraw-Hill Series in Electrical and Computer Engineering) 2nd Edition by Sanjit K. Mitra
2. Digital Signal Processing Using MATLAB Authors: John G. Proakis

Ref. Books

1. Digital Signal Processing Laboratory, Second Edition 2nd Edition by B. reetham Kumar
2. Digital Signal Processing Laboratory Experiments using MATLAB by HardikModi
3. http://www.ece.iit.edu/~biitcomm/Yarmouk/Digital

Subject Code	Title of the Subject	L	T	P	C	QP
BECPC5130	**DIGITAL VLSI DESIGN LABORATORY**	**0**	**0**	**2**	**1**	**-**

Pre -Requisite: Fundamental of Analogue Electronic Circuit, Digital Electronics Circuit, Physical Semiconductor Devices

Course Educational Objective

CEO1:	
CEO2:	

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand the static and dynamic behavior of MOSFETs (Metal Oxide Semiconductor Field Effect Transistors) and the secondary effects of the MOS transistor model.
CO2	Taware about the trends in semiconductor technology, and how it impacts scaling and its effect on device density, speed and power consumption.
CO3	Illustrate the behavior of MOS transistor as a switch and its capacitance.
CO4	Analyze the area ,delay and speed of the digital and analog circuits

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	3	3	-	-	-	-			
CO2	-	-	-	-	-	-	3	3	-	-	-	-			
CO3	-	-	-	-	-	-	3	2	-	-	-	-			
CO4	-	-	-	-	-	-	-	3	-	-	-	-			
Avg.	-	-	-	-	-	-	2.25	2.75	-	-	-	-			

SYLLABUS

List of Experiments :

1. Design of schematic and simple layout for CMOS Inverter & perform parasitic extraction and simulation.
2. Design of schematic and simple layout for CMOS NAND gate & perform parasitic extraction and simulation.
3. Design of schematic and simple layout for CMOS NOR gate & perform parasitic extraction and simulation.
4. Plotting of VTC curve of CMOS inverter using p-SPICE.
5. Modelling and transient analysis of 2-inputs NAND & NOR gates using p-SPICE.
6. Design a 4-bit adder -cum-sub tractor using:
7. 4:1 MUX using the following:
(a) Dataflow
(b) Using when else
(c) Structural modeling using 2:1 MUX
(d) Behavioral modeling using
(i) Case statement
8. Design a decoder (3: 8) and Encoder (Gray to Binary).
9. Design a BCD to 7-Segment Decoder.
10. Interface the 2-bit adder with 7-segment display.
11. Design 4-bit Even/Odd parity checker & generator.
12. Design of Flip-Flops:

(a) S-R Flip Flop (b) J-K Flip Flop (c) D Flip Flop (d) T Flip Flop
13. Design of counters: 4-bit up/down counters
14. Design & implementation of 16-bit Arithmetic & Logic unit using VHDL/Verilog
15. Design of a simple Microprocessor Data Path and Control Path using VHDL modeling

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

VI SEMESTER [THIRD YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC6010	Digital Communications	3	1	0	4
2	PC	BECPC6020	Microwave Theory and Techniques	3	0	0	3
3	PC	BECPC6030	Control Systems	3	0	0	3
4	PE	BECPE6041	Information Theory and Coding	3	0	0	3
		BECPE6042	Nano Electronics				
		BECPE6043	Biomedical Electronics				
		BECPE6044	Internet of Things				
5	OE		Open Elective-II *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
6	PC	BECPC6110	Digital Communication Techniques Laboratory	0	0	2	1
7	PC	BECPC6120	Microwave Techniques Laboratory	0	0	2	1
8	PC	BECPC6130	Control Systems Laboratory	0	0	2	1
9	PC	BECPC6140	Advanced Laboratory-I	0	0	2	1
10	EC	BTPEC6160	#Soft Skill and Employability Skill	0	0	2	1
TOTAL				**15**	**1**	**10**	**21**

#To be conducted by the Training & Placement Department of the College.

Subject Code	Title of the Subject	L	T	P	C	QP
BECPC6010	**DIGITAL COMMUNICATIONS**	**3**	**1**	**0**	**4**	**H**

Pre-Requisites (If any) – Basics of mathematical concepts, electronic circuits and analog communication

Course Educational Objective

CEO 1	Understand basic elements of digital communication system
CEO 2	Analyse the performance of modulation and demodulation techniques in various transmission environments

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Explain the different blocks in digital communication system.
CO2	Employ the time & frequency domain analysis of signals in a digital communication system.
CO3	Examine & differentiate the performance of a baseband & pass band digital communication system in terms of error rate and spectral efficiency.
CO4	Describe the principles of various digital modulation systems and their properties; including bandwidth, channel capacity, transmission over band limited channels, inter-symbol interference (ISI), demodulation methods, and error performance in the presence of noise.

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
Avg.	3	2.75	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 (15 hrs)

Digital Representation of Analog Signal - Sampling Theorem, Signal reconstruction, Types of Sampling Techniques, applications of sampling theorem.

Quantization of Signals, Quantization error, PCM, Electrical representation of binary digits, PCM System, Companding; Types of companding Line coding, T1 Digital System, Multiplexing T1 lines – The T2, T3 and T4 lines ;Differential PCM- Linear predicted design, Delta Modulation, and Adaptive Delta Modulation.

Noise in PCM and DM - Calculation of Quantization Noise, Output Signal Power, Thermal Noise, Output SNR in PCM, Quantization noise in Delta Modulation, output signal power, output SNR, Comparison with PCM and DM.

UNIT:2 (10 hrs)

Digital Modulation Schemes- Generation, Transmission, Reception; Spectrum and Geometrical Representation in the Signal Space of BPSK, DPSK, QPSK, QASK, M-ary PSK, BFSK, M-ary FSK, and Minimum Shifting Keying (MSK).

UNIT:3 (7 hrs)

Principle of Digital Data Transmission- Digital Communication Systems – Source, Line coder, Multiplexer, Regenerative repeater; Line Coding- PSD of various line codes, polar signaling,

constructing a DC Null in PSD by pulse shaping, On Off signaling, Bipolar signaling; Pulse shaping – ISI and effect, Nyquist first criterion for zero ISI; Scrambling, Digital receiver and regenerative repeaters; Equalizers, Timing extraction, Eye Diagram.

UNIT:4 (8 hrs)

Data Transmission- A base band signal Receiver, Peak signal to RMS noise output voltage ratio, calculation of optimum filter transfer function, optimum filter realization using Matched filter, Probability error of the matched filter, optimum filter realization using correlator.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures

Text Books:

1. Principles of Communication Systems, H Taub, D L Schilling and G Saha, TMH Education Pvt Ltd, 4th Edition 2013.
2. An Introduction to Analog and Digital communications, Simon Haykin, Wiley Publication, 2nd edition, 2007
3. Modern Digital and Analog Communication Systems, B.P. Lathi and Z Ding, Oxford University Press, New Delhi. 4th Edition 2010.

Reference Books:

1. Digital and Analog Communication System, Leon W. Couch-II, Prentice Hall of India, Pearson Education, 6th Edition 2001.
2. Digital and Analog Communication System, K. Sam Shanmugam, Wiley India Pvt. Ltd 2006.
3. Digital Communications – Fundamentals and applications, Bernard Sklar, Pearson education Publication, 2nd Edition, 2009.
4. R N Mutagi, Digital Communication- Theory, Techniques and Applications, Oxford University Press

Subject Code	Title of the Subject	L	T	P	C	QP
BECPC6020	**MICROWAVE THEORY AND TECHNIQUES**	**3**	**1**	**0**	**4**	**H**

Pre -Requisite: The students should have good background knowledge on semiconductor devices and its properties.

Course Educational Objectives

CEO1:	To gain basic knowledge on solid state devices and their application to high frequency.
CEO2:	Provide students the insight for understanding new semiconductor devices and technologies.
CEO3:	To provide the students a solid platform on solid state devices which can help them to work upon on real field applications like High frequency communications, radar communication etc.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Recognize the limitations of existing vacuum tubes and solid state devices at microwave frequencies
CO2	Study the performance of specialized microwave tubes such as klystron, reflex Klystron, magnetron and Travelling wave tube.
CO3	Understand the operation of passive waveguide components.
CO4	Analyze microwave circuits using scattering parameters

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	-	1	2
CO3	3	-	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	3	-	3	-	-	-	-	-	-	-	-	-	-	2	1
Avg.	3	1	1.25	-	0.75	-	-	-	-	-	-	-	-	1.25	1

SYLLABUS

UNIT: 1 12 HOURS

Introduction High Frequency Engineering. Microwave Tubes-
Limitations of conventional tubes.IEC, LI, Transit Time Effect Gain-Bandwidth, RF Limitations .Two Cavity Klystron Tube-Construction. Two Cavity Klystron Tube-Operation and Application. Reflex Klystron-Construction. Reflex Klystron- Operation and Application. Travelling Wave Tube (TWT)-Construction. Travelling Wave Tube (TWT) - Operation and Application. Magnetron-Construction. Magnetron- Operation and Application. Backward Wave Oscillators-Construction, Operation and Application. Crossed field amplifiers-Construction and Operation.

UNIT:2 12 HOURS

Microwave Solid State Devices.
Limitation of conventional solid state devices at Microwaves. Microwave Bipolar Junction Transistors Structure. Microwave Bipolar Junction Transistors Operation. Microwave Field Effect Transistors Structure. Microwave Field Effect Transistors Operation. PIN Diode-Construction & Operation. Schottky Barrier Diode(SBD)- Construction & Operation. Transferred Electron Devices (Gunn diode). Avalanche transit time effect –IMPATT Diodes. TRAPATT Diodes. Microwave Amplification by Stimulated Emission of Radiation (MASER)

UNIT:3 10 HOURS Microwave Components- Analysis of Microwave components -s-parameters. Junctions (E, H, Hybrid). Directional coupler. Bends and Corners. Microwave posts. S.S. tuners, Attenuators, Phase shifter. Ferrite devices (Isolator). Ferrite devices (Circulator, Gyrator). Cavity resonator
UNIT:4 8 HOURS Introduction to Radar Systems- Basic Principle-Block diagram. Operation of Radar. Radar range Equation. Pulse Repetition Frequency (PRF) and Range Ambiguities. 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 Scanning and Tracking Techniques- Various scanning techniques (Horizontal, vertical, Spiral); Scanning and Tracking Techniques-Various scanning techniques (palmer, raster, nodding); Angle tracking systems (Lobe switching, conical scan). Angle tracking systems (mono pulse),
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1. Microwave Engineering, David M. Pozer, Fourth Edition, Wiley Publications, 2011 2. Introduction to radar systems, Merill I. Skolink, McGraw Hill Publications, Second Edition, 2001 3. Microwave and Radar Engineering, G. S. Rao, Pearson India Publisher, 2014
Ref. Books Microwave devices and Circuits, Samuel Liao, Pearson Education Publisher, Third Edition,1990 Foundation of Microwave Engg, R.E. Collin, Second Edition,Wiley Publications, 2007 Microwave devices and Radar Engg, M. Kulkarni; Umesh Publications, Fifth Edition,1998 4. Microwave Engineering, Subol Kar, University Press.

Course Title						
Subject Code	**CONTROL SYSTEMS**	L	T	P	C	QP
BEEPC6030		**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To introduce students to the analysis of circuit networks and control systems.

CEO2: To provide the knowledge about stability and compensation considerations, using root locus, the Nichols chart, and Bode plots.

CEO3: To impart the idea of various principles which are usable in building and testing control systems.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	State the basic features, configuration and model of a control system.
CO2	Explain the behavior of different physical systems.
CO3	Apply compensating controllers to stabilize fluctuating factors for various industrial applications.
CO4	Differentiate the time domain & frequency domain behavior of a physical system.
CO5	Propose a specific PID or robust controller for a particular designing task.
CO6	Prepare, evaluate and appraise a control project that performs an engineering application.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	-			
CO2	2	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	3	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
CO5	3	3	-	-	-	-	-	-	-	-	-	-			
CO6	3	2	-	-	-	-	-	-	-	-	-	-			
Avg.	2.67	2.67	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT: 1 **(11 Hours)**

INTRODUCTION TO CONTROL SYSTEMS: Basic Concepts of Control Systems, Open loop and closed loop systems, Servo Mechanism/Tracking System, Regulators.

MATHEMATICAL MODELS OF PHYSICAL SYSTEMS: Differential Equations of Physical Systems, Mechanical Translational Systems, Electrical Systems, Analogy between Mechanical and electrical quintiles, Mechanical Accelerometers, Gear Trains.

TRANSFER FUNCTION: Block Diagram Algebra, Signal flow Graphs, Mason's Gain Formula.

FEEDBACK CHARACTERISTICS OF CONTROL SYSTEM: Effect of negative feedback on sensitivity, bandwidth, Disturbance, linearizing effect of feedback, Regenerative feedback.

CONTROL COMPONENTS: AC servomotor, DC servomotor, AC tachometer, Synchro and Stepper motor.

UNIT: 2 **(15 Hours)**

TIME RESPONSE ANALYSIS: Standard Test Signals, Time response of first order systems to

unit step and unit ramp inputs, Time Response of Second order systems to unit step and unit ramp input, Time Response specifications, Steady State Errors and Static Error Constants of different types of systems, Generalized error series and generalized error coefficients.

STABILITY AND ALGEBRAIC CRITERIA: concept of stability, Necessary conditions of stability, Hurwitz stability criterion, Routh stability criterion, Application of the Routh stability criterion to linear feedback system, Relative stability by shifting the origin in s-plane.

ROOT LOCUS TECHNIQUE: Root locus concepts, Rules of Construction of Root locus, Determination of Roots from Root locus for a specified open loop gain, Systems with transportation lag, Effect of adding open loop poles and zeros on Root locus.

UNIT: 3 **(8 Hours)**

FREQUENCY RESPONSE ANALYSIS: Frequency domain specifications, , Polar plots, Bode plot. Determination of Gain Margin and Phase Margin from Bode plot.

STABILITY IN FREQUENCY DOMAIN: Principle of argument, Nyquist stability criterion, Application of Nyquist stability criterion for linear feedback system.

UNIT: 4 **(6 Hours)**

CLOSED LOOP FREQUENCY RESPONSE: Constant M-circles, Constant N-Circles, Nichol's chart. Controllers: Concept of Proportional, Derivative and Integral Control actions, P, PD, PI, PID controllers. Zeigler-Nichols method of tuning PID controllers.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Modern Control Engineering by K. Ogata, 5th edition PHI.
2. Control Systems Engg. by I.J. Nagrath and M.Gopal, 5th Edition, New Age International Publishers (2010).
3. Modern Control Systems by Richard C.Dorf and Robert H. Bishop, 11th Ed (2009), Pearson

Reference Books:

1. Design of Feedback Control Systems by R.T. Stefani, B. Shahian, C.J. Savator, G.H. Hostetter, Fourth Edition (2009), Oxford University Press.
2. Control Systems (Principles and Design) by M.Gopal 3rd edition (2008), TMH.
3. Analysis of Linear Control Systems by R.L. Narasimham, I.K. International Publications
4. Control Systems Engineering by S.P. Eugene Xavier and J. Josheph Cyril Babu, 1st Edition (2004), S. Chand Co. Ltd.
5. Problems and solutions in Control System Engineering by S.N. Sivanandam and S.N. Deepa, Jaico Publishing House

Subject Code	Title of the Subject	L	T	P	C	QP
BECPE6041	**INFORMATION THEORY AND CODING**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: A good understanding of probability theory is required.

Course Educational Objectives

CEO1: The participants will learn the basic concepts of information theory and coding, including information, source coding, channel model, channel capacity, channel coding and so on.

CEO2: The main purpose of this course is to help students to complete the understanding of the wireless communication system with other advanced courses in wireless communication.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
CO2	Describe the real-life applications based on the fundamental theory.
CO3	Calculate entropy, channel capacity, bit error rate, code rate, and steady-state probability and so on.
CO4	Implement the encoder and decoder of one block code or convolution code using any program language.

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	2	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
Avg.	2.75	2.75	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **10 Hours**

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

UNIT:2 **12 Hours**

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. BCH Codes- Description of codes; Decoding of BCH codes; Implementation of error connection.

UNIT:3 **9 Hours**

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.

UNIT:4 **11 Hours**
Discrete Messages and information content- The Concept of amount of Information, Average Information, Entropy; Information rate, Source coding to increase average information per bit; Shanon-Fano coding; Huffman source coding algorithm, Lempel Ziv source coding algorithm.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
TEXT BOOKS 1. Information Theory, Coding and Cryptography, Ranjan Bose, TMH Publication 2. Introduction to Error Control Codes, S Gravano, Oxford University Press 3. Digital Communications – Fundamentals and applications, Bernard Sklar, Pearson education Publication, 2ndEdition, 2009.
REFERENCE BOOKS 1. Information Coding Techniques, R. Avudaiammal, Tat McGraw-Hill Education Pvt. Ltd., 2ndEdition New Delhi 2. Information Theory, F.M Reza: McGraw Hill 3. Error Control Coding, Shu Lin& J Costeib:, PHI

SUBJECT CODE	COURSE TITLE	L	T	P	C	QP
BECPE6042	**NANO ELECTRONICS**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: The students should have good background on microelectronics.

Course Educational Objectives

CEO1	To provide the basic concepts about device architecture and interface engineering at nano scale.
CEO2	To introduce different types of conventional and novel nanoelectronics devices for different applications.
CEO3	To provide the underlying physical processes governing the operation of spintronic devices and advance material(Graphene, CNT) based devices
CEO4	To familiar with modern MEMS/NEMS Devices

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Define the device physics in Nano scale engineering
CO2	Understand Nano device architectures in various applications
CO3	Apply the concept of spin during the electron transport across nanoelectronics devices.
CO4	Analyze the numerical simulations to understand fabrication process and device designing.

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	3	-	-	-	-	-	-	-	-			
CO3	1	2	3	1	-	-	-	-	-	-	-	-			
CO4	-	3	2	1	-	-	-	-	-	-	-	-			
Avg.	1.75	2	1.25	1.25	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(10 HOURS)**

Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones

UNIT:2 **(10 HOURS)**

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.)

UNIT:3 **(10 HOURS)**

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications encoder, Optical encoder, Bimetallic strip, Strain gauge, load cell

UNIT:4 **(10 HOURS)**

2D semiconductors and electronic devices, Heterostructure devices, Graphene,CNT, atomistic simulation, Introduction to MEMS/NEMS

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

TEXT BOOKS:

1. Stephen D. Sentaria, *Microsystem Design, Kluwer Academic Press*

2. Marc Madou, *Fundamentals of microfabrication& Nanofabrication.*
3. Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and ...
By Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, Cambridge University Press,2007
4. Julian W.Gardnes, Vijay K. Varda, *Micro sensors MEMS & Smart Devices, 2001.*
*5.*Semiconductor Devices, Physics and Technology, 8th edition, ISV (WSE) – 2015by Simon Sze Ming-Kwei Lee

REFERENCE BOOKS :

1. Nano Terchnology and Nano Electronics – Materials, devices and measurement Techniques by WR Fahrner – Springer
2. Nano: The Essentials – Understanding Nano Scinece and Nanotechnology by T.Pradeep; Tata Mc.Graw Hill.
3. Spin Electronics by M. Ziese and M.J. Thornton
4. Nanoelectronics and Nanosystems – From Transistor to Molecular and Quantum Devices by Karl Goser, Peter Glosekotter, Jan Dienstuhl
5. Silicon Nanoelectronics by ShunriOdo and David Feny, CRC Press, Taylor &FranicdGroup
6. Nanotubes and nanowires by C.N.R. Rao and A. Govindaraj, RSC Publishing
7. Quantum-Based Electronic Devices and Systems by M. Dutta and M.A. Stroscio, World Scientific.
8. James R Sheats and Bruce w.Smith, "Microlithography Science and Technology", Marcel Dekker Inc., New York, 1998.
9. J.P. Hirth and G.M.Pound "Evaporation: Nucleation and Growth Kinetics" Pergamon Press, Oxford,

Subject Code	Title of the Subject	L	T	P	C	QP
BECPE6043	**BIOMEDICAL ELECTRONICS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Biomedical equipments, cells and tissues.

Course Educational Objective

CEO1: Successfully practice biomedical engineering to serve state and regional industries, hospitals, government agencies, or national and international industries.

CEO2: Continue to utilize and enhance their engineering and biological training to solve problems related to health and healthcare that are globally relevant and based on ethically sound principles.

CEO3: Demonstrate leadership in their respective careers in biomedical engineering or interrelated areas of industry, government, academia, and clinical practice.

CEO4: Engage in life-long learning by continuing their education in graduate or professional school or through opportunities for advanced career or professional training.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Define and recognize several signals which are drawn out from the human body.
CO2	Describe divergent physical inabilities in living body by biomedical electrodes.
CO3	Employ quality assurance, risk assessment, and ethical issues in the context of instrumentation for medicine and healthcare.
CO4	Examine & interpret the simulated and experimental data.

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	2	-	-	-	-	-	-	-	-	-	-			
Avg.	3	2	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 10 Hours

BIOELECTRIC SIGNALS AND ELECTRODES:

Sources of biomedical signals, basic medical instrumentation system, PC based medical instruments, general constraints in design of medical instrumentation systems; origin of bioelectric signals, Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Electrooculogram (EOG); Electrode tissue interface, polarization, skin contact impedance, motion artifacts, Silver Chloride electrodes, Electrodes for ECG, Electrodes for EEG, Electrodes of EMG, Electrical conductivity of electrode jellies and creams, microelectrodes; Electrocardiograph-block diagram, ECG leads, effects of artifacts, multi-channel

UNIT:2 8 Hours

PACEMAKERS & DEFIBRILLATOR:

Need for cardiac pacemaker, external pacemaker, implantable pacemakers-types, ventricular synchronous demand pacemaker, programmable pacemaker, power sources for implantable pacemakers; Need for Defibrillator, DC defibrillator, automatic external defibrillator, implantable defibrillators.

UNIT:3 10 Hours BLOOD FLOW & CARDIAC OUTPUT MEASUREMENT: Electromagnetic blood flow meter principle, square wave electromagnetic flow meter, Doppler shift ultrasonic flow meter. ADVANCED DIAGNOSTIC & THERAPEUTIC INSTRUMENTS: Principle of surgical diathermy & surgical diathermy machine, Electro diagnosis-Electrotherapy-functional block diagram and working, interferential current therapy.
UNIT:4 10 Hours BIOSENSORS: Electrochemical transducers, Electrode potential and reference electrodes, potentiometric sensors, aerometric sensors, electrochemical gas sensors; chemical Transducers of acoustic and thermal principles. Biosensors – Enzyme based biosensors, Immune sensors, and microbial sensors.
Teaching Methods: Chalk& Board/ PPT/Video Lectures.
Text Books: 1.Hand Book of Biomedical Instrumentation-2nd Edition by R.S.Khandpur, Tata McGraw Hill 2003 2. Biomedical Instrumentation and Measurements-2nd Edition by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, PHI learning Pvt Ltd 2nd Edition
Reference. Books: 1. Biomedical signal processing :Principles and Technique, D.C Reddy Tata McGraw- Hill Education Pvt.Ltd, 2005 2. Introduction to Biomedical Equipment Technology-4th Edition by Joseph J. Carr, John M. Brown, Pearson Education 2007

SUBJECT CODE	Course Title	L	T	P	C	QP
BECPE6044	**INTERNET OF THINGS**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Micro-Controllers, I/O Devices, Wireless Sensor Network

Course Educational Objectives

CEO1	Introduction and description of core concepts of IoT, role and scope of smart sensors for insuring convergence of Technologies and multidisciplinary engineering practices, Machine Intelligence Quotient.
CEO2	Understand IoT Market perspective and use of Devices in IoT Technology.
CEO3	Understand State of the Art – IoT Architecture.
CEO4	Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand the vision of IoT from a global context.
CO2	Building state of the art architecture in IoT.
CO3	Developing and modifying code for various sensor based applications using wireless sensor modules and other I/O modules used in WoT(Web of Things).
CO4	Use of Devices, Gateways and Data Management in IoT.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	3	-	-	-	-	-	-	-	-			
CO3	1	2	3	1	-	-	-	-	-	-	-	-			
CO4	-	3	2	1	-	-	-	-	-	-	-	-			
Avg.	1.75	2	2.5	1.66	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(10hrs)**

INTRODUCTION

Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for end-user. Participation in the Internet of Things. Middle-ware for IoT: Overview– communication middle-ware for IoT –IoT Information Security

UNIT:2 **(14hrs)**

IOT PROTOCOLS

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security. Proximity Sensors-Magnetic Sensors-Gravity Sensors-Light Sensors.

UNIT:3 **(10hrs)**

WEB OF THINGS

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture standardization for WoT– Platform Middle-ware for WoT – Unified Multi-tier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middle-ware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT:4 **(10hrs)**

APPLICATIONS

Understanding NodeMCU and RaspberriPi. Internals and architecture of ESP8266 WiFi Module. Commercial Building Automation- Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Teaching Methods: Chalk & Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books :

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press – 2012.
2. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press – 2010.
3. Dieter Uckelmann; Mark Harrison; Florian Michahelles, " Architecting the Internet of Things" Springer – 2011.

Reference Books:

1. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012.

Subject Code	Title of the Subject	L	T	P	C	QP
BECPC6110	**DIGITAL COMMUNICATION TECHNIQUES LABORATORY**	**0**	**0**	**2**	**1**	**-**

Pre-Requisites (If any) – Basic Knowledge of analog communication & electronic circuits.

Course Educational Objectives

CEO -1 :	To understand and analyze the signal flow in a digital communication system
CEO-2:	To gain the practical hands-on experience of digital Modulations & communications Schemes.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Able to understand basic theories of Digital communication system in practical.
CO2	Able to design and implement different digital modulation and demodulation techniques.
CO3	Application of skills to use modern engineering tools, softwares& equipment's to analyze problems.
CO4	Able to identify and describe different techniques in modern digital communications, in particular in source coding using MAT Lab tools.

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	-	-	-	-	-	-	-	-	-	-			
CO2	2	3	-	-	-	-	-	-	-	-	-	-			
CO3	1	2	-	-	-	-	-	-	-	-	-	-			
CO4	2	3	-	-	-	-	-	-	-	-	-	-			
Avg.	1.5	2.75	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

List of Experiments:

1. Study the functioning of PCM and Delta modulator; Demonstrate the process of PCM modulation and Delta modulation.
2. Modulation generation and detection Signal generator CRO
3. To study Time division multiplexing.
4. To study the different channel coding and decoding technique.
5. Generation and reception of different types of signals like ASK, PSK, FSK.
6. To transmit and receive three separate signal audio, video, tone simultaneously through satellite link.
7. To transmit PC data through satellite link using a satellite communication Demonstration unit.
8. Experimentally compare different forms of BPSK, QPSK, and OQPSK and analyze their Spectrum with spectrum analyzer.
9. Spreading and dispreading using additive white Gaussian noise generation/ Gold code and other forms of spreading techniques.
10. Transmit different types of signals using ISDN system.
11. Analyze the process of data communication in LAN using LAN trainer and Compare the performance different media access techniques.

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPC6120	**MICROWAVE TECHNIQUES LABORATORY**	**0**	**0**	**2**	**1**	**-**

Pre -Requisite: Micro-Controllers, I/O Devices, Wireless Sensor Networks

Course Educational Objectives

CEO1	Introduction and description of core concepts of IoT, role and scope of smart sensors for insuring convergence of Technologies and multidisciplinary engineering practices, Machine Intelligence Quotient.
CEO2	Understand IoT Market perspective and use of Devices in IoT Technology.
CEO3	Understand State of the Art – IoT Architecture.
CEO4	Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Smart Application Implementation as per the industry requirement
CO2	Professional approach in projects development
CO3	Projects done here are trying to solve problems of various departments like health, food, emergency services, automation etc.
CO4	A professional approach to documentation, project completion and presentation.

CO – PO & PSO mapping

	PROGRAMME OUTCOMES												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	-	1	2
CO3	3	-	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	3	-	3	-	-	-	-	-	-	-	-	-	-	2	1
Avg.	3	1	1.25	-	0.75	-	-	-	-	-	-	-	-	1.25	1

SYLLABUS

1. How to connect to two types of network: an open network (without a password) and encrypted network (with password)
2. How to make 2 types of access point (hot spot): one with password and one without password
3. How to find IP and host name
4. How to Run a local web server
5. How make your Android App that controls an LED. You will use the online tool App Inventor
6. How to make your Androind App that gets data from a sensor connected to NODEMCU
7. How to make 2 NODEMCU communicate together. One will run as a Server, so listening to request. The other will be a client so sending request.
8. How to monitor a network of sensors conntected to NODEMC
9. How to make a program that scans the available machine or board connected to the network
10. How to make a WIFI network scanner

11. How to make a web page embedded into a NODEMCU to control an LED to the board
12. How sending data to the IOT platform thingspeak
13. How to send Tweet to Twitter
14. How to see the NTP (Network time protocol) or how to get time from the Internet

Teaching Methods: Chalk & Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books :

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press – 2012.
2. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press – 2010.
3. Dieter Uckelmann; Mark Harrison; Florian Michahelles, " Architecting the Internet of Things" Springer – 2011.

Reference Books:

The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012.

Course Title						
Subject Code	**CONTROL SYSTEMS LABORATORY**	L	T	P	C	QP
BEEPC6130		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To highlight the electrical modeling of a second order system and analyse the under-damped, over-damped and critically damped cases.

CEO2: To study the effects of poles and zeros location in the s-plane on the transient and steady state behavior.

CEO3: To investigate the Servo-Motor speed and position control principles by designing and selecting specific P, I and PIgains for specific responses.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Recognize analog and digital control skills to evaluate & control engineering problems.
CO2	Demonstrate the analog control experiments using analog computers and digital control experiments using PC & servo trainers.
CO3	Apply Laplace transform, transfer function, modelling RLC circuit and block diagram for simulation & control.
CO4	Analyze various practical sessions in control engineering leading towards a research point.
CO5	Design and determine control system parameters & transfer function by combining both the theoretical and applied analysis.
CO6	Justify the knowledge in the field of control engineering using both analog and digital techniques.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	3	-	-	-	-	-	-	-	-	-	-			
CO4	2	2	-	-	-	-	-	-	-	-	-	-			
CO5	3	2	-	-	-	-	-	-	-	-	-	-			
CO6	2	2	-	-	-	-	-	-	-	-	-	-			
Avg.	2.5	2.33	-	-	-	-	-	-	-	-	-	-			

SYLLABUS

LIST OF EXPERIMENTS

Control:

1. To study of speed torque characteristics of two phase ac servomotor and determination of its transfer function.
2. To obtain the frequency response of a lag and lead compensator.
3. To observe the time response of a second order process with P, PI and PID
4. Control and apply PID control to servomotor.
5. To study and validate the controllers for a temperature control system.

6. To study the position control system using Synchro.

Simulation:

1. To determine the step response and evaluation of time domain specification for a 2^{nd} order system.
2. To study of P, PI, PD and PID type controller on the step response of a feed back control system using simulink.
3. To draw the root locus for a given transfer function and verification of breakaway point and imaginary axis crossover point using MATLAB.
4. To draw the polar, Nyquist and bode plot for a given transfer function using MATLAB.
5. To design ac and dc electrical circuits using Simulink.

Subject Code	Title of the Course	L	T	P	C	QP
BECPC6140	**ADVANCED LABORATORY - I**	**0**	**0**	**2**	**1**	**-**

Pre -Requisite: Micro-Controllers, I/O Devices

Course Educational Objectives

CEO1:	Introduction and description of core concepts of Embedded Systems with a core Micro-Controller, role and scope of smart sensors for insuring convergence of Technologies and multidisciplinary engineering practices.
CEO2	Understand Embedded Market perspective and use of Devices in this Technology.
CEO3:	Understand State of the Art – Embedded Architecture.
CEO4:	Real World Embedded Design Constraints, Industrial Automation and Commercial Building Automation.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understanding basics of all kinds of Embedded Systems
CO2	Basics Implementation of Embedded Hardware Parts
CO3	Delivering a practical approach towards automation
CO4	Implementing hardware's and software's together.

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	1	1	1	-	-	-			
CO2	-	-	-	-	-	-	2	1	1	-	-	-			
CO3	-	-	-	-	-	-	1	1	1	-	-	-			
CO4	-	-	-	-	-	-	1	1	1	-	-	-			
Avg.	-	-	-	-	-	-	1.5	1	1	-	-	-			

SYLLABUS

1. Program for LED Blinking
2. Program for LED Patterns.
3. Program for RGB glow(RED, GREEN, BLUE).
4. Program for Seven Segment Dispaly as counter.
5. Program for ON/OFF switch to start a timer.
6. Program for DTMF controlled embedded system.
7. Prgram for controlling the Infrared Sensors.
8. Program for implementing password by matrix keypad.
9. Program for LCD based content display.
10. Program for sound controlled embedded system.
11. Program for dc-motor controlled embedded system
12. Program for controlling embedded gadjects through SMART Phone

Teaching Methods: Chalk & Board/ PPT/Video Lectures/Lecture by Industry Expert

Text Books :

1. AVR Microcontroller and Embedded Systems: Pearson New International Edition: ... Book by Muhammad Ali Mazidi, Sarmad Naimi, and Sepehr Naimi

Reference Books:

1. Embedded System Design with the Atmel AVR Microcontroller Textbook by Steven F. Barrett
2. C Programming for Microcontrollers: Featuring ATMEL's AVR Butterfly and free WinAVR Compiler Book by Joe Pardue
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C
Book by Janice Gillispie Mazidi, Muhammad Ali Mazidi, and Rolin D. McKinlay

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

VII SEMESTER [FOURTH YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PC	BECPC7010	Computer Networks	3	0	0	3
2	PE	BECPE7021	Mobile Communications	3	0	0	3
		BECPE7022	Antennas and Wave Propagation				
		BECPE7023	Analog VLSI Design				
		BECPE7024	Pattern Analysis and Machine Intelligence				
3	PE	BECPE7031	Embedded Systems	3	0	0	3
		BECPE7032	Adaptive Signal Processing				
		BECPE7033	Advanced Control Systems				
		BECPE7034	Industrial Electronics				
4	PE	BECPE7041	Speech and Audio Processing	3	0	0	3
		BECPE7042	Mixed Signal Design				
		BECPE7043	Telecommunication System Modeling and Simulation				
		BECPE7044	Fuzzy Logic and Neural Networks				
5	OE		Open Elective-III *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
6	PC	BECPC7110	Computer Networks Laboratory	0	0	2	1
7	PC	BECPC7140	Advanced Laboratory-II	0	0	2	1
8	EC	BECEC7150	Mini Project / Projects on Internet of Things	0	0	4	2
10	EC	BECEC7170	^Summer Internship-II	0	0	2	1
TOTAL				**15**	**0**	**10**	**20**

Subject Code	Title of the Subject	L	T	P	C	QP
BECPC7010	**COMPUTER NETWORKS**	**3**	**1**	**0**	**4**	**H**

Pre-Requisite: The students should have good background knowledge on electrical communication.

Course Educational Objectives

CEO1:	To develop an understanding of modern network architectures from a design and performance perspective.
CEO2:	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
CEO3:	To provide an opportunity to do network programming.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Study different types of networking architecture.
CO2	Study the operational procedure of different network components.
CO3	Understand the operation WLAN.
CO4	Analyse a network using both hardware and software simulation.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	3	-	-	-	-	-	-	-	-	1	2
CO3	3	-	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	3	-	3	-	-	-	-	-	-	-	-	-	-	2	1
Avg.	3	1	1.25	-	0.75	-	-	-	-	-	-	-	-	1.25	1

SYLLABUS

UNIT: 1 12 HOURS

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT:2 12 HOURS

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

UNIT:3 10 HOURS

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT:4 8 HOURS **Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill. 2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
Ref. Books 1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition. 2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India. 3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

SUBJECT CODE	Course Title	L	T	P	C	QP
BECPE7021	**MOBILE COMMUNICATIONS**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Digital communication .Basic knowledge in modulation techniques, communication systems and elementary calculus

Course Educational Objectives

CEO1	Discuss the concept of digital cellular systems (CDMA2000, WLAN, and LTE).
CEO2	Synthesis and analyze wireless and mobile cellular communication systems over a stochastic fading channel

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Illustrate basic concept of cellular radio concept
CO2	Indentify various propagation effects and design antenna to circular path loss for different condition.
CO3	Analyze & describe various wireless standards and its architecture
CO4	Classify multiple access techniques & spread spectrum and determine different mathematical parameters

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	-	-	-	-	-	-	-	-	-	-			
CO2	3	3	2	-	-	-	-	-	-	-	-	-			
CO3	3	-	-	-	-	-	-	-	-	-	-	-			
CO4	3	2	-	-	-	-	-	-	-	-	-	-			
Avg.	3	2.5	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(14 HOURS)**

An Overview of Wireless Systems- Introduction, First and Second Generation Cellular Systems, Cellular Communications from 1G to 3G, Wireless 4G Systems; Future Wireless Networks

Fundamentals of Cellular Communications- Introduction, Cellular Systems, Hexagonal Cell Geometry, Co-channel Interference Ratio, Cellular System Design in Worst-Case Scenario with an Omni directional Antenna, Co-channel Interference Reduction, Directional Antennas in Seven-Cell Reuse Pattern, Cell Splitting, Adjacent Channel Interference (ACI),handoff strategy.

UNIT:2 **(10 HOURS)**

Radio Propagation and path loss Models: Introduction, Free-space Attenuation, Attenuation over Reflecting Surfaces, Two-ray propagation Model, Characteristics of Wireless Channel: Coherence Time ,Coherence bandwidth, Doppler shift, Signal Fading Statistics, Propagation Path-loss Models -Cost 231 Model.

UNIT:3 **(8 HOURS)**

Wireless Application and Standards- Fundamentals of WLAN transmission technology, WLAN system architecture and its applications, IEEE 802.11, 802.11 systems architecture; WiMAX standards, Zigbee.

UNIT:4 **(8 HOURS)** **Multiple Access Techniques-** Introduction, Narrowband Channelized Systems, FDMA, TDMA and CDMA, System Capacity. **Spread Spectrum :** Introduction, Types of spread spectrum : DSSS&FHSS.Their operation, Processing gain, Diversity techniques
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert
TEXT BOOKS: 1. Wireless Communication and Networking, Essential Reading, V K Garg , Morgan Kaufman Publishers India; 2008 2. Wireless communication & networks, UpenDalal, Oxford University Press, 2014
REFERENCE BOOKS; 1. Wireless Communications, T S Rappaport, Pearson Education, India 2. Mobile Communication Engineering – Theory and Applications, W C Y Lee, TMH 3. Wireless Communications, T L Singhal, Tata McGraw Hill, 2010 4. Wireless communication, A Goldsmith, Cambridge

Subject Code	**Title Of The Subject**	L	T	P	C	QP
BECPE7022	**ANTENNAS & WAVE PROPAGATION**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Electromagnetic Engineering

Course Educational Objectives

CEO1:	To give the idea about electromagnetic and vector calculus
CEO2:	Provide the details of the parameters of an antenna.
CEO3:	To ascertain the implementation of antennas in day to day life
CEO4:	To provide the idea about the ionospheric radiation

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Define various antenna parameters
CO2	Analyse radiation patterns of antennas
CO3	Evaluate antennas for given specifications
CO4	Provide techniques for antenna parameter measurements

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	3	2	3	-	-	-	-	-	-	-	-	-	-	2	-

SYLLABUS

UNIT:1 **(10 Hours)**

Electromagnetic radiation and antenna fundamentals- Review of electromagnetic theory: Vector Potential, Solution of wave equation, retarded case, Hertizian dipole. Antenna characteristics: Radiation pattern, Beam solid angle, Directivity, Gain, Input Impedance, Polarization, Bandwidth, Reciprocity, Equivalence of Radiation patterns, Equivalence of Impedances, Effective aperture , Vector effective length, Antenna temperature.

UNIT:2 **(8 Hours)**

Wire antennas:- Short dipole, Radiation resistance and Directivity, Half wave Dipole, Monopole, Small loop antennas. Antenna Arrays: Linear Array and Pattern Multiplication, Two-element Array, Uniform Array, Polynomial representation, Array with non-uniform Excitation-Binomial Array.

UNIT:3 **(8 Hours)**

Aperture Antennas: - Magnetic Current and its fields, Uniqueness theorem, Field equivalence principle, Duality principle, Method of Images, Pattern properties, Slot antenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector, Corner Reflector, Common curved reflector shapes, Lens Antenna.

UNIT:4 **(12Hours)**

Special Antennas:-Long wire, V and Rhombic Antenna, Yagi-Uda Antena, Turnstile periodic Dipole Array, Spiral Antenna, Microstrip Patch Antennas.

Antenna Measurements:-Radiation Pattern measurement, Gain and Directivity Measurements, Anechoic Chamber measurement.

Radio wave propagation- Calculation of Great Circle Distance between any two points on

earth, Ground Wave Propagation, Free-space Propagation, Ground Reflection, Surface waves, Diffraction, Wave propagation in complex Environments, Tropospheric Propagation, Tropospheric Scatter. Ionospheric propagation: Structure of ionosphere, Sky waves, skip distance, Virtual height, Critical frequency, MUF, Electrical properties of ionosphere, Effects of earth's magnetic fields, Faraday rotation, Whistlers.
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books Antenna Theory Analysis and Design, C. A. Ballanis, John Wiley Publications, Second Edition, 2005. Antennas and Wave Propagation, A. R. Harish, M. Sachidanada, Oxford University Press,2007
References Books Antennas for all Applications, J.D .Kraus, Ronald J Marhefka and Ahmad S Khan, Tata McGraw-Hill Book Company. Third Edition , 2008. Antenna Wave Propagation, G.S.N. Raju, Pearson Education, 2006. Antenna and Radio Wave Propagation, R. E. Collin, McGraw Hill Publications, 1985. Antenna Analysis and Design, W.L Stutzman and G.A. Thiele, John Wiley Publications,2012.

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7023	**ANALOG VLSI DESIGN**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Analog Electronics Circuits, Advanced Electronics Circuits

Course Educational Objective

CEO1:	To familiar withAnalog circuits using CMOS
CEO2:	To design the single stage and differential MOS amplifiers& current mirrors
CEO3:	To analyze the frequency response of OP-AMP circuits & MOS amplifiers
CEO4:	To design reference circuits to test the analog ICs

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Define the significance of different biasing styles & their implementation in CMOS Analog Circuits
CO2	Understand basic building blocks like sources, sinks, mirrors, up to layout level
CO3	Comprehend the stability issues of the systems and design OpAmp fully compensated against process, supply and temperature variations
CO4	Analyze suitable topologies of the constituent sub systems and corresponding circuits as per the specifications of the system

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	-	-	3	-	-	-	-	-	-	-	-	1	2	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-	2	1	-
Avg.	1	1.25	-	0.75	-	-	-	-	-	-	-	-	1.25	1	-

SYLLABUS

UNIT:1 **12 Hours**

MOS FET device I/V characteristics, second order effects, Capacitances, body bias effect, Biasing Styles, MOS small signal Model, NMOS verses PMOS devices.

Basic building blocks and basic cells-Switches, active resistors, Current sources and sinks, Current mirrors: Basic current mirror, cascode current mirror, low voltage current mirror, Wilson and Widlar current mirrors,

UNIT:2. **08 Hours**

Voltage and current references, Single stage amplifier: Common source stage with resistive load, diode connected load, triode load, CS stage with source degeneration, source follower, CG stage, Gain boosting techniques, Cascode, folded cascode, choice of device models

UNIT:3 10 Hours

CMOS analog blocks: Differential amplifier and OPAMP design (Quasi differential amplifier, significance of tail current source, errors due to mismatch, replication principle, qualitative analysis, common mode response, differential amplifier with MOS loads, single ended conversion, gilbert cell. Operational amplifier characterization, 2 stage OP amp, process and temperature independent compensation, output stage); Frequency Synthesizers and Phased lock-loops

UNIT:4. **10 Hours**

Band Gap Reference: General considerations, Supply independent biasing, temperature independent references, negative-TC voltage, positive TC voltage, Bandgap reference, PTAT

generation, constant gm biasing, speed and noise issues, case study, curvature correction. PTAT, CTAT, Bandgap circuit, start-up circuit, curvature correction Design
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1. P R Gray and R G Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009. 2. Mohammed Ismail and Terri Fiez, Analog VLSI: Signal and Information Processing, McGraw-Hill, 1994. 3. Geiger, Allen and Stradder, VLSI Design Techniques for Analog and Digital Circuits, Tata McGraw-Hill Education, 2010. 4. Design of Analog CMOS Integrated Circuits, BehzadRazavi, Tata McGraw-Hill Publishing Company Limited, 2002.
Ref. Books 1) David A Johns, Ken Martin: Analog IC design, Wiley 2008. 2) R Gregorian and G C Temes: Analog MOS integrated circuits for signal processing, Wiley 1986 3)CMOS Analog Circuit Design, D. Holberg and P. Allen, Oxford University Press, 2002

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7024	**PATTERN ANALYSIS AND MACHINE INTELLIGENCE**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Analog Electronics Circuits, Advanced Electronics Circuits

Course Educational Objective

CEO1:	Density estimation methods
CEO2:	Linear models for regression and classification
CEO3:	Neural networks and kernel methods
CEO4:	Support Vector Machines (SVMs) and Relevance Vector Machines (RVMs)

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Have a comprehensive understanding of artificial intelligence, its related fields, and their relationships to one another.
CO2	Be able to understand and formulate general problems in the PAMI formalism.
CO3	Be able to apply pattern analysis and machine intelligence algorithms to learn and solve the PAMI problems.
CO4	Be prepared for further advanced courses in the fields of artificial intelligence, machine learning, pattern recognition, neural network, computer vision and imaging.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	2	-	-	-	-	-	-	-	-	-	-	-			
CO2	2	-	-	3	-	-	-	-	-	-	-	-			
CO3	-	2	-	-	-	-	-	-	-	-	-	-			
CO4	-	3	-	-	-	-	-	-	-	-	-	-			
Avg.	1	1.25	-	0.75	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **12 Hours**

Basics of Probability, Random Processes and Linear Algebra (recap): Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra.

Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors.

UNIT:2. **08 Hours**

Bayes Decision Theory : Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

Parameter Estimation Methods : Maximum-Likelihood estimation :Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and

clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation. Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.

UNIT:3 10 Hours

Dimensionality reduction: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorisation - a dictionary learning method.

Linear discriminant functions : Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.

UNIT:4. **10 Hours**

Artificial neural networks: Multilayer perceptron - feedforwark neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks.

Non-metric methods for pattern classification : Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001

S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 200

Ref. Books

1) C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006
2) Pattern Classification (2nd Ed), Duda, R.O. and Hart, P.E. and Stork, D.G., WileyInterscience, 2000 (for pattern recognition)

SUBJECT CODE	Course Title	L	T	P	C	QP
BECPE7031	**EMBEDDED SYSTEMS**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Fundamentals Of C language and Microcontrollers.

Course Educational Objectives

CEO1	Discuss the major components that constitute an embedded system
CEO2	Implement small programs to solve well defined problems on embedded platform
CEO3	Develop familiarity with tools used to develop in an embedded system
CEO4	Design embedded system for the betterment of the society

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define the fundamentals of Embedded system
CO2	Explain the difference between microprocessor & microcontroller
CO3	Demonstrate the advantage of Real time operating system
CO4	Design Embedded systems using Embedded C

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	1	3	1	-	-	-	-	-	-	-	-	-			
CO4	-	-	2	-	-	-	-	-	-	-	-	-			
Avg.	2.33	2	1.5	-	-	-	-	-	-	-	-	-			

SYLLABUS

Module I Hardware Concepts **10 hours**

Application and characteristics of embedded systems, Overview of Processors and hardware units in an embedded system, General purpose processors, Microcontrollers, ARM-based Systems on a Chip (SoC), Application-Specific Circuits (ASICs), Levels of hardware modelling, VHDL, Sensors, A/D-D/A converters, Actuators, Interfacing using UART, USB, CAN bus, SRAM and DRAM, Flash memory

Module II

Embedded C and AVR **15 hours**

Introduction to Embedded systems design:

Introduction to Embedded system, Embedded System Project Management, ESD and Co-design issues in System development Process, Design cycle in the development phase for an embedded system, Use of target system or its emulator and In-circuit emulator, Use of software tools for development of an ES.

Embedded C Programming:

Embedded C V/s C language, DDR, PORT and PIN commands, special data types, Infinite while loop, if conditions

AVR Interfacing and Applications:

Interfacing External Memory, Keyboard and Display Devices: LED, 7-segment LED display, LCD, Ultrasonic Sensor, IR Sensor.

Proteus Design Suite: Circuit building for all applications

Module III

Real Time Operating System **12 hours**

Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix-based Real-time operating systems, POSIX-RT, A survey of contemporary Real-time operating systems, Microkernel-based systems.

Module IV

Embedded Application Development **8 hours**

Embedded system development life cycle, State charts, General language characteristics , Features of MISRA C for embedded programming, Hardware/Software Co-design , Hardware/software partitioning, Testing embedded systems, Design for testability and Self-test.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/ Model demonstration

Text Books

1.Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley, 2002. (For Module 1)

2.David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000.(For module 3 & 4)

Ref. Books

1.S. Chattopadhyay, Embedded System Design, PHI

2.Shibu KV, Introduction to Embedded Systems, TMH

3.Wayne Wolf, Computers as Components; Principles of Embedded Computing System Design – Harcourt India, Morgan Kaufman Publishers, 2001

4.Rajkamal, Embedded Systems Architecture, Programming and Design, TATA McGraw-Hill, 2003

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7032	**ADAPTIVE SIGNAL PROCESSING**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Signals & Systems, Digital Signal Processing

Course Educational Objectives

CEO1:	Perform simple spectral factorization tasks.
CEO2:	Derive and apply the principle of statistical orthogonality
CEO3:	Design infinite impulse response (IIR) filters
CEO4:	Derive the least mean squares (LMS) and recursive least squares (RLS) adaptive filter algorithms and apply them to problems in system identification, linear predication and equalization

Course Outcomes: ***Upon successful completion of this course, students should be able to***

CO1	Use basic probability theory to model random signals in terms of Random Processes.
CO2	Use covariance matrices to describe the second order statistics of Random Processes.
CO3	Understand and derive the Wiener filter for signals with known second order statistics and formulate the Wiener filter as a constrained optimization problem.
CO4	Use and understand the LMS algorithm for iteratively estimating the Wiener filter weights.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	3	-	-	-	-	-	-	-			
CO3	3	-	2	-	-	-	-	-	-	-	-	-			
CO4	3	-	3	-	-	-	-	-	-	-	-	-			
Avg.	3	1	1.25	-	0.75	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(10hrs)**

Introduction: Adaptive Systems - Definition and characteristics, General properties, Open and Closed Loop Adaptations, Applications

The Adaptive Linear Combiner: Performance function, Gradient and Mean Square Error, Examples.

UNIT:2 **(12hrs)**

Theory of Adaptation with Stationary Signals: Properties of the Quadratic Performance Surface, Significance of eigen values, eigen vectors, coorelation matrix.

Searching the Proformance Surface: A simple gradient search algorithm, Stability and Rate of convergence, the learning curve

Gradient Estimation and its effects on Adoption: The performance penalty, Variance of the gradient estimate, Misadjustment

UNIT:3 **(10hrs)**

Adaptive Algorithms and Structures: The LMS Algorithm, Convergence, learning Curve, Performance analysis, Filtered X LMS algorithm,

Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

UNIT:4 **(10hrs)**
Applications: Adaptive Modeling and System Identification using adaptive filter, Inverse Adaptive Modeling, Deconvolution, and equalization using adaptive filter, Adaptive Control Systems using Filtered X LMS Algorithm, Adaptive Noise Cancellation using Adaptive filter
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books : Bernard Widrow and Samuel D. Stearns, Adaptive Signal Processing, Pearson Education, 2nd impression 2009.
Reference Books: Simon Haykin, Adaptive Filter Theory, 4th Edn., Pearson Education. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7033	**ADVANCED CONTROL SYSTEMS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Control Systems, Signal Systems

Course Educational Objectives

CEO1:	Perform discrete representation of LTI systems.
CEO2:	Derive and apply stability of open loop and closed loop discrete-time systems.
CEO3:	Design digital controllers.
CEO4:	Derive and analyse the state feedback and output feedback controllers

Course Outcomes: ***Upon successful completion of this course, students should be able to***

CO1	Obtain discrete representation of LTI systems.
CO2	Analyse stability of open loop and closed loop discrete-time systems.
CO3	Design and analyse digital controllers.
CO4	Design state feedback and output feedback controllers.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	3	-	-	-	-	-	-	-			
CO3	3	-	2	-	-	-	-	-	-	-	-	-			
CO4	3	-	3	-	-	-	-	-	-	-	-	-			
Avg.	3	1	1.25	-	0.75	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(10hrs)**

Discrete Representation of Continuous Systems

Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

UNIT:2 **(12hrs)**

Discrete System Analysis

Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.

Stability of Discrete Time System

Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

UNIT:3 **(10hrs)**

State Space Approach for discrete time systems

State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.

Design of Digital Control System

Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

UNIT:4 **(10hrs)**

Discrete output feedback control

Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books :

1. K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.
2. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
3. G. F. Franklin, J. D. Powell and M. L. Workman, "Digital Control of Dynamic Systems", Addison-Wesley, 1998.

Reference Books:

1. B.C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980.

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7034	**INDUSTRIAL ELECTRONICS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Electronics Circuits

Course Educational Objectives

CEO1:	Apply critical thinking in solving industrial electronic problems.
CEO2:	Use tools/test equipment to analyse electronic components.
CEO3:	Learn about industrial control devices.
CEO4:	Learn about the latest electronic devices available in industry.

Course Outcomes: ***Upon successful completion of this course, students should be able to***

CO1	Learn about the digital ICs and sensory electronic devices.
CO2	Be able to understand the functions of transducer.
CO3	Perform basic electronics troubleshooting.
CO4	Gain some experience with operational amplifiers.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	3	-	-	-	-	-	-	-			
CO3	3	-	2	-	-	-	-	-	-	-	-	-			
CO4	3	-	3	-	-	-	-	-	-	-	-	-			
Avg.	3	1	1.25	-	0.75	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(10hrs)**

Discrete Control Input and Output Devices

Introduction to discrete control, Mechanical and Electrical Switch Classifications, Mutually-Activated Electronic Circuit Switches, Mechanically-Activated Electronic Circuit Switches, Discrete Output Devices, Relays, Control Diagrams.

Operational Amplifiers and Linear ICs

Introduction to the Op-Amp Parameters, Understanding Op-Amp Data Sheets, Inverting Amplifiers, Non-inverting amplifiers, Summing Amplifiers, Differential Amplifiers, Voltage – to-Current Converters, Integrators and Differentiators, Comparators and Detectors, Active Filter Circuits, Instrumentation Amplifiers.

UNIT:2 **(12hrs)**

Thyristors (SCRs, TRIACs)

Silicon Controlled Rectifiers, Thyristor Triggering Devices, SCR Applications, Triacs, Triac Applications, Controlled Thyristor Switches

Discrete Automation Sensors and Devices

Introduction to Electronic Sensors, Non-contact Sensors, Sensor Output Interfaces, Analog Automation Sensors, Sensor Applications and Selection, Integrating Sensors into Power and Control Circuits

UNIT:3 **(10hrs)**

Analog Process Control Devices and Sensors

Process Actuators and Output Devices, Control Valves, Electrical Heating Elements, Control Sensors, Transmitters, and Transducers, Temperature Sensors, Pressure Sensors,
Flow Sensors, Level Sensors, Position Sensors.

UNIT:4 **(10hrs)**

Safety

Introduction to Safety, Safety Standards, Presence Sensors, Interlock Devices, Developing a Safety Strategy.

Data Communication Between Intelligent Machines

Classification of Network Media, Enterprise Networks, Fieldbus Networks, Factory-Floor Data Network.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books :

1. Rehg, James, A., Sartori, Glenn. Industrial Electronics. 5th ed. Upper Saddle River: Prentice Hall. 2006.

Reference Books:

1. Maloney, Timothy. Modern Industrial Electronics, 5th ed. Upper Saddle River: Prentice Hall. 2004.

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7041	**SPEECH & AUDIO PROCESSING**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Signals & Systems, Digital Signal Processing

Course Educational Objectives

CEO1:	To learn basic concepts of speech & audio processing.
CEO2:	To study fundamentals and mathematical models in digital speech & audio processing
CEO3:	To develop time and frequency domain techniques for speech analysis.
CEO4:	To study linear predictive analysis techniques for speech processing.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Define speech production.
CO2	Discuss theory and models in speech & audio Processing.
CO3	Illustrate various techniques involved in collecting the features from the speech signal in both time and frequency domain.
CO4	Analyze the various techniques involved in speech and speaker detection.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	3	-	3	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
Avg.	3	2	0.75	-	0.75	-	-	-	-	-	-	-	-	1	-

SYLLABUS

UNIT:1 **10 Hours**

Mechanics of speech- Speech production: Mechanism of speech production, Acoustic phonetics - Digital models for speech signals - Representations of speech waveform: Sampling speech signals, basics of quantization, delta modulation, and Differential PCM -Auditory perception: psycho acoustics.

UNIT:2 **12 Hours**

Time domain methods for speech processing- Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function –Pitch period estimation using Auto Correlation Function.

UNIT:3 **12 Hours**

Frequency domain method for speech processing- Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays -Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder , Channel Homomorphic vocoder speech analysis: Cepstral analysis of Speech, Formant Estimation, Homomorphic and speech vocoder.

UNIT:4 **10 Hours**

Linear predictive analysis of speech- Basic Principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm, Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis, VELP – CELP.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books Digital Processing of Speech signals, L.R.Rabiner and R.W.Schaffer, Prentice Hall 1979
Reference Books: 1. Discrete-Time Speech Signal Processing, Thomas F, Quatieri, Prentice Hall /Pearson Education, 2004. Speech and Audio Signal Processing, Ben Gold and Nelson Morgan, John Wileyand Sons Inc., Singapore, 2004 3. Fundamentals of Speech Recognition, L.R. Rabiner and B. H. Juang, PrenticeHall, 1993. 4. Discrete Time Processing of Speech Signals, J.R. Deller, J.H.L. Hansen and J.G.Proakis, John Wiley, IEEE Press, 1999. 5. Speech Communication Human and Machine, Douglas O Shaughnessy.S BSPBOOKS PVT LTD, 2nd edition

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7042	**MIXED SIGNAL DESIGN**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Fundamental of Electronics devices, Network theory ,Analogue Electronic Circuit, Digital Electronics Circuit

Course Educational Objective

CEO1: To understand the basic concept of analogue device and digital device and its application.

CEO2: To get a complete knowledge CMOS Logic circuits and their working principle.

CEO3: To analysis the switching action ultra-low power circuit design, error resilient circuit design, power management circuits and basic design of analog circuits.

CEO4: Familiar about the concept design different architectures in mixed signal mode.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

At the end of this course students will be able to demonstrate the ability to

CO1	Describe relevant properties of analogue and digital signals and explain the consequences of these for high speed digital and mixed signal designs with switching action.
CO2	Demonstrate understanding of common data converter parameters
CO3	Analyze performance for designing mixed-signal building blocks including comparators and data converters
CO4	Use low-voltage, low-power design techniques for mixed-signal CMOS ICs.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	-	-	-	-	-	-	-	-	-			
CO2	2	2	1	-	-	-	-	-	-	-	-	-			
CO3	2	-	1	-	-	-	-	-	-	-	-	-			
CO4	2	-	2	-	-	-	-	-	-	-	-	-			
Avg.	2	1	1.25	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **12 Hours**

Analog and discrete-time signal processing, introduction to sampling theory; Basic sampling circuits for analog signal sampling, performance metrics of sampling circuits, different types of sampling switches. Sample-and-Hold Architectures-Open-loop & closed-loop architectures, open-loop architecture with miller capacitance, Multiplexed-input architectures, recycling architecture Analog continuous-time filters: passive and active filters;
Basics of analog discrete-time filters and Z-transform

UNIT:2 **08 Hours**

Switched-capacitor filters-Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications Integrator Based Filters Low Pass filters, active RC integrators, MOSFET -C integrators, transconductance-c integrator, discrete time integrators. Filtering topologies -bilinear transfer function and bi quadratic transfer function

UNIT:3 **10 Hours**

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACsMixed-signal layout, Interconnects and data transmission; Voltage-mode signalling and data transmission; Current-mode signaling and data transmission.

UNIT:4. **10 Hours**

Introduction to frequency synthesizers and synchronization;

Basics of PLL,. Characterization of a comparator, basic CMOS comparator design, analog multiplier design, PLL -simple PLL, Analog PLLs; Digital PLLs; DLLs charge-pump PLL, applications of PLL.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books

1. David A. Johns, Ken Martin, "Analog Integrated Circuit Design", John Wiley and Sons, 1997.
2. Design of analog CMOS integrated circuits by Behzad Razavi, McGraw-Hill, 2003.
3. CMOS circuit design, layout and simulation by R. Jacob Baker, Revised second edition, IEEE press, 2008.
4. CMOS Integrated ADCs and DACs by Rudy V. dePlassche, Springer, Indian edition, 2005.
5. Electronic Filter Design Handbook by Arthur B. Williams, McGraw-Hill, 1981.

Ref. Books

1. Design of analog filters by R. Schauman, Prentice-Hall 1990 (or newer additions)
2. An introduction to mixed-signal IC test and measurement by M. Burns et al., Oxford university press, first Indian edition, 2008.
3. .R. Jacob Baker, "CMOS Mixed-Signal Circuit Design", Wiley Inter-Science, 2003.
4. .R. Gregorian, G. C. Temes, "Analog MOS Integrated Circuits for Signal Processing", John Wiley and Sons, 1986.
5. .P.E. Allen, Doug Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2011

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7043	**TELECOMMUNICATION SYSTEM MODELING AND SIMULATION**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite:

Course Educational Objective

CEO1	To enable the students in understanding the various aspects of simulation methodology and performance
CEO2	To model different types of communication systems & channels and process them.
CEO3	To enable the students in understanding and interpreting results using case studies.

Course Outcome

At the end of this course students will be able to demonstrate the ability to

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Recognize and mathematically model physical phenomena.
CO2	Understand and describe the various simulation techniques.
CO3	Apply the knowledge of the different simulation techniques for designing a communication system or channel.
CO4	Simulate the phenomena so as to depict the characteristics that may be observed in a real experiment.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	3	-	-	-	-	-	-	-	-	3	2
CO3	1	-	2	-	-	-	-	-	-	-	-	-	-	-	1
CO4	2	-	3	-	-	-	-	-	-	-	-	-	-	-	1
Avg.	1.25	1	1.25	-	0.75	-	-	-	-	-	-	-	-	0.75	1

SYLLABUS

UNIT:1 (9 Hours)

SIMULATION METHODOLOGY : Introduction, Aspects of methodology, Performance Estimation, Simulation sampling frequency, Low pass equivalent simulation models for bandpass signals, Multicarrier signals, Non-linear and time varying systems, Post processing – Basic graphical techniques and estimations.

UNIT:2 (10 Hours)

RANDOM SIGNAL GENERATION & PROCESSING: Uniform random number generation, Mapping uniform random variables to an arbitrary pdf, Correlated and Uncorrelated Gaussian random number generation, PN sequence generation, Random signal processing, Testing of random number generators.

UNIT:3 (8 Hours)

MONTE CARLO SIMULATION Fundamental concepts, Application to communication systems, Monte Carlo integration, Semi-analytic techniques, Case study: Performance estimation of a wireless system

UNIT:4 (13Hours)

ADVANCED MODELS & SIMULATION TECHNIQUES Modeling and simulation of non-linearities : Types, Memoryless non-linearities, Non-linearities with memory, Modeling and simulation of Time varying systems : Random process models, Tapped delay line model, Modelling and simulation of waveform channels, Discrete memoryless channel models, Markov model for discrete channels with memory, Tail extrapolation, pdf estimators, Importance Sampling methods, Case study: Simulation of a Cellular Radio System.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, Principles of Communication Systems Simulation, Pearson Education (Singapore) Pvt. Ltd, 2004.

2.M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, Simulation of Communication Systems: Modeling, Methodology and Techniques, Plenum Press, New York, 2001

Reference Books:

1.Averill.M.Law and W. David Kelton, Simulation Modeling and Analysis, McGraw Hill Inc., 20

2. Geoffrey Gorden, System Simulation, Prentice Hall of India, 2nd Edition, 1992.

3. Jerry Banks and John S. Carson, Discrete Event System Simulation, Prentice Hall of India, 1984.

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE7044	**FUZZY LOGIC AND NEURAL NETWORKS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite:

Course Educational Objective

CEO1	To impact knowledge on fuzzy logic principles.
CEO2	To understand models of ANN.
CEO3	To use the fuzzy logic and neural network for application related to design and manufacture.

Course Outcome

At the end of this course students will be able to demonstrate the ability to

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Develop the skill in basic understanding on fuzzy and neural network.
CO2	Explore the functional components of neural classification conducer and the functional components of fuzzy logic classification on controller.
CO3	Apply the knowledge of the different simulation techniques for designing a communication system or channel.
CO4	Develop and implement a basic trainable neural network (or) a fuzzy logic system to design and manufacturing.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	-	-	-	-	-	-	-	-	-	-			
CO2	1	2	-	-	3	-	-	-	-	-	-	-			
CO3	1	-	2	-	-	-	-	-	-	-	-	-			
CO4	2	-	3	-	-	-	-	-	-	-	-	-			
Avg.	1.25	1	1.25	-	0.75	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 (9 Hours)

INTRODUCTION TO FUZZY LOGIC PRINCIPLES: Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.

UNIT:2 (10 Hours)

ADVANCED FUZZY LOGIC APPLICATIONS: Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – systactic recognition – fuzzy optimization.

UNIT:3 (8 Hours)

INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS: Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods –

Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.

UNIT:4 (13Hours)

OTHER ANN ARCHITECTURES: Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive reasonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – kohenen self organizing maps – learning vector quantization – counter propagation networks – industrial applications.

RECENT ADVANCES: Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial immune systems – applications in design and manufacturing.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Rajasekaran. S.. Vijayalakshmi Pai. G.A. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India Private Limited, 2003

2. Timothy J.Ross, "Fuzzy logic with Engineering Applications", McGraw Hill, 1995.

3. Zurada J.M. "Introduction to Artificial Neural Systems", Jaico publishing house, 1994.

Reference Books:

1. Klir.G, Yuan B.B. "Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
2. Laurance Fausett, "Fundamentals of Neural Networks", Prentice hall, 1992
3. Gen, M. and Cheng R. "Genetic Algorithm and Engineering Design", john wiley 1997

Course Title						
Subject Code	**COMPUTER NETWORKS LABORATORY**	L	T	P	C	QP
BECPC7110		**0**	**0**	**2**	**1**	**-**

Pre-requisites *(if any)*:

Course Educational Objectives

CEO1: To introduce socket programming.

CEO2: To be familiar with simulation tools and have hands on experience on various networking protocols .

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Use simulation tools.
CO2	Implement the various protocols.
CO3	Analyse the performance of the protocols in different layers.
CO4	Analyze various routing algorithms.

CO - PO & PSO Matrix

CO	PROGRAM OUTCOMES												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-			
CO2	3	3	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	-	-	-	-	-	-	-	-	-	-			
CO4	3	3	3	-	-	-	-	-	-	-	-	-			
Avg.	3	2.5	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

1. Implementation of Stop and Wait Protocol and Sliding Window Protocol.
2. Study of Socket Programming and Client – Server model
3. Write a code simulating ARP /RARP protocols.
4. Write a code simulating PING and TRACEROUTE commands
5. Create a socket for HTTP for web page upload and download.
6. Write a program to implement RPC (Remote Procedure Call)
7. Implementation of Subnetting .
8. Applications using TCP Sockets like

a. Echo client and echo server b. Chat c. File Transfer

9. Applications using TCP and UDP Sockets like d. DNS e. SNMP f. File Transfer
10. Study of Network simulator (NS).and Simulation of Congestion Control Algorithms using NS

Subject Code	Title Of The Subject	L	T	P	C	QP
BEIPC7140	**ADVANCED LABORATORY - II**	**0**	**0**	**2**	**1**	**-**

Pre -Requisite: Micro-Controllers, I/O Devices, Wireless Sensor Networks

Course Educational Objectives

CEO1	Introduction and description of core concepts of IoT, role and scope of smart sensors for insuring convergence of Technologies and multidisciplinary engineering practices, Machine Intelligence Quotient.
CEO2	Understand IoT Market perspective and use of Devices in IoT Technology.
CEO3	Understand State of the Art – IoT Architecture.
CEO4	Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Smart Application Implementation as per the industry requirement
CO2	Professional approach in projects development
CO3	Projects done here are trying to solve problems of various departments like health, food, emergency services, automation etc.
CO4	A professional approach to documentation, project completion and presentation.

CO – PO & PSO mapping

	PROGRAMME OUTCOMES												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-	-	-	-	-	-	-	-	-	-			
CO2	1	2	-	-	3	-	-	-	-	-	-	-			
CO3	1	1	2	-	-	-	-	-	-	-	-	-			
CO4	2	1	3	-	-	-	-	-	-	-	-	-			
Avg.	1.25	1	1.25	-	0.75	-	-	-	-	-	-	-			

SYLLABUS

1. How to connect to two types of network: an open network (without a password) and encrypted network (with password)
2. How to make 2 types of access point (hot spot): one with password and one without password
3. How to find IP and host name
4. How to Run a local web server
5. How make your Android App that controls an LED. You will use the online tool App Inventor
6. How to make your Android App that gets data from a sensor connected to NODEMCU
7. How to make 2 NODEMCU communicate together. One will run as a Server, so listening to request. The other will be a client so sending request.
8. How to monitor a network of sensors connected to NODEMC
9. How to make a program that scans the available machine or board connected to the network
10. How to make a WIFI network scanner
11. How to make a web page embedded into a NODEMCU to control an LED to the

board 12. How sending data to the IOT platform thingspeak 13. How to send Tweet to Twitter 14. How to see the NTP (Network time protocol) or how to get time from the Internet
Teaching Methods: Chalk & Board/ PPT/Video Lectures/Lecture by Industry Expert
Text Books : **1.** Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press – 2012. 2. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press – 2010. 3. Dieter Uckelmann; Mark Harrison; Florian Michahelles, " Architecting the Internet of Things" Springer – 2011.
Reference Books: The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012.

Subject Code	Title Of The Subject	L	T	P	C	QP
BEIEC7150	**Mini Project / Projects on Internet of Things**	**0**	**0**	**4**	**2**	**-**

Pre -Requisite: Micro-Controllers, I/O Devices, Wireless Sensor Networks

Course Educational Objectives

CEO1	Introduction and description of core concepts of IoT, role and scope of smart sensors for insuring convergence of Technologies and multidisciplinary engineering practices, Machine Intelligence Quotient.
CEO2	Understand IoT Market perspective and use of Devices in IoT Technology.
CEO3	Understand State of the Art – IoT Architecture.
CEO4	Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Smart Application Implementation as per the industry requirement
CO2	Professional approach in projects development
CO3	Projects done here are trying to solve problems of various departments like health, food, emergency services, automation etc.
CO4	A professional approach to documentation, project completion and presentation.

CO – PO & PSO mapping

	PROGRAMME OUTCOMES												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	-	-	-	-	-	-	-	-	-	-			
CO2	1	2	-	-	3	-	-	-	-	-	-	-			
CO3	1	1	2	-	-	-	-	-	-	-	-	-			
CO4	2	1	3	-	-	-	-	-	-	-	-	-			
Avg.	1.25	1	1.25	-	0.75	-	-	-	-	-	-	-			

SYLLABUS

1. Introduction of IOT with RaspberryPi
2. Hardware Introduction and SetUp of Raspberry Pi.
3. Headless Booting of Raspberry Pi through LAN and Wifi
4. SSH and Remote Desktop setup in Raspberry Pi
5. Working with Linux Terminal
6. Basic of Python programming on Raspberry Pi
7. Introduction of Raspberry Pi
   - A) GPIO PINS
   - B) CAMERA INTERFACE
   - C) DISPLAY INTERFACE
   - D) Raspi.config Tool
8. LED Blinkwith Raspberry Pi

A) RPi.GPIO

B) GPIO Zero

9. LED Glow on Button Press using Raspberry Pi
10. Interfacing various sensors using Raspberry Pi (Any two sensors as per

availability) 11. Home Automation on ThingsSpeak and GCP IOT(Relay Connection Implementation) 12. Web Page based LED Controller on LOCAL NETWORK 13. Web Page based LED Controller on GLOBE NETWORK (with help of Dataplicity) 14. Introduction of MQTT 15. Introduction of Httpclient library with Python (Request Module)
Teaching Methods: Chalk & Board/ PPT/Video Lectures/Lecture by Industry Expert

UG IN ELECTRONICS & COMMUNICATION ENGINEERING

VIII SEMESTER [FOURTH YEAR]

Sl. No.	Course Category	Course Code	Course Title	L	T	P	Credits
THEORY							
1	PE	BECPE8011	Satellite Communications	3	0	0	3
		BEIPE8012	Micro-Electro-Mechanical Systems				
		BECPE8013	High Speed Electronics				
		BECPE8014	Wavelet Transforms				
2	PE	BECPE8021	Digital Image and Video Processing	3	0	0	3
		BECPE8022	Error Correcting Codes				
		BEIPE8023	Wireless Sensor Networks				
		BECPE8024	Cryptography and Network Security				
3	OE		Open Elective-IV *(Any One)*	3	0	0	3
PRACTICAL / SESSIONAL							
4	EC	BECEC8150	Major Project / Industrial Project / Startup Training cum Project	0	0	10	5
5	EC	BECEC8180	Seminar and Technical Writing	0	0	2	1
6	EC	BECEC8190	Comprehensive Viva-Voce	0	0	2	1
TOTAL				**9**	**0**	**14**	**16**

SUBJECT CODE	Course Title	L	T	P	C	QP
BECPE8011	**SATELLITE COMMUNICATIONS**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Electromagnetic, Digital Communications

Course Educational Objectives

CEO1	To enable the student to become familiar with satellites and its services
CEO2	To impart the idea of satellite orbits & lunching
CEO3	To study various antenna types useful in satellite communication

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Understand the fundamental of orbital machines & calculate key geometric & timing parameters for a variety of common satellite orbits.
CO2	Explain the multiple radio access techniques &find the user assessing the radio frequency
CO3	Define various satellite antenna &design link power budget for satellites.
CO4	Recognize &design different satellite antennas.

CO - PO & PSO Matrix

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	2	-	-	-	-	-	-	-	-	-			
CO4	2	1	2	-	-	-	-	-	-	-	-	-			
Avg.	2.75	2	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 (**12 hrs**)

BASICSOF SATELLITE ORBITS: Frequency allocations for Satellite Services, Orbital mechanics and parameters, look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Satellite Subsystem: Attitude and orbit control system (AOCS), TT&C, Description of spacecraft System; Transponders.

SATELLITE LINK DESIGN: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

UNIT: 2 (**10 hrs.**)

SATELLITE ACCESSES: Multiple access techniques for satellite links, Preassigned FDMA, Demand Assigned FDMA, TDMA, Preassigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code Division Multiple Access; Estimating Channel requirements, SPADE, Random access.

SATELLITE MOBILE AND SPECIALIZED SERVICES: Introduction, Satellite Mobile Services, VSATs, Global Positioning Satellite System (GPS). DBSTV System Design.

UNIT:3 **(11hrs)**

PROPAGATION ON SATELLITE: Introduction, Quantifying attenuation and depolarization, Atmospheric Losses, Ionosphere Effects , Tropospheric Scintillation, hydrometric & non hydrometric effects, ionosphere effects, rain and ice effects.

SATELLITE ANTENNAS: Basic Antennas Theory –Horn, Parabolic, Dipole; Antenna relationships:Gain, pointing loss, Directivity, Efficiency.

UNIT:4 **(7 hrs)**

EARTH STATION TECHNOLOGY: Design of large antennas – Cassegrain antennas,optimizing gain of large antenna, antenna temperature.

DESIGN OF SMALL EARTH STATION ANTENNAS: Front fed paraboloid reflector antennas, offset fedantennas, beam steering, Global Beam Antenna, equipment for earth station.

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ Demonstration.

Text Books:

1. Satellite Communication, T. Pratt, C. Bostian, John Wiley Co, 2nd Edition.
2. Satellite Communication, Principles & Applications, R.N.Mutagi, Oxford University Press, 1st Edition, 2016

Reference Books:

1. Digital Communication with Satellite and Fiber Optic Application, HarlodKolimbins, PHI
2. Satellite Communication, Robert M. Gagliardi, CBS Publishers
3. Satellitte Communication Systems, Richharia. BSP BOOKS PVT LTD.
4. Satellitte Communication Engg., MichealKolawole, BSP BOOKS PVT LTD

Subject Code	Title of the subject	L	T	P	C	QP
BEIPE8012	**MICRO-ELECTRO MECHANICAL SYSTEMS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite:

Course Educational Objective

CEO1:	A sound knowledge of the fundamental scientific principles involved in the operation, design, and fabrication of integrated circuits.
CEO2:	A comprehensive understanding of relevant technologies such as integrated circuit process integration and manufacturing.
CEO3:	Application of engineering principles to the design and development of current and future semiconductor technologies.
CEO4:	A breadth of knowledge, including the multidisciplinary nature of microelectronic engineering as well as the broad social, ethical, safety, and environmental issues within which engineering is practiced.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Recognize the physical, chemical, biological, and engineering principles involved in the design and operation of current & future micro devices.
CO2	Illustrate the limitations and current challenges in microsystems technology.
CO3	Apply new ideas and applications for MEMS devices.
CO4	Inspect the situations where MEMS sensors and actuators would be ideal for application to various products.

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	-	-	-	-	-	-	-	-	-	-			
CO2	-	1	3	-	3	-	-	-	-	-	-	-			
CO3	2	1	-	-	-	-	-	-	-	-	-	-			
CO4	3	2	-	-	-	-	-	-	-	-	-	-			
Avg.	1.25	1.25	0.75	-	0.75	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **10 Hours**

INTRODUCTION TO MEMS: Smart materials, Structures and systems, Integrated Microsystem, Applications.

MICROMACHINING TECHNIQUES: Silicon as material for micromachining, Photolithography, thin film deposition, doping, Etching: wet and dry etching, surface and bulk micromachining, Wafer bonding, packaging.

UNIT:2 **12 Hours**

MICROSYSTEM MODELING AND DESIGN: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage.

UNIT:3 **14 Hours**

MEMS APPLICATIONS: MECHANICAL SENSORS AND ACTUATORS: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Piezoelectric actuators**.**
Optical: Micro-lens, Micro-mirror, Optical switch

RADIO FREQUENCY MEMS: Inductor, Varactor, Filter, and Resonator. Microfluidics: Capillary action, Micro pumping, Electro wetting, Lab-on-a-chip.
Teaching Methods: Chalk& Board/ PPT/Video Lectures.
Text Books: G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi, 2010. N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi, 2007. Reference.
Reference Books: T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE8013	**HIGH SPEED ELECTRONICS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Physics of Semiconductor Devices

Course Educational Objective

CEO1:Characterize the governing parameters deciding the speed of the semiconductor devices

CEO2: Familiar with designing of Hetero structure Devices to operate in High frequency

CEO3: Design current voltage models for high speed devices like MESSFETs, SOI MESFETs

CEO4: Develop of high speed circuit using advance semiconductor devices

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Describe the physical characteristics, such as electronic structures and optical and transport properties of semiconductors and I-V characteristics of semiconductor devices.
CO2	Understand the design and operation of high speed semiconductor devices
CO3	Apply fundamental principles and processes to III –V binary and ternary compound semiconductor devices
CO4	Analyze&model some semiconductor properties, processes and device characteristics using equations

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1	-	-	-	-	-	-	-	-	-			
CO2	3	1	1	-	-	-	-	-	-	-	-	-			
CO3	3	1	1	-	-	-	-	-	-	-	-	-			
CO4	3	2	2	-	-	-	-	-	-	-	-	-			
Avg.	3	1.25	1.25	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **12Hours**

Important parameters governing the high speed performance of devices and circuits:- Transit time of charge carriers, junction capacitances, ON-resistances and their dependence on the device geometry and size, carrier mobility, doping concentration and temperature. Contact resistance and interconnection/interlayer capacitances in the Integrated Electronics Circuits.

Silicon based MOSFET and BJT circuits for high speed operation and their limitations: - Emitter coupled Logic (ECL) and CMOS Logic circuits with scaled down devices. Silicon On Insulator (SOI) wafer preparation methods and SOI based devices and SOI CMOS circuits for high speed low power applications.

UNIT:2 **08Hours**

Materials for high speed devices and circuits: -

Merits of III –V binary and ternary compound semiconductors (GaAs, InP, InGaAs, AlGaAs ETC.), silicon-germanium alloys and silicon carbide for high speed devices, as compared to silicon based devices. Brief outline of the crystal structure, dopants and electrical properties such as carrier mobility, velocity versus electric field characteristics of these materials. Material and device process technique with these III-V and IV – IV semiconductor

UNIT:3. **12Hours**

Metal semiconductor contacts and Metal Insulator Semiconductor and MOS devices: Native oxides of Compound semiconductors for MOS devices and the interface state density related issues. Metal semiconductor contacts, Schottky barrier diode. Thermionic Emission model for current transport and current-voltage (I-V) characteristics. Effect of interface states and interfacial thin electric layer on the Schottky barrier height and the I-V characteristics

Metalsemiconductor Field Effect Transistors (MESFETs):

Pinch off voltage and threshold voltage of MESFETs. D.C. characteristics and analysis of drain current. Velocity overshoot effects and the related advantages of GaAs, InP and GaN based devices for high speed operation. Sub threshold characteristics, short channel effects and the performance of scaled down devices.

UNIT:4 **12Hours**

High Electron Mobility Transistors (HEMT):

Hetero-junction devices. The generic Modulation Doped FET(MODFET) structure for high electron mobility real1ization. Principle of operation and the unique features of HEMT. InGaAs/InP HEMT structures.

HBT: Hetreojunction Bipolar Transistor

High speed Circuits:

GaAs Digital Integrated Circuits for high speed operation- Direct Coupled Field Effect Transistor Logic (DCFL), Schottky Diode FET Logic (SDFL), Buffered FET Logic(BFL). GaAs FET Amplifiers. Monolithic Microwave Integrated Circuits (MMICs)

High Frequency resonant – tunneling devices. Resonant-tunneling hot electron transistors and circuits.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. C.Y. Chang, F. Kai, GaAs High-Speed Devices: Physics, Technology and Circuit Applications Wiley.
2. Cheng T. Wang, Ed., Introduction to Semiconductor Technology: GaAs and Related Compounds,John Wiley & Sons,
3. David K. Ferry, Ed., Gallium Arsenide Technology, Howard W. Sams& Co., 1985
4. Avishay Katz, Indium Phosphide and Related materials: Processing, Technology and Devices, Artech House, 1992.
5. S.M. Sze, High Speed Semiconductor Devices, Wiley (1990) ISBN 0-471-62307-5

Ref. Books:

1. Ralph E. Williams, Modern GaAs Processing Methods, Artech (1990), ISBN 0-89006-343-5,
2. Sandip Tiwari, Compound Semiconductor Device Physics, Academic Press (1991), ISBN 0-12-691740-X
3. G.A. Armstrong, C.K. Maiti, TCAD for Si, SiGe and GaAs Integrated Circuits, The Institution of Engineering and Technology, London, United Kingdom, 2007,ISBN 978-0-86341-743-6.
4. John H. Davies, " The Physics of Low-Dimensional Semiconductors an Introduction", Cambridge University Press, 1998.

SUBJECT CODE	Course Title	L	T	P	C	QP
BECPE8014	**WAVELETS TRANSFORMS**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Signals & Systems, Digital Signal Processing

Course Educational Objectives

CEO1	Develop an understanding of the theoretical underpinnings of wavelet transforms and their applications.
CEO2	Learn how to use a computer algebra system for mathematical investigations, as a computational and visualization aid, and for the implementation of mathematical algorithms
CEO3	Get a flavor of the ideas and issues involved in applying mathematics to a relevant engineering problem
CEO4	Be able to give and defend a mathematical presentation to a group of your peers

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define the terminology that are used in the wavelets literature
CO2	Understand how to use the modern signal processing tools using signal spaces, bases, operators and series expansions
CO3	Explain the concepts, theory, and algorithms behind wavelets from an interdisciplinary perspective that unifies harmonic analysis (mathematics), filter banks (signal processing), and multire solution analysis (computer vision)..
CO4	Apply wavelets, filter banks, and multiresolution techniques to a problem at hand, and justify why wavelets provide the right tool.

CO-POs & PSOs Mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	-	-	-	-	-	-	-	-	-	-			
CO2	2	-	1	-	-	-	-	-	-	-	-	-			
CO3	3	-	1	-	-	-	-	-	-	-	-	-			
CO4	3	3	-	-	-	-	-	-	-	-	-	-			
Avg.	2.25	2.5	1	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT-I **(10hrs)**

Continuous Wavelet Transform Introduction, Continuous-time wavelets, Definition of the CWT, the VWT as a Correlation, Constant-Factor Filtering Interpretation and Time-Frequency Resolution, the VWT as an Operator, Inverse CWT, Problems.

Introduction to Discrete Wavelet Transform And Orthogonal Wavelet Decomposition: Introduction, Approximation of Vectors in Nested Linear Vector Subspaces, Examples of an MRA, Problems.

UNIT-II **(10hrs)**

MRA, Orthonormal Wavelets, And Their Relationship To Filter Banks: Introduction, Formal Definition of an MRA, Construction of General Orthonormal MRA, a wavelet Basic for the MRA, Digital Filtering Interpretation, Examples of Orthogonal Basic Generating Wavelets,

Interpreting Orthonormal MRAs for Discrete-Time signals, Miscellaneous Issues Related to PRQME Filter Banks, generating Scaling Functions and wavelets from Filter Coefficient, Problems

UNIT-III **(10hrs)**

Wavelet Transform And Data Compression: Introduction, Transform Coding, DTWT for Image Compression, Audio Compression, And Video Coding Using Multiresolution Techniques: a Brief Introduction.

Other Application 0f Wavelet Transforms: Introduction, Wavelet denoising speckles Removal, Edge Detection and Object Isolation, Image Fusion, Object Detection by Wavelet Transform of Projections, Communication application

UNIT-IV **(10hrs)**

Wavelet Packets and M-Band Wavelets: Wavelet Packet Analysis: Signal representation using Wavelet Packet Analysis, Selection of best basis, Introduction of M-Band wavelet system, Signal representation using MBand wavelet systems. Applications of Wavelets: Applications of wavelets in signal and image processing and other related engineering Fields

Teaching Method(s): Chalk & Board/ PPT/Video Lectures/ MOOC/ Internship/Industry Guest Lecture/ Invited Guest lecture/ Demonstration. etc.(can be chosen one or many)

Text Books:

1. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).
2. Rao, "Wavelet Transforms", Pearson Education, Asia.
3. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms",Prentice Hall, (1997).

SUBJECT CODE	Course Title	L	T	P	C	QP
BECOE8021	**DIGITAL IMAGE AND VIDEO PROCESSING**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Concept of Digital Signal Processing

Course Educational Objectives

CEO1	Representation of digital images and video in the spatial (pixel) and frequency domains, and learn common digital video formats.
CEO2	Understand basic image and video filtering operations and fundamentals of image Compression.
CEO3	Understand fundamentals of video compression and recent image and video compression standards
CEO4	Analyze and interpret the results of image processing methods and algorithms

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Define images and videos as 2-dimensional (2D) and 3-dimensional (3D) signals and their analog/digital dichotomy.
CO2	Discuss characteristics of an image depending on its placement over the electromagnetic spectrum.
CO3	Illustrate image and video enhancement to improve the appearance and usefulness of an image or video.
CO4	Analyze image and video compression technique to achieve lossless compression.

CO - PO & PSO Matrix

	PROGRAMME OUTCOMES												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	2	-	-	-	-	-	-	-	-	-			
CO4	2	1	2	-	-	-	-	-	-	-	-	-			
Avg.	2.75	2	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(10hrs)**

Fundamentals – Steps in digital image processing, sampling and quantization, relationship between pixels, imaging geometry

Image Transforms – Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, Discrete Cosine Transform, Walsh Transform, Hadamard Transform, Hotelling Transform.

UNIT:2 **(12hrs)**

Image Enhancement – Point processing, spatial filtering (smoothing and sharpening filters), Enhancement in frequency domain.

Filtering in the Frequency Domain: preliminary concepts, 2D DFT and its properties, basic Filtering in the frequency domain, image smoothing and sharpening.

UNIT:3 **(12hrs)**

Image Restoration and Reconstruction: Image restoration/degradation model, noise models, restoration in the presence of noise only, estimating the degradation function.

Color Image and Video Processing: Color models, Color transformation, Pixel-based model,

Space-frequency model, Mosaic creation. Geometrical model, Video restoration, Region-based model, Shot detection, object tracking.
UNIT:4 **(8hrs)** **Wavelets and Multi-resolution Processing:** multiresolution expansions, wavelet transforms inone and two dimension. **Image Compression:** Fundamentals, Some basic compression methods
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1) Digital Image Processing, R.C. Gonzalez, R.E. Woods, Pearson Education , 3rd Edition, 2007 2) Digital Image Processing, S. Sridhar, Oxford University Press,2011 3) Digital Image Processing And Analysis, B. Chanda, Dutta D. Majumder ,PHI
Reference Books 1) Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard E. Woods Pearson Education, Inc., Seventh Edition, 2004. 2) Digital Image Processing, William K. Pratt, John Wiley, New York, 2002

SUBJECT CODE	Course Title	L	T	P	C	QP
BECOE8022	**ERROR CORRECTING CODES**	**3**	**0**	**0**	**3**	**H**

Pre-requisites *(if any)*: Concept of Information Theory

Course Educational Objectives

CEO1	Understand Decoding Tables, Hamming Weight and Distance and Error Correction vs Detection.
CEO2	Understand basic image and video filtering operations and fundamentals of image Compression.
CEO3	Design an error detecting and correcting system for magnetic storage device to meet given system specification.
CEO4	Understand Generator Matrix, Parity-Check Matrix and Error-Correcting Capability of a Linear Code.

Course Outcomes

At the end of this course students will be able to demonstrate the ability to

CO1	Students learn theoretical background for coding theory.
CO2	Students learn algebraic and convolutional codes.
CO3	Illustrate practical coders and decoders.
CO4	Students learn to design and implement coders and decoders.

CO - PO & PSO Matrix

	PROGRAMME OUTCOMES												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	-	-	-	-	-	-	-			
CO2	3	2	-	-	-	-	-	-	-	-	-	-			
CO3	3	2	2	-	-	-	-	-	-	-	-	-			
CO4	2	1	2	-	-	-	-	-	-	-	-	-			
Avg.	2.75	2	2	-	-	-	-	-	-	-	-	-			

SYLLABUS

UNIT:1 **(10hrs)**

Introduction to Coding

Basic Definitions, Block Codes and Maximum Likelihood Decoding, Decoding Tables, Hamming Weight and Distance, Error Correction vs Detection.

Linear Block Codes

Definitions, Generator Matrix, Parity-Check Matrix, Error-Correcting Capability of a Linear Code, The Standard Array.

UNIT:2 **(12hrs)**

Binary Cyclic Codes

Description of Cyclic Codes, Encoding with (n-k)-Stage Shift Register, Syndrome Calculations and Error Detection, A General Decoder for Cyclic Codes, Shortened Cyclic Codes.

Error Trapping Decoding for Cyclic Codes

Error Trapping Decoding, Hamming Codes, Double-Error-Detecting and Single-Error-Correcting Hamming Codes, A Modified Error-Trapping Decoding, Goley Code.

UNIT:3 **(12hrs)**

BCH Codes

Description of Codes, Decoding of the BCH Codes, Implementation of Error Correction,

Nonbinary BCH Codes and Reed-Solomon Codes. **Single-Burst-Error-Correcting Codes**
UNIT:4 **(8hrs)** **Burst-and-Random-Error-Correcting Codes** **Error Detecting and Correcting Systems Design and Hardware Implementation**
Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS
Text Books 1) Nagi El Naga, "Error Detecting and Correcting Systems Design," Lecture Notes, ECE Department, California State University, Northridge.
Reference Books 1. Shu Lin, "An Introduction to Error-Correcting Codes", Prentice-Hall. 2. Wakerly, John, "Error Detecting Codes, Self-Checking Circuits and Applications." 3. Peterson, W. W. and E.J. Weldon, Jr., "Error-Correcting Codes", the M.I.T. Press, Cambridge, MA 1970 4.Lin, Shu/D. J. Costello, Jr., "Error Control Coding: Fundamentals and Applications", Prentice-Hall, 1983

Subject Code	**Title Of The Subject**	L	T	P	C	QP
BEIPE8023	**WIRELESS SENSOR NETWORKS**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Knowledge of physics, optical communication & computer networks required.

Course Educational Objective

CEO1:	To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology
CEO2:	Understand the medium access control protocols and address physical layer issues
CEO3:	Learn key routing protocols for sensor networks and main design issues

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Describe and explain radio standards and communication protocols on the link and networking layers for wireless personal area networks, and inter-working with wireless local area networks and cellular networks
CO2	Describe and explain the function and use of sensors especially for medical and sports applications
CO3	Describe and explain operating systems and programming languages for wireless sensor nodes
CO4	Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-

SYLLABUS

UNIT:1 **9 Hours**

OVERVIEW OF WIRELESS SENSOR NETWORKS: Key definitions of sensor networks, Advantages of sensor Networks, Uniqueconstraints an challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks. **ARCHITECTURES**: Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT:2 **9 Hours**

NETWORKING Technologies: Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

MAC Protocols for Wireless Sensor Networks: Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention – Based Protocols, Contention – Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT:3 **10 Hours**

ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing.

Optical Receiver Operations: Fundamental receiver operation - Pre amplifiers, Error sources, Receiver configuration, Probability of error; Quantum limit.

UNIT:4 **12 Hours**

TRANSPORT LAYER AND SECURITY PROTOCOLS: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

SECURITY IN WSNs: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node- level software platforms, Node-level Simulators, State-centric programming.

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

Ad Hoc Wireless Networks: Architectures and Protocols – C. Siva Ram Murthy and B.S.Manoj, 2004, PHI

Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – Jagannathan Sarangapani, CRC Press

Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.

Reference Books:

Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.

Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.

Wireless Sensor Networks – C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.

Wireless Sensor Networks – S Anandamurugan , Lakshmi Publications

Subject Code	Title Of The Subject	L	T	P	C	QP
BECPE8024	**CRYPTOGRAPHY AND NETWORK SECURITY**	**3**	**0**	**0**	**3**	**H**

Pre -Requisite: Knowledge of physics & computer networks required.

Course Educational Objective

CEO1:	Explain the objectives of information security
CEO2:	Explain the importance and application of each of confidentiality, integrity, authentication and availability
CEO3:	Understand various cryptographic algorithms.

Course Outcomes: ***Upon successful completion of this course, students should be able to:***

CO1	Understand basic cryptographic algorithms, message and web authentication and security issues.
CO2	Ability to identify information system requirements for both of them such as client and server.
CO3	Ability to understand the current legal issues towards information security.
CO4	Understand Intrusions and intrusion detection

CO – PO & PSO mapping

COs	PROGRAMME OUTCOMES												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	1	-	3	-	-	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	1.25	1	1.25	-	0.75	-	-	-	-	-	-	-	-	-	-

SYLLABUS

UNIT:1 **9 Hours**

UNIT – I: Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT:2 **9 Hours**

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT:3 **10 Hours**

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key

Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure **Optical Receiver Operations**: Fundamental receiver operation - Pre amplifiers, Error sources, Receiver configuration, Probability of error; Quantum limit.

UNIT:4 **12 Hours**

Transport-level Security: Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH) Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN, IEEE 802.11i Wireless LAN Security

Teaching Methods: Chalk& Board/ PPT/Video Lectures/Lecture by Industry Expert/MOOCS

Text Books:

1. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

Reference Books:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security : Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning