NETAJI SUBHAS UNIVERSITY

EVALUATION SCHEME & SYLLABUS FOR

BACHELOR OF TECHNOLOGY

ELECTRONICS AND COMMUNICATION ENGINEERING (ECE)

On

Choice Based Credit System
(Effective from the : 2023-24)

Netaji Subhas University
Pokhari, Near Bhilai Pahadi,
Jamshedpur, Jharkhand

I SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BT 101	Engineering Mathematics-I	3	1	-	4	30	70	100
BT 102	Engineering Physics	4	-	-	4	30	70	100
BT 103	Programming in C	4	-	-	4	30	70	100
BT 104	Elements of Mechanical Engineering	3	-	-	4	30	70	100
BT 105	Basic of Electrical Engineering	3	1	-	4	30	70	100
BT 106	Professional Communication Skill	3	-	-	3	30	70	100
Practical								
BT 107L	Engineering Physics **Lab**	-	-	4	2	15	35	50
BT 108L	Programming in C **Lab**	-	-	4	2	15	35	50
	Total	**20**	**2**	**8**	**27**	**210**	**490**	**700**

II SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BT 201	Engineering Mathematics-II	3	1	-	4	30	70	100
BT 202	Engineering Chemistry	4	-	-	4	30	70	100
BT 203	Elements of Civil Engineering and Mechanics	4	-	-	4	30	70	100
BT 204	Computer Aided Engineering Drawing	4	-	-	4	30	70	100
BT 205	Basic Electronics	4	-	-	3	30	70	100
BT 206	Software Engineering	3	1	-	3	30	70	100
Practical								
BT 207L	Engineering Chemistry Lab	-	-	4	2	15	35	50
BT 208L	Workshop Practice	-	-	4	2	15	35	50
	Total	**22**	**2**	**8**	**26**	**210**	**490**	**700**

III SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BT301	Engineering Mathematics-III	3	1	0	4	30	70	100
BTECE302	Analog Electronics	3	0	0	3	30	70	100
BTECE303	Circuit Analysis	3	0	0	3	30	70	100
BTECE304	Electronic Engineering Materials	3	1	0	4	30	70	100
BTECE305	Electrical & Electronic measurement	3	0	0	3	30	70	100
BTECE306	Object Oriented Programming using C++	3	0	0	3	30	70	100
Practical								
BTECE307L	Electrical & Electronics Measurement Lab	-	-	4	2	15	35	50
BTECE308L	Object Oriented Programming using C++ Lab	-	-	4	2	15	35	50
BTECE309L	Analog Electronics Lab	-	-	4	2	15	35	50
	Total	18	2	12	26	225	525	750

IV SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BT401	Engineering Mathematics–IV	3	1	-	4	30	70	100
BTECE402	Electromagnetic & Field Theory	3	-	-	3	30	70	100
BTECE403	Analog and Linear Integrated Circuit	3	-	-	3	30	70	100
BTECE404	Digital system design	3	-	-	3	30	70	100
BTECE405	Digital Electronics and Logic Design	3	-	-	3	30	70	100
BTECE406	Data structure and its Algorithm	4	-	-	4	30	70	100
Practical								
BTECE407L	Analog and Linear Integrated Circuit lab.	-	-	2	2	15	35	50
BTECE408L	Digital Electronics and Logic Design Lab.	-	-	2	2	15	35	50
BTECE409L	Mini project	-	-	2	2	15	35	50
	Total	19	1	6	26	225	525	750

V SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BTECE501	VLSI Technology	3	0	0	3	30	70	100
BTECE502	Control System Engineering	3	0	0	3	30	70	100
BTECE503X	Elective - I	3	0	0	3	30	70	100
BTECE504	Antenna and wave propagation	3	0	0	3	30	70	100
BTECE505	Digital Communication	3	0	0	3	30	70	100
BTECE506	Microprocessor & Microcontroller	3	0	0	3	30	70	100
Practical								
BTECE507L	Microprocessor & Microcontroller Lab	-	-	2	2	15	35	50
BTECE508L	Control System Lab	-	-	2	2	15	35	50
BTECE509V	Comprehensive VIVA Voce	-	-	2	2	15	35	50
	Total	18		6	24	225	525	750

Elective-I

BTECE5031	Digital Signal Processing
BTECE5032	Introduction to MEMS
BTECE5033	Electrical Machines

VI SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BTECE601	Microelectronics and VLSI Design	3	0	0	3	30	70	100
BTECE602	Analog Communication	3	1	0	4	30	70	100
BTECE603	Power Electronics	3	0	0	3	30	70	100
BTECE604X	Elective - II	3	0	0	3	30	70	100
BTECE605	Microwave theory and techniques	3	0	0	3	30	70	100
BTECE606	Embedded system & IOT	3	0	0	3	30	70	100
Practical								
BTECE607L	Power Electronics Lab	-	-	2	2	15	35	50
BTECE608L	VLSI Lab.	-	-	2	2	15	35	50
	Summer Internship-(Credits will be counted in next Semester)							
	Total	18	1	4	23	210	490	700

Internship: 6-8weeks industrial training can be conducted at the end of VI Semester but evaluation will be done next semester

Elective-II

BTECE 6041	Problem solving using computer
BTECE 6042	Wireless Communication
BTECE 6043	Speech and Audio Processing

VII SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BTECE701	Optical Fiber Communication	3	0	0	3	30	70	100
BTECE702	Database Management system	3	0	0	3	30	70	100
BTECE703X	Elective - III	3	0	0	3	30	70	100
BTECE704	Satellite Communication	3	0	0	3	30	70	100
BTECE705	Image processing	0	0	2	1	30	70	100
Practical								
BTECE705L	Project -I	0	1	6	4	15	35	50
BTECE706L	Database Management system Lab	0	0	4	2	15	35	50
BTECE707V	Summer internship training viva voce							
	Total	12	1	12	19	180	420	600

Elective-III

BTECE 7031	Mobile Communication and Network
BTECE 7032	Information Theory and Coding
BTECE 7033	Electronic Device Modeling

VIII SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BT801	Financial Engineering	3	0	0	3	30	70	100
BTECE802X	Biomedical Electronics	3	0	0	3	30	70	100
BTECE803X	Elective - IV	3	0	0	3	30	70	100
Practical								
BTECE804V	Project - II	-	-	12	12	50	150	200
	Total	9		12	21	140	360	500

Elective-IV

BTECE 8031	Nano electronics
BTECE 8032	Computer Network
BTECE 8033	Machine Learning & AI

Programme Educational Objectives (PEOs)

The Program Educational Objectives of the Electronics and Communication Engineering undergraduate program are for graduates to achieve the following, within few years of graduation. The graduates of Electronics and Communication Engineering Program will

PEO 1: Be engaged in successful careers in industry through their strong technical, hands-on, critical thinking, and team player skills.

PEO 2: Pursue professional development to enhance their undergraduate degree and advance their careers

PEO 3: Involve in continuous learning through state-of-the-art technologies for solving societal problems using logical and flexible approaches in decision-making.

PROGRAM OUTCOMES

After completing this Undergraduate program, a learner

PO 1: Apply the knowledge of Mathematics, Science, and Engineering fundamentals, and an engineering specialization to solution of complex engineering problems ***(Engineering Knowledge)***

PO 2: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences ***(Problem analysis)***

PO 3: Design of solutions for complex engineering problems and design of system components or processes that meet the specified needs with appropriate considerations of public health and safety, and cultural, societal, and environmental considerations ***(Design/development of solutions)***

PO 4: Use research based methods including design of experiments, analysis and interpretation of data and synthesis of information leading to logical conclusions ***(Conduct investigations of complex problems)***

PO 5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling complex engineering activities with an understanding of limitations ***(Modern tool usage)***

PO 6: Apply reasoning within the contextual knowledge to access societal, health, safety, legal, and cultural issues and the con-sequent responsibilities relevant to the professional engineering practice ***(The engineer and society)***

PO 7: Understand the impact of the professional engineering solutions in the societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable developments ***(Environment and sustainability)***

PO 8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice ***(Ethics)***

PO 9: Function effectively as an individual independently and as a member or leader in diverse teams, and in multidisciplinary settings ***(Individual and team work)***

PO 10: Communicate effectively on complex engineering activities with the engineering community and with society at large such give and receive clear instructions ***(Communication)***

PO 11: Demonstrate knowledge and understanding of engineering management principles and apply those to one's own work as a member and leader of a team to manage projects in multidisciplinary environments ***(Project management and finance)***

PO 12: 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 ***(Life-long Learning).***

Programme Specific Outcome (PSOs)

Programme Specific Outcome (PSOs) are specific statements that describe the professional career accomplishments that the program is designed. The PSOs of the (ECE) are as follows:

PSO 1: Analyse specific engineering problems relevant to Electronics & Communication Engineering by applying the knowledge of basic sciences, engineering mathematics and engineering fundamentals.

PSO 2: Design electronics and communication systems containing electronic devices, software, and hardware using the significant analytical knowledge in Electronics & Communication Engineering and applying modern tools.

PSO 3: Apply and transfer interdisciplinary systems and Engineering approaches to the various areas, like Communications, Signal processing, VLSI and Nanotechnology.

1st SEMESTER

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BT 101	Engineering Mathematics-I	3	1	-	4	30	70	100
BT 102	Engineering Physics	4	-	-	4	30	70	100
BT 103	Programming in C	4	-	-	4	30	70	100
BT 104	Elements of Mechanical Engineering	3	-	-	4	30	70	100
BT 105	Basic of Electrical Engineering	3	-	-	4	30	70	100
BT 106	Professional Communication Skill	3	-	-	3	30	70	100
	Practical							
BT 107L	Engineering Physics **Lab**	-	-	4	2	15	35	50
BT 108L	Programming in C **Lab**	-	-	4	2	15	35	50
	Total	**20**	**1**	**8**	**27**	**210**	**490**	**700**

ENGINEERING MATHEMATICS-I (BT 101)

Subject Code	**BT 101**	**IA Marks**	**30**
Number of Lecture Hours/Week	**04**	**Term End Exam Marks**	**70**
Total Number of Lecture Hours	**60**	**CREDITS**	**04**

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following:

- nth derivatives of product of two functions and polar curves.
- Partial derivatives
- Vector calculus
- Reduction formulae of integration; to solve First order differential equations.
- Solution of system of linear equations, quadratic forms.

Module - 1

Differential Calculus -1: Determination of n^{th} order derivatives, Leibnitz's theorem (without proof) - problems.

Taylor's and Maclaurin's theorems for function of one variable (statement only)- problems. Evaluation of Indeterminate forms.

Partial derivatives – Definition and simple problems, Euler's theorem (without proof) – problems, total derivatives, partial differentiation of composite functions- problems. Definition and evaluation of Jacobians

Hours-15

Module -2

Differential Calculus -2

Polar Curves - angle between the radius vector and tangent, angle between two curves, Pedal equation of polar curves. Derivative of arc length - Cartesian, Parametric and Polar forms (without proof)- problems. Curvature and Radius of Curvature – Cartesian, Parametric, Polar and Pedal forms (without proof) - problems

Hours - 15

Module-3

Integral Calculus:

Reduction formule (m and n are positive integers), evaluation of these integrals with standard limits (0 to $\pi/2$) and problems.

Hours - 10

Module-4

First order Differential Equations:

Exact, reducible to exact and Bernoulli's differential equations. Orthogonal trajectories in Cartesian and polar form. Simple problems on Newton's law of cooling.

Hours - 10

Module-05

Linear Algebra

Rank of a matrix by elementary transformations, solution of system of linear equations - Gauss-elimination method, Gauss–Jordan method and Gauss-Seidel method, Linear transformation, Eigen values and Eigen vectors. diagonalization of a square matrix. Reduction of Quadratic form

Hours - 10

COURSE OUTCOMES		Bloom's Knowledge Level
CO1	Use partial derivatives to calculate rates of change of multivariate functions.	K_2
CO2	Analyze position, velocity, and acceleration in two or three dimensions using the calculus of vector valued functions	K_4
CO3	Recognize and solve first-order ordinary differential equations, Newton's law of cooling	K_3
CO4	Use matrices techniques for solving systems of linear equations in the different areas of Linear Algebra	K_4
CO5	Solution of system of linear equations, quadratic forms.	K_5

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	2	2	2	1	0	0	1	1	0	0
[CO2]	3	3	2	3	2	2	0	0	1	2	0	0
[CO3]	2	3	3	3	2	1	0	0	1	2	0	1
[CO4]	3	3	2	3	3	2	1	0	1	2	1	1
[CO5]	3	3	2	3	3	2	1	0	1	2	1	1
Avg	**2.8**	**3**	**2.2**	**2.8**	**2.4**	**1.6**	**1**	**0**	**1**	**1.8**	**1**	**1**

Text Books:

1. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 42nd edition, 2013.

2. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 42nd edition, 2013.

3. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 2013

Reference Books:

1. B.V. Ramana, **"Higher Engineering Mathematics"**, Tata Mc Graw-Hill, 2006
2. N.P. Bali and Manish Goyal, **"A text book of Engineering mathematics"**, Laxmi publications, latest edition.
3. H.K. Dass and Er. Rajnish Verma, **"Higher Engineering Mathematics"**, S. Chand publishing, 1st edition, 2011.

ENGINEERING PHYSICS (BT102)

Subject Code	**BT 102**	**IA Marks**	**30**
Number of Lecture Hours/Week	**04**	**Term End Exam Marks**	**70**
Total Number of Lecture Hours	**60**	**CREDITS**	**04**

Course Objectives:

The Objective of this course is to make students learn and understand basic concepts and principles of physics to analyze practical engineering problems and apply its solutions effectively and meaningfully. To understand building up of models, design issues, practical oriented skills and problem- s o l v i n g challenges are the great task of the course. To know about shock waves and practical applications is the prime motto to introduce new technology at the initial stage of Engineering.

Module-I: Quantum Mechanics

Introduction to quantum physics, Black body radiation, Planck's law, Photoelectric effect, Compton effect, de-Broglie's hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg's Uncertainty principle, Born's interpretation of the wave function, Schrodinger's time independent wave equation, Particle in one dimensional box.

Hours-10

Module-II: Semiconductor Physics

Intrinsic and Extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Carrier transport: diffusion and drift, Hall effect, p-n junction diode, Zener diode and their V-I Characteristics, Bipolar Junction Transistor (BJT): Construction, Principle of operation.

Hours-15

Module-III: Opto electronics

Radiative and non - radiative recombination mechanisms in semiconductors, LED and semiconductor lasers: Device structure, Materials, Characteristics and figures of merit, Semiconductor photo detectors: Solar cell, PIN and Avalanche and their structure, Materials, working principle and Characteristics.

Hours-15

Module-IV: Lasers and Fibre Optics

Lasers: Introduction to interaction of radiation with matter, Coherence, Principle and working of Laser, Population inversion, Pumping, Types of Lasers: Ruby laser, Carbon dioxide (CO2) laser, He-Ne laser, Applications of laser. Fibre Optics: Introduction, Optical fibre as a dielectric wave guide, Total internal reflection, Acceptance angle, Acceptance cone and Numerical aperture, Step and Graded index fibres, Losses associated with optical fibres, Applications of optical fibres.

Hours-05

Module-V: Electromagnetism and Magnetic Properties of Materials

Laws of electrostatics, Electric current and the continuity equation, Ampere's and Faraday's laws, Maxwell's equations, Polarization, Permittivity and Dielectric constant, Internal fields in a solid, Clausius - Mossotti equation, Ferro electrics and Piezoelectric. Magnetization, permeability and susceptibility, Classification of magnetic materials, Ferro magnetism and ferromagnetic domains, Hysteresis, Applications of magnetic materials.

Hours-15

COURSEOUTCOMES		**Bloom's Knowledge Level**
CO1	Learn and understand more about basic principles and to develop problem solving skills and implementation in technology	K1
CO2	Gain Knowledge about Modern physics and quantum mechanics will update the basic concepts to implement the skills	K2
CO3	Study of material properties and their applications is the prime role to understand and use in engineering applications and studies	K2
CO4	Study Lasers and Optical fibers and its applications are to import knowledge and to develop skills and to use modern instruments in the engineering applications	K3
CO5	Understand Crystal structure and applications are to boost the technical skills and its applications.	K1, K2

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	3	2	2	1	0	0	1	1	0	0
[CO2]	3	3	2	3	2	2	0	0	1	2	0	0
[CO3]	3	3	2	2	2	1	0	0	1	1	0	1
[CO4]	3	3	2	3	3	2	0	0	1	2	1	1
[CO5]	3	3	2	2	2	1	0	0	1	1	0	1
Avg	**3**	**3**	**2.2**	**2.4**	**2.2**	**1.4**	**0**	**0**	**1**	**1.4**	**1**	**1**

Text Books:

1. Wiley precise Text, Engineering Physics**,** Wiley India Private Ltd., New Delhi. Book series – 2014,
2. Dr. M.N. Avadhanulu, Dr. P.G. Kshirsagar, Text Book of Engineering Physics**,** S Chand Publishing, New Delhi – 2012

PROGRAMMING IN C (BT103)

Subject Code	**BT 103**	**IA Marks**	**30**
Number of Lecture Hours/Week	**04**	**Term End Exam Marks**	**70**
Total Number of Lecture Hours	**60**	**CREDITS**	**04**

Course Objectives:

- Design solutions to simple engineering problem by applying the basic programming principles of C language and basic mathematical knowledge.

- Choose a suitable C-construct to develop C code for a given problem.
- Recognize the bugs in the C program.
- Apply the C-language syntax rules to correct the bugs in the C program.
- Develop simple C programs to illustrate the applications of different data types such as arrays, pointers, functions.

Module:-1

Basics of Computer Hardware and Software: -

Basics of Computer Architecture: processor, Memory, Input& Output devices,
Application Software & System software: Compilers, interpreters, High level and low level languages, Introduction to structured approach to programming, Flow chart Algorithms, Pseudo code (*bubble sort, linear search - algorithms and pseudo code*)

Hours-15

Module:-2

Program Basics

Basic structure of C program: Character set, Tokens, Identifiers in C, Variables and Data Types, Constants, Console IO Operations, printf and scanf.

Operators and Expressions: Expressions and Arithmetic Operators, Relational and Logical Operators, Conditional operator, size of operator, Assignment operators and Bitwise Operators. Operators Precedence, Preprocessor directive.

Control Flow Statements: If Statement, Switch Statement, Unconditional Branching using goto statement, While Loop, Do While Loop, For Loop, Break and Continue statements. (Simple programscovering control flow)

Hours-15

Module 3

Arrays and strings

Arrays Declaration and Initialization, 1-Dimensional Array, 2-Dimensional ArrayString processing:

In built String handling functions (strlen, strcpy, strcat and strcmp, puts, gets). Linearsearch program, bubble sort program, simple programs covering arrays and strings

Hours-10

Module 4

Pointers

Basics of Pointer: declaring pointers, accessing data though pointers, NULL pointer, array access using pointers, pass by reference effect

Working with functions

Introduction to modular programming, writing functions, formal parameters, actual parameters Pass by Value, Recursion, Arrays as Function Parameters structure, union, Storage Classes, Scope and life time of variables, simple programs using functions. **Hours-10**

Module 5

Structure & Union

Introduction, Declaration and Initialization, Array of Structures, Unions.

File Handling:-

File Operations: open, close, read, write, append Sequential access and random access to files: In built file handling functions (rewind(),fseek(), ftell(),feof(), fread(), fwrite()), simple programs covering pointers and files **Hours-10**

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Understand the basics of computer architecture, including the processor, memory, and input/output devices.	K1
CO2	Gain knowledge about application software, system software, compilers, interpreters, high-level and low-level languages, and structured programming approaches (flowcharts, algorithms, pseudocode).	K2
CO3	Learn the basic structure of C programs, including tokens, variables, data types, constants, and console I/O operations.	K2

CO4	Master control flow statements like if, switch, loops, and branching in C programming, and understand their usage in problem-solving.	K3
CO5	Develop skills in using arrays and strings (1D and 2D arrays) and solve problems like linear search and bubble sort using arrays and strings.	K4

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2	1	2	1	1	1	1	2	2	1	1
[CO2]	3	3	2	2	3	1	1	2	2	2	1	1
[CO3]	3	2	2	3	3	1	1	1	1	2	1	1
[CO4]	3	3	3	3	2	2	1	2	2	3	1	1
[CO5]	3	3	3	2	3	2	1	2	2	3	2	1
Avg	**3**	**2.6**	**2.2**	**2.4**	**2.4**	**1.4**	**1**	**1.6**	**1.8**	**2.4**	**1,2**	**1**

Text Books: -

- Schaum Series, Gottfried B.S.,Tata McGraw Hill,Programming with C
- E. Balagurusamy, Mcgraw Hill,Programming in ANSI C
- Asok N Kamthane, Pearson,Programming in C
- Anita Goel, Pearson, Computer Fundamentals

ELEMENTS OF MECHANICAL ENGINEERING (BT104)

Subject Code	**BT104**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course objectives:

- Students belonging to all branches of Engineering are made to learn certain fundamental topics related to mechanical engineering so that they will have a minimum understanding of mechanical systems, equipment and process.

Module -1

Energy Resources: **Non-renewable and renewable energy resources, Petroleum based solid, liquid and gaseous fuels, Calorific values of fuels, Combustion and combustion products of fuels.**

Solar Power: Solar Radiation, Solar constant (definition only), Solar Thermal energy harvesting, ex: liquid flat plate collectors, solar ponds (principle of operation only), Solar photo voltaic principle.

Wind Power: principle of operation of a typical windmill.

Hydro Power: Principles of electric power generation from hydro power plants,

Nuclear Power: Principles of Nuclear power plants,

Bio Fuels: introduction to bio fuels, examples of various biofuels used in engineering applications, Comparison of bio fuels with petroleum fuels in terms of calorific value and emission.

Hours-15

Module- 2

Turbines and IC Engines and Pumps Steam turbines: Classification, Principle of operation of Impulse and reaction turbines, Gas turbines: Classification, Working principles and Operations of Open cycle and closed cycle gas turbines.

Water turbines: Classification, Principles, and operations of Pelton wheel, Francis turbine and Kaplan turbine

Internal Combustion Engines: Classification, I.C. Engines parts, 2 Stroke and 4 stroke Petrol engines, 4 stroke diesel engines. P-V diagrams of Otto and Diesel cycles. Problems on indicated power, brake power, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, and specific fuel consumption.

Hours-15

Module- 3

Machine Tools Operations: Turning, facing, knurling, Thread cutting, Taper Turning, Drilling, Boring, Reaming, Tapping, Counter Sinking, Counter Boring, - Plane milling, End milling, Slot milling. (No sketches of Machine tools, sketches to be used only for explaining operations.)

Hours-10

Module-4

Engineering materials and joining processes: Engineering Materials: Types and applications of Ferrous & Nonferrous metals and alloys,
Composites: Definition, Classification and applications(Air craft and Automobiles)

Soldering, Brazing and Welding:
Definitions, classification, and method of soldering, Brazing and welding. Differences between soldering, Brazing and Welding. Description of Electric Arc Welding and Oxy - Acetylene Welding.

Hours-10

Module-5

Refrigeration, Air-Conditioning:

Refrigerants: properties of refrigerants, list of commonly used refrigerants. Refrigeration – Definitions – Refrigerating effect, Ton of Refrigeration, Ice making capacity, COP, Relative COP, Module of Refrigeration. Principle and working of vapor compression refrigeration and vapour absorption refrigeration: Principles and applications of air conditioners, Room air conditioner .

Hours-10

	Course outcome	**Bloom's Knowledge Level**
CO1	Various Energy sources, Boilers, Prime movers such as turbines and IC engines, refrigeration and air-conditioning systems	K1
CO2	Metal removal process using Lathe, drilling, Milling Robotics and Automation.	K2
CO3	Fair understanding of application and usage of various engineering materials.	K3

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	3	2	3	3	1	2	2	3	3	3
[CO2]	3	2	2	2	3	3	3	2	2	1	2	3
[CO3]	2	3	1	3	2	3	2	2	2	3	3	2
Avg	**2.6**	**2.6**	**2**	**2.3**	**2.6**	**3**	**2**	**2**	**2**	**2.3**	**2.6**	**2.6**

Text Books:

1. V.K.Manglik, "Elements of Mechanical Engineering", PHI Publications, 2013. (Module-1,2,4,5)
2. Mikell P.Groover, "Automation, Production Systems & CIM", 3rd Edition, PHI (Module -3)
3. K.R.Gopalkrishna, "A text Book of Elements of Mechanical Engineering"-Subhash Publishers, Bangalore. (Module -1,2,3,4,5)

BASIC OF ELECTRICAL ENGINEERING (BT105)

Subject Code	**BT105**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course objectives:

- 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.
- Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
- Develop selection skill to identify the type of generators or motors required for particular application.
- Highlight the importance of transformers in transmission and distribution of electric power.
- Emphasize the effects of electric shock and precautionary measures.
- Improve the ability to function on multi-disciplinary teams.

Module -1

Ohm's law and Kirchhoff 's laws, analysis of series, parallel circuit by independent voltage sources, concept of power and energy, definition of magnetic circuit and analogy between electric and magnetic circuits, faradays laws of electromagnetic induction, concept of Network Theorem.

Hours-10

Module -2

Single Phase A.C. Circuits: Average value, R.M.S. value, form factor and peak factor for sinusoidal wave form, Steady State Analysis of series R-L-C circuits. Concept of Reactance, Impedance, Susceptance, Admittance, Concept of Power Factor, Real, Reactive and Complex power, Illustrative Problems **Hours-15**

Module - 3

Single phase transformers: principle of operation, constructional features and emf equation. DC. Generator: principle of operation, constructional features, emf equation.
DC Motor: principle of operation, Back emf, torque equation.

Hours-10

Module- 4

Three phase Induction Motor: principle of operation, types; Synchronous Machines: principle of operation of Synchronous generator and motor. EMF equation, Voltage regulation, Applications and starting of Synchronous motor. Introduction to single-phase induction Motor.

Hours-10

Module-5

Electrical Installations: Components of LT Switchgear: Switch Fuse Module (SFU), MCB, ELCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption and battery backup.

Measuring Instruments: Construction and Principle of operation of dynamo meter type watt meter and single-phase induction type energy meter

Hours-15

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	To predict the behavior of electrical and magnetic circuits	K2
CO2	Select the type of generator / motor required for a particular application	K4
CO3	Realize the requirement of transformers in transmission and distribution of electric power and other applications	K2
CO4	Practice Electrical Safety Rules & standards.	K1
CO5	To function on multi-disciplinary teams	K5

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	3	2	3	3	1	2	2	3	3	3
[CO2]	3	2	2	2	3	3	3	2	2	1	2	3
[CO3]	2	3	1	3	2	3	2	2	2	3	3	2
[CO4]	3	1	3	3	3	3	3	2	2	3	2	3
[CO5]	3	3	3	2	2	3	3	2	2	3	3	3
Avg	**2.8**	**2.4**	**2.4**	**2.4**	**2.6**	**3**	**2.4**	**2**	**2**	**2.6**	**2.6**	**2.8**

Text books:

- V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill
- Vincent DelToro, " Electrical engineering Fundamentals", PHI second edition 2011
- Bolestaad, :"Electronics Devices and Circuits Theory", Pearson Education India
- Edward Hughes, " Electrical Technology,", Pearson Education
- D.P. Kothari and Nagrath " Theory and Problems in electrical Engineering", PHI edition2011

PROFESSIONAL COMMUNICATION SKILL (BT106)

Subject Code	**BT106**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	45	**CREDITS**	03

Course Objective:
To enable students how to improve communication skills.

To develop Writing skills in preparing business letters, report, memos, and proposals. To develop Oratory skills through public speaking

To understand importance of professional attire in corporate environment.

To get knowledge on various business etiquette and inculcate the etiquette for corporate fit.

Module-I: Concepts of Communications

Introduction: Definition and Process of Communication - Forms of Verbal and Non-verbal Communication.
Barriers of Communication: Communication Barriers and Overcoming Communication Barriers - Guidelines for Effective Communication.
Business Writing: Direct and Indirect approaches to Business Writing - Five Main Stages of Writing Business Messages. Exercise: Role Play, Square Talk Activity.

Hours-15

Module-II: Written Business Communication

External Communication: The Seven C's of Letter writing - Kinds of Business Letters - Business Reports and Proposals - Purpose of Business Reports.

Internal Communication: Format and Principles of Writing Memos - General Warning - Cautions. Exercise: Preparation of Reports on different issues.

Hours-10

Module-III: Oral Communication

Public Speaking: Types of Public Speaking - importance of Public Speaking.
Power Point Presentation: Planning the Presentation - Delivering the Presentation - Developing & Displaying Visual Aids - Handling Questions from the Audience.
Listening: Definition - Types of Listening Skills - Features of a Good Listener - Causes and effects of Poor Listening.
Exercise: Elocution and Extempore.

Hours-10

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Module-IV: Behavioral Techniques

Body Language: Facial Expressions - Body Posture - Gestures - Eye Movement - Touch and the use of Personal Space.
Business Attire and Grooming: Different types of Attire - Guidelines for Business Attire. Exercise: Power of Body Language, Charades.

Hours-5

Module-V: Etiquettes

Etiquettes: Greeting Etiquette - Corporate Etiquette - Telephone Etiquette - E-mail Etiquette – Meeting Etiquette - Netiquette - Personal Etiquette - Social Etiquette - Dining Etiquette. Exercise: Introduction and Art of Conversation, Telephonic Activity.

Hours-5

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Develop knowledge, skills, and judgment around human communication hat facilitate their ability to work collaboratively with others.	K1
CO2	Understand and practice different techniques of communication.	K2
CO3	Practice and adhere to the 7Cs of Communication.	K2
CO4	Familiarize with different types of Communication.	K3
CO5	Understand and practice Interview Etiquettes.	K2

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	2	2	3	2	3	2	2	3	2	2
[CO2]	3	3	3	2	3	2	3	2	2	3	2	3
[CO3]	3	2	3	3	3	3	2	3	3	3	3	2
[CO4]	2	2	3	2	3	2	3	3	2	2	2	3
[CO5]	3	2	3	2	3	2	2	3	3	3	3	2
Avg	**2.6**	**2.4**	**2.8**	**2.2**	**3**	**2.2**	**2.6**	**2.6**	**2.4**	**2.8**	**2.4**	**2.4**

TEXT BOOKS:

- Meenakshi Raman and Prakash Singh, Business Communication, Oxford
- **Lesikar:** Basic Business Communication, TMH
- **David Irwin:** Effective Business Communications, Viva- Thorogood. Rajendra Pal, J S Korlaha
- **HI:** Essentials of Business Communication: Sultan Chand & Sons, New Delhi

2nd *SEMESTER*

Code No.	Name of the Subjects	Periods			Credits	Marks		
		L	T	P		IA	TE	TM
BT 201	Engineering Mathematics-II	3	1	-	4	30	70	100
BT 202	Engineering Chemistry	4	-	-	4	30	70	100
BT 203	Elements of Civil Engineering and Mechanics	4	-	-	4	30	70	100
BT 204	Computer Aided Engineering Drawing	4	-	-	4	30	70	100
BT 205	Basic Electronics	4	-	-	3	30	70	100
BT 206	Software Engineering	3	1	-	3	30	70	100
	Practical							
BT 207L	Engineering Chemistry **Lab**	-	-	4	2	15	35	50
BT 208L	Workshop Practice	-	-	4	2	15	35	50
	Total	**22**	**2**	**8**	**26**	**210**	**490**	**700**

ENGINEERING MATHEMATICS-II (BT201)

Subject Code	**BT201**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course objectives:

To enable students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following

- Ordinary differential equations
- Partial differential equations
- Double and triple integration
- Laplace transform

Module – I

Linear differential equations with constant coefficients: Solutions of second and higher order differential equations - inverse differential operator method, method of undetermined coefficients and method of variation of parameters.

Hours-10

Module -II

Linear differential equations with variable coefficients: Solution of Cauchy's and Legendre's linear differential equations.

Nonlinear differential equations - Equations solvable for p, equations solvable for y, equations solvable for x, general and singular solutions, Clairauit's equations and equations reducible to Clairauit's form.

Hours-15

Module – 3

Partial Differential equations:

Formulation of Partial differential equations by elimination of arbitrary constants/functions, solution of non-homogeneous Partial differential equations by direct integration, solution of homogeneous Partial differential equations involving derivative with respect to one independent variable only.

Derivation of one-dimensional heat and wave equations and their solutions by variable separable method.

Hours-15

Module-4

Integral Calculus:

Multiple integrals: Beta and Gamma functions: definitions, Relation between beta and gamma functions and simple problems**.**

Evaluation of double and triple integrals. evaluation of double integrals by changing the order of integration and by changing into polar co-ordinates .Applications of multiple integrals to find area and volume.

Hours-10

Module-5

Laplace Transform

Definition and Laplace transforms of elementary functions.

Laplace transforms of $e^{at}f(t)$, $t^n f(t)$ and f(t) (without proof), t periodic functions and Module-step function- problems

Inverse Laplace Transform

Inverse Laplace Transform - problems, Convolution theorem to find the inverse Laplace transforms (without proof) and problems, solution of linear differential equations using Laplace Transforms.

Hours-10

COURSE OUTCOMES		Bloom's Knowledge Level
CO1	Solve differential equations of electrical circuits, forced oscillation of mass spring and elementary heat transfer	K1
CO2	Solve partial differential equations fluid mechanics, electromagnetic theory and heat transfer.	K2
CO3	Evaluate double and triple integrals to find area, volume, mass and moment of inertia of plane and solid region.	K3
CO4	Use curl and divergence of a vector valued functions in various applications of electricity, magnetism and fluid flows.	K4

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	3	2	3	3	1	2	2	3	3	3
[CO2]	3	2	2	2	3	3	3	2	2	1	2	3
[CO3]	2	3	1	3	2	3	2	2	2	3	3	2
[CO4]	3	1	3	3	3	3	3	2	2	3	2	3
Avg	**2.75**	**2.25**	**2.25**	**2.5**	**2.75**	**3**	**2.25**	**2**	**2**	**2.5**	**2.5**	**2.75**

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Text Books:

1. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers,42nd edition, 2013.
2. Kreyszig, "Advanced Engineering Mathematics " -Wiley, 2013

Reference Books:

- B.V.Ramana "Higher Engineering M athematics" Tata Mc Graw-Hill, 2006
- N PBali and Manish Goyal, "A text book of Engineering mathematics" ,Laxmi publications, latest edition.
- H. K Das and Er. Rajnish Verma ,"Higher Engineering Mathematics", S. Chand publishing,1st edition, 2011.

ENGINEERING CHEMISTRY (BT202)

Subject Code	**BT202**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course objectives:

To provide students with knowledge of engineering chemistry for building technical competence in industries, research and development in the following fields

- Electrochemistry & Battery Technology.
- Corrosion & Metal Finishing.
- Fuels & Solar energy.
- Polymers.
- Water Technology & Nano Materials.

Module -1

Electrochemistry and Battery Technology

Electrochemistry: Introduction, Derivation of Nernst equation for electrode potential. Reference electrodes: Introduction, construction, working and applications of calomel and Ag / AgCl electrodes. Measurement of electrode potential using calomel electrode. Ion selective electrode: Introduction; Construction and working of glass electrode, determination of pH using glass electrode. Concentration cells: Electrolyte concentration cells, numerical problems.

Battery Technology: Introduction, classification - primary, secondary and reserve batteries. Characteristics - cell potential, current, capacity, electricity storage density, energy efficiency, cycle life and shelf life. Construction, working and applications of Zinc- Air, Nickel- metal hydride batteries. Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell with H_2SO_4 electrolyte.

Hours-10

Module -2

Corrosion and Metal Finishing:

Corrosion: Introduction, electrochemical theory of corrosion, galvanic series. Factors affecting the rate of corrosion: ratio of anodic to cathodic areas, nature of metal, nature of corrosion product, nature of medium – pH, conductivity, and temperature. Types of corrosion- Differential metal, differential aeration (Pitting and water line) and stress. Corrosion control: Inorganic coatings-Anodizing of Al and phosphating; Metal coatings-Galvanization and Tinning. Cathodic protection (sacrificial anodic and impressed current methods).

Metal Finishing: Introduction, Technological importance. Electroplating: Introduction, principles governing-Polarization, decomposition potential and overvoltage. Factors influencing the nature of electro deposit-current density, concentration of metal ion & electrolyte; pH, temperature & throwing power of plating bath; additives- brighteners, levellers, structure modifiers & wetting agents. Electroplating of Nickel (Watt's Bath) and Chromium(decorative and hard). Electro less plating: Introduction, distinction between electroplating and electro less plating, electro less plating of copper & manufacture of double sided Printed Circuit Board with copper.

Hours-10

Module – 3

Fuels and Solar Energy:

Fuels: Introduction, classification, calorific value- gross and net calorific values, determination of calorific value of fuel using bomb calorimeter, numerical problems. Cracking: Introduction, fluidized catalytic cracking, synthesis of petrol by Fishcher-Tropsch process, reformation of petrol, octane and cetane numbers., anti knocking agents, power alcohol & biodiesel.

Solar Energy: Introduction, utilization and conversion, photovoltaic cells- construction and working. Design of PV cells: Modules, panels & arrays. Advantages & disadvantages of PV cells. Production of solar grade silicon: Union carbide process, purification of silicon (zone refining), doping of silicon-diffusion technique (n&p types).

Hours-15

Module - 4

Polymers:

Introduction, types of polymerization: addition and condensation, mechanism of polymerization-free radical mechanism taking vinyl chloride as an example. Molecular weight of polymers: number average and weight average, numerical problems. Glass transition temperature (Tg): Factors influencing Tg-Flexibility, inter molecular forces, molecular mass, branching & cross linking and stereo regularity. Significance of Tg. Structure property relationship: crystallinity, tensile strength, elasticity & chemical resistivity. Synthesis, properties and applications of PMMA (plexi glass), Polyurethane and polycarbonate. Elastomers: Introduction, synthesis, properties and applications of Silicone rubber.

Hours-10

Module-5
Water Technology and Nanomaterials:

Water Technology: Introduction, boiler troubles with disadvantages & prevention methods-scale and sludge formation, priming and foaming, boiler corrosion(due to dissolved O2, CO2 and MgCl2). Determination of DO, BOD and COD, numerical problems on COD. Sewage treatment: Primary, secondary (activated sludge method) and tertiary methods. Softening of water by ion exchange process

Nano Materials: Introduction, properties (size dependent). Synthesis-bottom up approach (sol-gel, precipitation, gas condensation & chemical vapour condensation processes). Nano scale materials-carbon nano tubes, nano wires, fullerenes, dendrimers, nano rods, & nano composites.

Hours-15

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Electrochemical and Concentration Cells, Classical & Modern Batteries, and Fuel Cells	K1
CO2	Causes & Effects of Corrosion of Metals and Control of Corrosion. Modification of Surface Properties of Metals via Electroplating and Electroless Plating	K2
CO3	Production & Consumption of Energy for Industrialization of the Country and Living Standards of People. Utilization of Solar Energy for Different Useful Forms of Energy	K3
CO4	Replacement of Conventional Materials by Polymers for Various Applications	K4

CO5	Boiler troubles; sewage treatment and desalination of sea water, and Overviewing of synthesis, properties and applications of nanomaterials	K2

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	2	2	3	1	2	1	3	1	1	2
[CO2]	2	3	2	2	3	2	3	2	2	2	1	2
[CO3]	3	3	3	3	3	3	3	2	2	3	1	3
[CO4]	3	3	3	3	2	3	3	3	1	2	3	2
[CO5]	3	3	3	3	3	2	3	3	2	3	1	3
Avg	**2.8**	**3**	**2.6**	**2.8**	**2.8**	**2.2**	**2.8**	2.2	2	**2.2**	**1.4**	**2.4**

Text Books:

1. B.S.Jai Prakash, R.Venugopal, Sivakumaraiah & Pushpa Iyengar. **"Chemistry for Engineering Students"**, Subhash Publications,Bangalore.
2. R.V.Gadag & A.Nityananda Shetty., **"Engineering Chemistry"**, I K International Publishing House Private Ltd. New Delhi.
3. P.C.Jain & Monica Jain.,**"Engineering Chemistry"**, Dhanpat Rai Publications, New Delhi.

Reference Books:

1. O.G.Palanna,**"Engineering Chemistry"**, Tata McGraw Hill Education Pvt.Ltd. New Delhi, Fourth Reprint.
2. G.A.Ozin & A.C. Arsenault, **"Nano chemistry A Chemical Approach to Nanomaterial's"**, RSC publishing, 2005.
3. **"Wiley Engineering Chemistry"**, Wiley India Pvt. Ltd. New Delhi. Second Edition.

ELEMENTS OF CIVIL ENGINEERING AND MECHANICS(BT203)

Subject Code	**BT203**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course Objectives:

The objectives of this course is to make students to learn basics of Civil Engineering concepts and infrastructure development, solve problems involving Forces, loads and Moments and know their applications in allied subjects. It is a pre-requisite for several courses involving Forces, Moments, Centroids, Moment of inertia and Kinematics.

Module 1: Introduction to Civil Engineering & Engineering Mechanics

Introduction to Civil Engineering

Scope of different fields of Civil Engineering - Surveying, Building Materials, Construction Technology, Geotechnical Engineering, Structural Engineering, Hydraulics, Water Resources and Irrigation Engineering, Transportation Engineering, Environmental Engineering.

Infrastructure: Types of infrastructure, Role of Civil Engineer in the Infrastructural Development, Effect of the infrastructural facilities onsocio-economic development of a country. Roads: Classification of Roads and their functions, Comparison of Flexible and Rigid Pavements (Advantages and Limitations)

Bridges: Types of Bridges and Culverts, RCC, Steel and Composite Bridges

Dams: Different types of Dams based on Material, Structural behavior and functionality with simple sketches.

Introduction to Engineering Mechanics: Basic idealizations - Particle, Continuum and Rigid body; Newton's laws-Force and its characteristics, types of forces-Gravity, Lateral and its distribution on surfaces, Classification of force systems, Principle of physical independence, superposition, transmissibility of forces, Introduction to SI Modules. Couple, Moment of a couple, Characteristics of couple, Moment of a force, Equivalent force - Couple system; Numerical problems on moment of forces and couples, on equivalent force - couple system.

Hours-15

Module 2: Analysis of Concurrent Force Systems

Concepts: Resultants and Equilibrium

Composition of forces - Definition of Resultant; Composition of coplanar - concurrent force system, Parallelogram Law of forces, Principle of resolved parts; Numerical problems on composition of coplanar concurrent force systems.

Equilibrium of forces - Definition of Equilibrant; Conditions of static equilibrium for different force systems, Lami's theorem; Numerical problems on equilibrium of coplanar –

concurrent and non-concurrent force systems.

Application- Static Friction in rigid bodies in contact

Types of friction, Laws of static friction, Limiting friction, Angle of friction, angle of repose; Impending motion on horizontal and inclined planes; Numerical Problems on single and two blocks on inclined planes

Hours-15

Module - 3 Analysis of Non-Concurrent Force Systems

Concepts: Resultants and Equilibrium

Composition of coplanar - non-concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar non-concurrent Force system. Application- Support Reaction in beams Types of Loads and Supports, statically determinate beams, Numerical problems on support reactions for statically determinate beams with Point load (Normal and inclined) anduniformly distributed and uniformly varying loads and Moments.

Hours-10

Module 4 Centroids and Moments of Inertia of Engineering Sections:

Centroids

Introduction to the concept, centroid of line and area, centroid of basic geometrical figures, computing centroid for–T,L,I,Z and full/quadrant circular sections and their built up sections. Numerical problems **Moment of Inertia** Introduction to the concept, Radius of gyration, Parallel axis theorem, Perpendicular axis theorem, Moment of Inertia of basic planar figures, computing moment of Inertia for – T, L, I, Z and full/quadrant circular sections and their built up sections. Numerical problems

Hours-10

Module 5: Kinematics

Concepts and Applications

Definitions – Displacement – Average velocity – Instantaneous velocity – Speed – Acceleration - Average acceleration – Variable acceleration – Acceleration due to gravity – Newton's Laws of Motion. Rectilinear Motion–Numerical problems. Curvilinear Motion – Super elevation – Projectile Motion – Relative motion – Numerical problems. Motion under gravity – Numerical problems.

Hours-10

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Understand the basics of Civil Engineering, including its scope, and knowledge about Roads, Bridges, and Dams.	K1, K2
CO2	Analyze the action of forces, moments, and other loads on systems of rigid bodies.	K2, K3
CO3	Compute the reactive forces and the effects caused by external loads on structural systems.	K3, K4
CO4	Determine the centroid and compute the moment of inertia for regular cross-sections.	K3, K4
CO5	Express the relationship between the motion of bodies and the forces acting on them in mechanics.	K2, K3

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2	1	1	2	1	1	1	2	2	1	1
[CO2]	3	3	2	2	3	2	2	2	3	3	2	2
[CO3]	3	3	3	2	3	3	3	3	3	3	3	2
[CO4]	3	3	3	3	3	2	3	3	3	3	3	2
[CO5]	2	3	2	2	3	3	3	3	3	3	2	3
Avg	**2.8**	**2.8**	**2.2**	**2**	**2.8**	**2.2**	**2.4**	**2.4**	**2.8**	**2.8**	**2.2**	**2**

TEXT BOOKS

- Elements of Civil Engineering and Engineering Mechanics by M.N. Shesha Prakash and Ganesh. B. Mogaveer, PHI Learning, 3rd Revised edition (2014)

- Engineering Mechanics-Statics and Dynamics by A Nelson, Tata McGraw Hill Education Private Ltd, New Delhi, 2009.

- Elements of Civil Engineering (IV Edition) by S.S. Bhavikatti, New Age International Publisher, New Delhi, 3rd edition 2009.

REFERENCES

1. Engineering Mechanics by S.Timoshenko, D.H.Young, and J.V.Rao, TATA McGraw-Hill Book Company, New Delhi.

2. Beer FP and Johnson ER, "Mechanics for Engineers- Dynamics and Statics"- 3rd SI Metric edition, Tata McGraw Hill. - 2008

COMPUTER AIDED ENGINEERING DRAWING (BT204)

Subject Code	**BT204**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course objectives:

- Engineering drawing is an important tool for all Engineers and for many others professionals. It is the language of Engineers. Engineering Drawing communicates all needed information from the engineer who designed a part to the workers who will manufacture it.
- The aim of the subject is to equip students with the fundamentals of Computer Aided Engineering Drawing and to further the ability to communicate information by graphical means.

Module -1
Introduction to Computer Aided Sketching

Introduction, Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing. Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Co-ordinate system and reference planes. of HP, VP, RPP & LPP. of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, material conventions and lettering.

Hours-15

Module -2

Orthographic projections

Introduction, Definitions - Planes of projection, reference line and conventions employed, 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 (No application problems).

Orthographic Projections of Plane Surfaces (First Angle Projection Only)
Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only (No problems on punched plates and composite plates).

Hours-15

Module-3

Projections of Solids (First angle Projection only)
Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions (No problems on octahedrons and combination solid).

Hours-5

Module-4

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. (No problems on sections of solids)Development of lateral surfaces of above solids, their frustums and truncations. (No problems on lateral surfaces of trays, tetrahedrons, spheres and transition pieces).

Hours-10

Module-5

Isometric Projection (Using Isometric Scale Only)
Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combination of solids (Maximum of three solids).

Hours-15

COURSE OUTCOMES		Bloom's Knowledge Level
CO1	Understand the basic concepts of computer-aided sketching, drawing tools, and coordinate systems.	K1,K2
CO2	Apply orthographic projection methods to represent plane surfaces and solids in different positions.	K3,K4
CO3	Analyze and create sectional views and develop the lateral surfaces of solids.	K3,K4
CO4	Synthesize isometric projections of simple geometric shapes and solids using isometric scale.	K4,K5
CO5	Demonstrate proficiency in using CAD tools for creating and modifying 2D/3D models, including advanced commands.	K3,K4

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2	1	2	1	2	1	1	2	2	1	1
[CO2]	3	3	3	2	3	2	3	2	3	3	2	2
[CO3]	3	3	3	2	3	3	3	2	2	3	2	3
[CO4]	3	3	3	3	3	2	3	3	3	3	2	3
[CO5]	3	3	3	3	3	3	3	3	3	3	3	3
Avg	**3**	**2.8**	**2.6**	**2.4**	**2.6**	**2.4**	**2.6**	**2.2**	**2.6**	**2.8**	**2**	**2.4**

TEXT BOOKS:

1. Engineering Drawing – N.D. Bhatt & V.M. Panchal, 48th edition, 2005 Charotar Publishing House, Gujarat.

2. "Computer Aided Engineering Drawing"by Dr. M H Annaiah, Dr C N Chandrappa and Dr B Sudheer Premkumar Fifth edition, New Age International Publishers.

REFERENCE BOOKS:

- Computer Aided Engineering Drawing – S. Trymbaka Murthy, - I.K.
- International PublishingHouse Pvt. Ltd., New Delhi, 3rd revised edition-2006.
- Engineering Graphics - K.R. Gopalkrishna, 32nd edition, 2005- Subash Publishers Bangalore.

BASIC ELECTRONICS (BT205)

Subject Code	**BT205**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	45	**CREDITS**	03

Course Objectives:

- To study in detail about construction of several electronic devices.
- To analyse the characteristics of various electronic devices and circuits.
- To understand the internal structure and characteristics of Op-amp.
- To learn about the linear and non-linear applications of Op-amp.

Module – I: Semi-Conductors and Diodes:

Conductors, Semiconductors, Intrinsic Semiconductors, Extrinsic Semi-Conductors. Diode Theory: Basic Ideas, The ideal Diode, Forward and Reverse Bias, Diode Equation, Volt-Ampere Characteristic. Special diodes: symbol of zener diode, operation, V-I characteristics, symbol of photo diode, working principle, LED symbol and principle. **Hours-10**

Module – II: Rectifiers:

Half-wave Rectifier, Full-wave and Bridge Rectifier, derivation of Ripple factor, efficiency of Half-wave, full-wave and Bridge rectifiers. Merits and demerits of Half-wave, full-wave and Bridge rectifiers, Comparisons of rectifiers. **Hours-10**

Module- III: Bipolar Junction Transistors:

Symbols of pnp and npn transistors and their working principles, Transistor currents, input and output characteristics of Common base configuration, Common Emitter configuration Transistor Switch, Amplifiers: working principles of Common base amplifier, Common Emitter amplifier, Common collector amplifier and their applications.

Hours-7

Module- IV: Characteristics of OP- Amps

Introduction to OP-amp, Op-amp Block Diagram, ideal and practical Op-amp specifications, 741 op-amp & its features, Op-Amp parameters & Measurement, Input & Out put off set voltages & currents, slew rates, CMRR, PSRR.

Hours-8

Module-V: Applications of Op-Amps:

Inverting and non-inverting amplifier, Integrator and differentiator, Comparators.

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Understand the internal structure and characteristics of Op-amps.	K1,K2
CO2	Analyze the working principles of diodes, rectifiers, and transistors	K2,K3
CO3	Apply the principles of Op-amps to design basic circuits like inverting/non-inverting amplifiers and integrators.	K3,K4
CO4	Evaluate the performance of different rectifiers and compare their efficiencies and ripple factors.	K4,K5
CO5	Design and analyze bipolar junction transistor (BJT) amplifiers and switches, and understand their applications.	K3,K4

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2	2	1	2	1	1	1	2	2	1	2
[CO2]	3	3	2	2	3	2	2	2	2	2	2	3
[CO3]	3	3	3	2	3	2	3	3	3	3	2	3

[CO4]	3	3	2	2	3	3	3	2	2	3	2	3
[CO5]	3	3	3	3	3	2	3	3	3	3	3	3
Avg	**3**	**2.8**	**2.4**	**2**	**2.8**	**2**	**2.4**	**2.2**	**2.4**	**2.6**	**2**	**2.8**

Text Books:

1. Electronic Principles, Albert Malvino and David J Bates, 7th Edition, Tata McGraw –Hill.

2. Electronic Devices and Circuits Theory, Boyelstad, Pearson Education, 8th Edition, September 2011.

3. Op-Amps and Linear Integrated Circuits , - Ramakanth A. Gayakwad, PHI, 4th Edition, 2009

4. Linear Integrated Circuits – D. Roy Chowdhury, New Age International Pvt.Ltd., 2nd Edition, 2003.

SOFTWARE ENGINEERING (BT206)

Subject Code	**BT206**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	45	**CREDITS**	03

Course Objectives:

- Understand the software life cycle models
- Understand the importance of the software development process
- Understand the importance of modeling and modeling languages
- Design and develop correct and robust software products

Module-I

Introduction:

Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.

Hours-5

Module-II

Software Requirement Specifications (SRS) Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS.

Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.

Hours-10

Module-III

Software Design: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and

Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.

Hours-10

Module-IV

Software Testing: Testing Objectives, Module Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.

Hours-10

Module-V

Software Maintenance and Software Project Management Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

Hours-10

COURSE OUTCOMES		Bloom's Knowledge Level
CO1	Identify the need for engineering approach to software development and various processes of requirements analysis for software engineering problems.	K1, K2
CO2	Analyze various software engineering models and apply methods for design and development of software projects.	K2,K3
CO3	Work with various techniques, metrics, and strategies for Testing software projects.	K3, K4
CO4	Identify and apply the principles, processes, and main knowledge areas for Software Project Management.	K2, K3
CO5	Proficiently apply standards, CASE tools, and techniques for engineering software projects.	K3,K4

KL-Bloom's Knowledge Level (K_1, K_2,K_3,K_4,K_5,K_6)

K_1-Remember, K_2-Understand, K_3-Apply, K_4-Analyze, K_5-Evaluate, K_6- Create

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	2	2	3	1	2	1	2	2	2	3
[CO2]	3	3	3	3	3	2	3	2	3	2	2	3
[CO3]	2	3	3	3	3	2	3	2	3	3	2	3
[CO4]	3	3	3	3	3	3	3	2	2	2	3	3
[CO5]	3	3	3	3	3	3	3	2	2	3	3	3
Avg	**2.8**	**3**	**2.8**	**2.8**	**3**	**2.2**	**2.8**	**1.8**	**2.4**	**2.4**	**2.4**	**3**

Text books:

1. R. S. Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.

2. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.

3. K. K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

4. Pankaj Jalote, Software Engineering, Wiley
5. Deepak Jain," Software Engineering: Principles and Practices", Oxford University Press.

2nd Year Syllabus details

SEMESTER III

ENGINEERING MATHEMATICS – III (BT-301)

Subject Code	**BT301**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS - 04**	04

Course objectives:

This course will enable students to

- Comprehend and use of analytical and numerical methods in different engineering fields
- Apprehend and apply Fourier Series
- Realize and use of Fourier transforms and Z-
- Transforms Use of statistical methods in curve fitting applications
- Use of numerical methods to solve algebraic and transcendental equations, vector integration and calculus of variation

Module – I

VECTOR DIFFERENTIATION

Scalar and vector point functions – Del applied to scalar point functions – Directional derivative – Del applied to vector point functions – Physical interpretation of divergence and curl – Del applied twice to point functions – Del applied to products of point functions.

Hours-15

Module – II

VECTOR INTEGRATION

Integration of vectors – Line integral, circulation, work done – Surface integral, flux – Green's theorem in the plane – Stoke's theorem – Volume integral – Gauss divergence theorem (all theorems without proofs) – Irrotational and solenoidal fields.

Hours-10

Module – III

PARTIAL DIFFERENTIAL EQUATIONS AND THEIR APPLICATIONS

Introduction – Formation of partial differential equations by eliminating arbitrary constants and functions – Solutions of a partial differential equations by direct Integration – Linear equations of the first order (Lagrange's linear equations).

Applications: Method of separation of variables – Vibrations of a stretched string: Wave equation – One dimensional heat flow equation ($\partial u/\partial t=c^{2} (\partial^2 u)/(\partial x^2)$), and two dimensional heat flow equation (i.e. Laplace equation : $(\partial^2 u)/(\partial x^2)+(\partial^2 u)/(\partial y^2)=0$).

Hours-15

Module – IV

FOURIER SERIES

Introduction – Euler's formula – Conditions for a Fourier expansion – Functions having points of discontinuity – Change of interval – Even and odd functions – Half range series – Parseval's formula.

Hours-10

Module – V

FOURIER TRANSFORMS

Introduction – Definition – Fourier integral theorem (without proof) - Fourier sine and cosine integrals – Fourier transforms – Properties of Fourier transforms – Convolution theorem – Parseval's identity for Fourier transforms – Relation between Fourier and Laplace transforms Fourier transforms of the derivatives of a function – Applications of transforms to boundary value problems.

Hours-10

COURSE OUTCOMES		Bloom's Knowledge Level
CO1	Apply gradient, divergence & curl to scalar and vector point functions and also physically interpret their meaning.	K3, K4
CO2	Apply the concepts of Vector calculus & the corresponding theorems to evaluate line, surface and flux integrals.	K3, K4
CO3	Solve both first & higher order partial differential equations by different techniques and apply to two-dimensional heat conduction equations, vibrations of a string etc.	K3, K4
CO4	Apply infinite Fourier series to represent discontinuous function which occurs in signal processing & electrical circuits.	K3, K4
CO5	Apply the principles of Fourier transforms to Boundary value problems	K3, K4

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	**2**	**2**	**2**	**3**	**2**	**1**	**2**	**2**	**2**	3
[CO2]	3	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**3**	2
[CO3]	2	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	3
[CO4]	2	**3**	**2**	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**2**	2
[CO5]	2	**2**	**3**	**3**	**2**	**2**	**3**	**2**	**3**	**3**	**2**	2
Avg	**2.4**	**2.4**	**2.6**	**2.4**	**2.2**	**2.6**	**2.6**	**2**	**2.4**	**2.6**	**2.2**	**2.4**

Test Books:

1. Peter V. O'Neil, Advance Engineering Mathematics Thomson (Cengage) Learning, 2007.
2. Jain, Iyenger & Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, New Delhi.
3. JN Kapur, Mathematical Statistics, S. Chand & company Ltd.
4. BS Grewal, Higher Engineering Mathematics, Khanna Publishers.

Analog Electronics (BTECE302)

Course Prerequisite: Students should have basic knowledge on Basic Electronics and fundamental of Engineering mathematics.

Course Objective:

1. To introduce the students to details concept on semiconductor devices (such as BJT, MOSFET).
2. To introduce the concept of positive and negative feedback in electronic circuits.
3. To analyse and interpret FET and MOSFET circuits for small signal at low and high frequencies.

	COURSE OUTCOMES	Bloom's Knowledge Level	
CO 1	Ability to analyze PN junction in semiconductor devices under various conditions.	K3,K4	
CO 2	Ability to design and analyze simple rectifiers and voltage regulators.	K3,K4	
CO 3	Ability to design and analyze simple rectifiers and voltage regulators using diodes.	K3,K4	
CO 4	Ability to describe the behavior of special purpose diodes.	K2,K3	
CO 5	Ability to design and analyze simple BJT and MOSFETs.	K3,K4	

Course Content:

CO-PO Matrix														
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**PO.12]**		**[PO.1**
[CO1]	3	3	3	3	3	3	3	3	3	3	3	3		3
[CO2]	3	3	3	3	3	3	3	3	3	3	3	3		3
[CO3]	3	3	3	3	3	3	3	3	3	3	3	3		3
[CO4]	2	2	2	2	2	2	2	2	2	2	2	2		2
[CO5]	3	3	3	3	3	3	3	3	3	3	3	3		3
Avg	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**	**2.8**		**2.8**

Module -I	**Bipolar Junction Transistors DC Circuits:** Transistor Configurations: CE,CB and CC, The Operating Point, Bias Stability, Transistor, Fixed bias, Emitter Bias, Self-Bias etc., Stabilization against Variations in ICO, VBE and β, Bias Compensation Techniques, Thermal Runaway, Thermal Stability.	10 hrs
Module-II	**BJT at Low and High Frequencies:** Two Port Devices and the Hybrid Model, Transistor Hybrid Model, Small Signal Amplifier Performance in terms of h-parameters, exact analysis of BJT CE, Comparison of CE, CC & CB Amplifier's	15 hrs

	performance parameters, High Input Impedance Transistor Circuits; Frequency Response of an Amplifier, Step Response of an Amplifier, Bandpass of Cascaded Stages, RC- Coupled Amplifier, Low-Frequency Response of an RC-Coupled Stage, The Hybrid-π Common-Emitter Transistor Model, Hybrid-π Conductance, The Hybrid-π Capacitances, The CE short-Circuit Current Gain, Current Gain with Resistive Load.	
Module-III	**Feedback amplifiers and Oscillators:** The Feedback Concept, The Transfer gain with Feedback, General Characteristics of Negative-Feedback Amplifiers, Topologies of Negative-Feedback, Summery of Effect of Negative-Feedback on Gain, Input Resistance, Output Resistance & Bandwidth of Amplifier, Sinusoidal Oscillators, The Transistor Phase-Shift Oscillator, A General form of LC Oscillator Circuit, Transistor Hartley & Colpitts Oscillator.	10 hrs
Module-IV	**Large Signal Low Frequency Amplifiers** Classification of Amplifies, Class A Large-Signal Amplifiers, Second – Harmonic Distortion, The Transformer-Coupled Audio Power Amplifier & it's Efficiency, Class B Amplifiers, Class B Push-Pull & Complementary-Symmetry Amplifier, Class AB Operation.	10 hrs
Internal assessment		
Part A	CIA-I: Module I and II	
	CIA-II: Module III and IV	

Text Books:

1. Electronics Fundamentals And Applications, "P C Chattopadhyay, D. Rakshit", 16th Edition, New Age International Private Limited.
2. Donald Neaman, "Electronic Circuit Analysis and Design",3rd Edition, Tata McGraw Hill.
3. David A. Bell,"Electronic Devices and Circuits", 5thEdition, Oxford press

4. R. L. Boylstad, and L. Nashlesky, “Electronic Devices and circuits Theory”, 9th Edition, Prentice Hall of India, 2006.

Reference Books:

1. Millman Halkias, “Integrated Electronics-Analog and Digital Circuits and Systems”, Tata McGraw Hill, 2000.
2. Phillip E. Allen, Douglas R. Holberg, “CMOS Analog Circuit Design”, Second Edition, Oxford.
3. K. R. Botkar, “Integrated Circuits”, 5th Edition, Khanna Publication.

Electrical & Electronic Measurement (BTECE305)

Course Prerequisite: Knowledge of fundamental concepts of basic electrical and electronics technology.

Course Objective: The objective of the teaching of this course is to make the students skilled in handling the various instruments for measurement purposes. In addition to this, they will get familiar with measurement errors, AC and DC bridges, and various transducers used in measurement for different quantities.

Course Outcomes:

	COURSEOUTCOMES	**Bloom's Knowledge Level**
CO 1	Evaluateerrorsinmeasurementaswellasidentifyandusedifferenttypesofinstrume ntsfor the measurement of voltage, current, power and energy.	K1
CO 2	Display the knowledge of measurement of electrical quantities resistance, inductance and capacitance with the help of bridges.	K2
CO 3	Demonstratetheworkingofinstrumenttransformersaswellascalculatetheerrorsin current and potential transformers.	K2
CO 4	Manifest the working of electronic instruments like voltmeter, multi-meter, frequency meter and CRO	K3
CO 5	Display the knowledge of transducers, their classifications and their applications for the measurement of physical quantities like motion force, pressure, temperature, flow and liquid level.	K4

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	2	2	2	2								
[CO2]	2	1	1									
[CO3]	1	1	1									
[CO4]	1	1	2		2	2	2			1	1	
[CO5]	2	2	2	2	2	2	2			2	2	
Avg	**1.60**	**1.40**	**1.60**	**2.00**	**2.00**	**2.00**	**2.00**			**1.50**	**1.50**	

Level	Bachelor	
Course Content:		
Module -I	**Instruments and Measurement Instruments and Measurement**: Definition, Application and Methods of measurements, instrument	10 hrs

	Classification, Functional Elements of an instrument. **Measurement Errors:** Accuracy, precision, resolution and significant figures, Gross error, systematic error, absolute error and relative error, guaranteed error, Measurement error combination, basics of statistical analysis.	
Module-II	**DC & AC Measurement:** Galvanometers, AnalogAmmeter,Voltmeter, PMMC, Moving Iron,Electrostatic, Ohmmeter, AC voltmeterusing rectifier, true RMS voltmeter, Digital VOM meter.	12 hrs
Module-III	**Resistance, Capacitance, and Inductance Measurements:** Voltmeter and ammeter methods,Wheatstone bridge, low, medium andhigh resistance measurements, ACbridge theory, capacitance bridges, Inductance bridges, Q meter.	10 hrs
Module-IV	**Transducers and CROs Transducers:** Principles, Classification and selection of Transducers, Requirements, Types and Application of Transducers, Resistance, Capacitance, inductance Transducers, Potentiometer, Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors. **Cathode Ray Oscilloscopes:** Block Schematic, Principles and applications. Dual Trace and Dual Beam Oscilloscopes, Digital Storage Oscilloscopes.	12 hrs
	Internal assessment	
Part A	CIA-I: Module I, and II	
	CIA-II: Module III, and IV	20 Marks
Part B	EoSE: Term Exam	70 Marks

Text/Reference Books:

1. Electronic Instrumentation & Measurement by William D Cooper & Albert C. Helfric, PHI Publications.
2. Electrical and Electronic Measurements and Instrumentation by A. K Sawhne, Dhanpar Rai & Co.
3. Electronic Measurements and Instrumentation by R.S. Sedha, S. Chand Publications

ELECTRONIC ENGINEERING MATERIALS (BTECE304)

Subject Code	**BTECE304**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course Objective:

At the end of the course, the students will be able to:

- To gain knowledge in applications properties strengthening mechanisms in structural steels and super alloys and stainless steels
- To develop a fundamental understanding of various electrical and electronic materials
- To be able to understand and importance of bio materials.

Module-I

Conductivity of Metal: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

Hours-15

Module-II

Dielectric Properties: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, frequency dependence of permittivity, dielectric losses, significance of the loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, Ferro electricity, piezo electricity.

Hours-15

Module-III

Magnetic properties of Materials: Introduction, Classification of magnetic materials, diamagnetism, Para magnetism, ferro magnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance**.**

Hours-10

Module-IV

Semiconductors: energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

Hours-5

Module-V

Insulators-properties – visual – electrical – mechanical- thermal - chemical properties - Classification based on operating temperature as per IS. Properties and application of fibrous material-impregnated fibrous- bitumen-wax-insulating liquid-enamel-varnish-ceramics-mica-asbestos-glass-rubber-synthetic resin- thermo- plast resin-Polyethylene-Teflon-PVC-Gas Insulating materials- air-Nitrogen-SF6 - Dielectric materials - Polarization-applications-capacitors.

Hours-15

COURSE OUTCOMES		Bloom's Knowledge Level
CO1	Understand the nature of interaction between atoms in crystalline solid materials that determines their dielectric, magnetic, and electrical properties.	K2
CO2	Analyze the relation between the macroscopic dielectric constant and the atomic structure of an insulator.	K4,
CO3	Fundamental concepts of magnetic fields required to illustrate the magnetic dipoles. This forms the basis to understand the magnetic properties of dia, para, ferro, antiferro, and ferri magnetic materials.	K2
CO4	Fundamentals concerned with conduction mechanism in metals and superconductors.	K2
CO5	Understand the basics for classification of materials based on its conductivity, nature of chemical bonds in Si and Ge, carrier density, energy band structure, and conduction mechanism in intrinsic and extrinsic semiconductors	K2

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	2	1										1
[CO2]	2	2	2									1
[CO3]	2	2	2									2
[CO4]	2	2	2									2
[CO5]	2	2	2			2						1
Avg	**2**	**1.8**	**1.6**			**.4**						**1.4**

Course Outcome:

- To select and design components based on their properties and requirements.
- Awareness about the electrical and electronic materials.
- Knowledge about bio materials like, titanium and stainless steel based.

Textbooks/References:

4. C.S.Indulkar and S. Thiruvengadam, S., “An Introduction to Electrical Engineering
5. Kenneth G. Budinski, “Engineering Materials: Prentice Hall of India, New Delhi
6. Superalloys-II edited by C.T. SIMS, N.S. Stoloff and W.C. Hagel A Wiley-Inter science publication John Wiley and sons, New York, 1972.

Circuit Analysis (BTECE303)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 3 hrs/week	End of semester Examination-70 marks	Theory-3

Course Prerequisite: 10+2 physics and linear algebra.

Course Objective: To introduce the fundamentals of electrical network analysis using graph theory, matrices, differential equations, network theorems, symmetrical component analysis. To introduce transient network analysis and their application. To introduce multi- port network, network function and network synthesis techniques.

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

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	COURSE OUTCOMES	**Bloom's Knowledge Level**
CO 1	Analyze basic electrical circuits using Kirchhoff's laws and network theorems	K3
CO 2	Solve AC and DC circuits using mesh and nodal analysis methods.	K3
CO 3	Determine transient and steady-state response of RLC circuits.	K4
CO 4	Evaluate two-port networks and their parameters for circuit design.	K5
CO 5	Use simulation tools for analyzing electrical circuits	K3

Level	Bachelor	
Course Content:		
Module -I	Network Topology: Concept of network graphs, tree, link, cut set, network matrices, node incidence matrix, loop incidence matrix, cut set incidence matrix, Formulation and solution of network equilibrium equations on loop and node basis.	9 hrs
Module-II	Network Analysis Techniques and Theorems: Elements of	12 hrs

	electrical circuits and their properties, Mesh current and Node voltage analysis using matrices, Thevenin's, Norton's, Superposition, Maximum power transfer theorem, Substitution theorem, Compensation theorem, Reciprocity theorem, Millman's theorem, Tellegen's theorem for AC and DC networks, Duality and concept of dual network, Resonance in series and parallel circuits.	
Module - III	Transient Network Analysis: Laplace transform fundamentals, properties, initial and final value theorems, convolution integral, waveform synthesis, Response of RL, RC and RLC networks using Laplace Transforms for Module step, impulse, ramp, sinusoidal, exponential and combination of these inputs, application of transient network analysis.	12 hrs
Module-IV	Two-port networks and Network functions: z-parameters, y-parameters, h-parameters, and ABCD parameters; reciprocity and symmetry in two-port networks, image, and iterative impedances.	12 hrs

Internal assessment

Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	20 Marks
Part B	ESE: Term Exam	70 Marks

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12**
[CO1]	3	3										
[CO2]	3	3										
[CO3]	3	3		2								
[CO4]	3	3	2									
[CO5]			3									
Avg	**2.4**	**2.4**	**1**	**.4**								

Text/Reference Books:

1. M.E. Valkenburg, "Network Analysis," 3rd Ed., Pearson Prentice Hall, 2006.
2. F. F. Kuo, "Network Analysis and Synthesis," 2nd Ed., Wiley India, 2007.
3. W.H. Hayt, J. E. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis," 6th Edition, Tata McGraw Hill, 2007.
4. C.K. Alexander and M.N.O. Sadiku, "Fundamentals of Electric Circuits," 3rd Edition, Tata McGraw Hill, 2008.
5. Sudhakar, S S Palli, "Circuits and Networks", 2nd Edition, Tata McGraw Hill.

Object Oriented Programming using C++ (BTECE306)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 3hrs/week	End of semester Examination-70 marks	Theory-3
Course Prerequisite: 10+2 physics and linear algebra.		

Course Objective: To introduce the fundamentals of electrical network analysis using graph theory, matrices, differential equations, network theorems, symmetrical component analysis. To introduce transient network analysis and their application. To introduce multi- port network, network function and network synthesis techniques.

Course Outcomes:

COURSE OUTCOMES		Bloom's Knowledge Level
CO 1	Creating simple programs using classes and objects in C++	K3
CO 2	Implement Object-Oriented Programming concepts in C++	K3
CO 3	Develop applications using stream I/O and file I/O	K3
CO 4	Implement simple graphical user interfaces (GUIs)	K3
CO 5	Implement Object-Oriented Programs using templates and exceptional handling concepts	K4

CO-PO Matrix														
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10**	**PO.11**	**PO.12**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	3	2	3	2	2	1	2	3			1	2
[CO2]	3	3	3	2	3	3	2	1	2	3			2	2
[CO3]	3	3	3	2	3	2	2	1	2	3			1	2
[CO4]	3	3	2	3	3	2	2	3	2	3			1	2
[CO5]	3	3	3	3	3	3	3	3	3	3			3	3
Avg	**3**	**3**	**2.8**	**2.4**	**3**	**2.4**	**2.2**	1.8	2.2	**3**			**1.6**	**2.2**

Level	Bachelor
Course Content:	

Module -I	Network Topology: Concept of network graphs, tree, link, cut set, network matrices, node incidence matrix, loop incidence matrix, cut set incidence matrix, Formulation and solution of network equilibrium equations on loop and node basis.	9 hrs
Module-II	Network Analysis Techniques and Theorems: Elements of	12 hrs

	electrical circuits and their properties, Mesh current and Node voltage analysis using matrices, Thevenin's, Norton's, Superposition, Maximum power transfer theorem, Substitution theorem, Compensation theorem, Reciprocity theorem, Millman's theorem, Tellegen's theorem for AC and DC networks, Duality and concept of dual network, Resonance in series and parallel circuits.	
Module - III	Transient Network Analysis: Laplace transform fundamentals, properties, initial and final value theorems, convolution integral, waveform synthesis, Response of RL, RC and RLC networks using Laplace Transforms for Module step, impulse, ramp, sinusoidal, exponential and combination of these inputs, application of transient network analysis.	12 hrs
Module-IV	Two-port networks and Network functions: z-parameters, y-parameters, h-parameters, and ABCD parameters; reciprocity and symmetry in two-port networks, image and iterative impedances.	12 hrs

Internal assessment

Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	20 Marks
Part B	ESE: Term Exam	60 Marks

Text/Reference Books:

1. M.E. Valkenburg, "Network Analysis," 3rd Ed., Pearson Prentice Hall, 2006.
2. F. F. Kuo, "Network Analysis and Synthesis," 2nd Ed., Wiley India, 2007.
3. W.H. Hayt, J. E. Kemmerly and S. M. Durbin, "Engineering Circuit Analysis,"
4. 6thEdition, Tata McGraw Hill, 2007.
5. C.K. Alexander and M.N.O. Sadiku, "Fundamentals of Electric Circuits," 3rd
6. Edition,Tata McGraw Hill, 2008

SEMESTER-IV

ENGINEERING MATHEMATICS – IV (BT-401)

Subject Code	**BT401**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	60	**CREDITS**	04

Course Objective:

- The knowledge of Mathematics is necessary for a better understanding of almost all the engineering and science subjects.
- Here our intention is to make the students acquainted with the concept of basic topics from Mathematics, which they need to pursue their engineering degree in different disciplines.
- The statistical methods of studying data samples, hypothesis testing and statistical quality control, control charts and their properties.

Module – I: FUNCTIONS OF A COMPLEX VARIABLE

Introduction – Limit of a complex function – Derivative of (z) – Analytic functions – Harmonic functions – Applications to flow problems. Complex Integration – Cauchy's theorem – Cauchy's integral formula – Series of complex terms (Statements of Taylor's and Laurent's Series without proof) – Zeros of an analytic function – Residues – Calculation of residues – Evaluation of real definite integrals (Integration around the Module circle, Integration around the small semi-circle, Indenting the contours having poles on the real axis).Geometric representation.

15 Hours

Module – II: FINITE DIFFERENCES & INTERPOLATION

Finite differences – Forward differences – Backward differences – Central differences – Differences of a polynomial – Factorial notation – Other difference operators – To find one or more missing terms – Newton's interpolation formulae – Central difference interpolation formulae – Interpolation with unequal intervals – Lagrange's interpolation formula – Inverse interpolation. **15 Hours**

Module – III: NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation – Formulae for derivatives – Maxima and minima of a tabulated function – Numerical integration – Newton-Cotes quadrature formula – Trapezoidal rule – Simpson's $\frac{1}{3}^{rd}$ –rule , Simpson's $\frac{3}{8}^{th}$ –rule.

Hours-10

Module – III: NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation – Formulae for derivatives – Maxima and minima of a tabulated function – Numerical integration – Newton-Cotes quadrature formula – Trapezoidal rule – Simpson's $\frac{1}{3}^{rd}$ –rule , Simpson's $\frac{3}{8}^{th}$ –rule.

Hours-10

Module – IV: Z – TRANSFORMS

Introduction – Definition – Some standard Z-transforms – Linearity property –Damping rule – Some standard results – Shifting U_n to the right, Shifting U_n to the left – Two basic theorems (Initial value theorem and Final value theorem) – Convolution theorem – Convergence of Z-transforms – Two sided Z-transform of U_n – Evaluation of inverse Z-transforms (Power series method, Partial fraction method, Inverse integral method) – Applications to difference equations.

Hours-10

Module – V: SAMPLING THEORY

Introduction – Sampling distribution – Testing a hypothesis – Level of significance – Confidence limits – Test of significance of large samples (Test of significance of single mean, difference of means) – Confidence limits for unknown – Small samples – Students t-distribution – Significance test of a sample mean – Significance test of difference between sample means – Chi-Square (χ^2) Test – Goodness of fit.

Hours-10

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Understand, interpret and use the basic concepts: Analytic function, harmonic function, Taylor and Laurent Series, Singularity, Residues, and evaluation of improper integrals.	K2
CO2	Familiarize with the concepts of Finite Differences and Interpolation techniques.	K2
CO3	Familiarize with the concept of Differentiation and Integration by numerical methods.	K3
CO4	Understand the characteristics and properties of Z-transforms and its applications.	K2
CO5	Analyze statistical data using statistical tests and draw valid inferences about the population parameter	K4

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	2	2	3	2	2	1	2	3	2	1
[CO2]	2	3	3	2	3	2	2	1	2	3	1	2
[CO3]	3	3	3	2	3	2	2	1	2	3	2	2
[CO4]	3	2	2	3	3	2	2	1	2	3	1	2
[CO5]	3	3	3	2	3	3	3	2	3	3	2	3
Avg	**2.8**	**2.8**	**2.6**	**2.4**	**3**	**2.2**	**2.2**	**1.2**	**2.4**	**3**	**1.6**	**2.2**

REFERENCE BOOKS:

1. **Dr. N.P. Bali, Dr. Ashok Saxena, Dr. N.Ch. S. Narayana**, "*A Text book on EngineeringMathematics*", Laxmi Publications (P)Ltd., New Delhi.
2. **H. K. Dass**, "*Advanced Engineering Mathematics*", S. Chand and Company Ltd.
3. **Erwin Kreyszig**. "*Advanced Engineering Mathematics*", John Wiley and Sons, New York.
4. **Dr. B.S. Grewal**, "*Higher Engineering Mathematics*", 43rd edition, Khanna Publishers,New Dehli.

ELECTROMAGNETIC & FIELD THEORY (BTECE402)

Subject Code	**BTECE402**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	45	**CREDITS**	03

Course objective:

- To introduce the basic mathematical concepts related to electromagnetic vector fields.
- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations.
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Transmission lines.

Module-I

Introduction: Vector Relation in rectangular, cylindrical, spherical and general curvilinear coordinate system. Concept and physical interpretation of gradient, Divergence and curl, Green's Stoke's and Helmholtz theorems. Electrostatics: Electric field vectors-electric field intensity, flux density & polarization. Electric field due to various charge configurations.

Hours-10

Module-II

The potential functions and displacement vector Gauss's law, Poisson's and Laplace's equation and their solution. Uniqueness theorem. Continuity equation. Capacitance and electrostatics energy. Field determination by method of images. Boundary conditions. Field mappings and concept of field cells.

Hours-10

Module-III

Magneto statics: Magnetic field vector: Magnetic field intensity, flux density & magnetization, Bio-Savart's law, Ampere's law, Magnetic scalar and vector potential, self & mutual inductance Energy stored in magnetic field, Boundary conditions, Analogy between electric and magnetic field, Field mapping and concept of field cells

Hours-10

Module-IV

Time Varying Fields: Faraday's law, Displacement currents and equation of continuity Maxwell's equations, Uniform plane wave in free space, dielectrics and conductors, skin effect sinusoidal time variations reflections, refraction & polarization of Upstanding wave ratio. Pointing vector and power considerations

Hours-10

Module-V

Transmission Lines: The high-frequency circuit. LCR ladder model. The transmission Lin equation. Solution for loss-less lines Wave velocity and wave impedance. Reflection and Transmission coefficients at junctions. VSWR.

Hours-05

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Understand the basic mathematical concepts related to electromagnetic vector fields.	K2
CO2	Apply the principles of electrostatics to the solutions of problems relating to electric field and electric potential, boundary conditions, and electric energy density.	K3
CO3	Apply the principles of magnetostatics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions, and magnetic energy density	K3
CO4	Understand the concepts related to Faraday's law, induced EMF, and Maxwell's equations.	K2
CO5	Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.	K3

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	2	2	3	2	3	2	2	2	1	3	1	1
[CO2]	3	3	2	2	3	3	3	2	2	2	3	3
[CO3]	3	3	2	3	2	3	2	3	2	3	2	2
[CO4]	2	2	2	3	2	2	3	3	1	3	2	2
[CO5]	3	3	2	3	3	3	3	3	2	3	2	2
Avg	**2.6**	**2.6**	**2.2**	**2.6**	**2.6**	**2.6**	**2.6**	**2.6**	**1.6**	**2.8**	**2**	**2**

.

TextBooks/References:

- Hayt: Engineering Electromagnetics, 7/e, (With CD), MGH
- Matthew N. O. Sadiku: Principles of Electromagnetics, 4th ed., Oxford
- G. S. N. Raju: Electromagnetic Field Theory and Transmission Lines, Pearson.
- J. D. Kraus: Electromagnetic. 5th edition, MGH. 1999
- S. Baskaran and K. Malathi: Electromagnetic Field and Waves, Scitech Pub.
- R. S. Kshetrimayum, Electromagnetic Field Theory, Cengage Learning.
- V.V. Sarwate: Electromagnetic Field and Waves, Willey Eastern Ltd.

Analog and Linear Integrated Circuit (BTECE403)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 3hrs/week	End of semester Examination-70 marks	Theory-3

Course Prerequisite: Knowledge of fundamental concepts of basic electrical and electronics technology.

Course Objective:

- To study various op-amp parameters and their significance for Op-Amp.
- To learn frequency response and transient response for Op-Amp.
- To analyze and identify linear and nonlinear applications of Op-Amp.
- To understand the functionalities of 555 Timer IC and PLL. Their uses in various applications in communication and control systems.

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

	COURSE OUTCOMES	Bloom's Knowledge Level
CO 1	Explain the characteristics and applications of diodes, BJTs, and FETs.	K2
CO 2	Analyze the performance of single-stage and multi-stage amplifiers.	K4
CO 3	Design and simulate basic operational amplifier circuits.	K6
CO 4	Examine the working of active filters and oscillators using op-amps.	K4
CO 5	Evaluate the performance of IC-based voltage regulators and waveform generators.	K5

Level	Bachelor	
Course Content:		
Module -I	**OP-AMP Basics:**	12 hrs

	Introduction to op-amps, ideal Characteristics, Pin configuration of 741 op-amp, Block diagram of OP- AMP, Voltage series and voltage shunt feedback amplifier and its effect on Ri, Ro, bandwidth, and voltagegain, Differential Amplifier; Bias, offsets and drift, CMRR, slew rate, Frequency compensation of OP-AMP.	
Module-II	**Linear and Non-linear applications of OPAMP:** Inverting and non- inverting summing, scaling and averaging Amplifier Differential Amplifier configurations, Current to Voltage and Voltage to Current Convertor, Integrator, Differentiator; Comparator, characteristics of comparator, applications of comparator, Schmitt trigger, voltage limiters, clippers and clampers, peak detectors, sample and hold circuits.	12 hrs
Module-III	**Active Filters and Oscillators:** Active Filters, Low pass, High pass, Band pass and Band Reject filters, Design and frequency scaling of First order and second order, Butterworth filters. Oscillators, Oscillator principle, types and frequency stability, design of phase shift, wein bridge, and Quadrature Oscillators, voltage controlled oscillators.	10 hrs
Module-IV	**555 Timer and Phase Locked Loop:** 555 Timer functional diagram, monostable and astable operation, applications, Block diagram of PLL and its function, PLL types, characteristics/parameters of PLL, and different applications of PLL.	8 hrs

Internal assessment		
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	20 Marks
Part B	EoSE: Term Exam	60 Marks

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO. 12]**
[CO1]	2											
[CO2]	3	3										
[CO3]	3		3		2							
[CO4]	3	2										
[CO5]	3	2			3							
Avg	**2.8**	**1.4**	**.6**		**1**							

Text/Reference Books:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill,India 2008.
3. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes.
4. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill.
5. S. P. Bali,”Linear Integrated Circuits”, Mc Graw Hill 2008.

Digital System Design (BTECE404)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 3 hrs/week	End of semester Examination-70 marks	Theory-3
	Internal assessment: 30 marks	
		Total-3

Course Prerequisite: Students should have basic knowledge on Basic Electronics, and Electronic devices and circuits.

Course Objective:

4. To acquaint the students with the fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
5. To lay the foundation for further studies in areas such as VLSI, computer, microprocessor etc.

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

	COURSE OUTCOMES	**Bloom's Knowledge Level**
CO 1	Explain number systems, Boolean algebra, and logic simplification techniques.	K2
CO 2	Design and simplify combinational circuits using K-maps and logic gates	K6
CO 3	Analyze and design sequential circuits using flip-flops and finite state machines	K4
CO 4	Implement digital systems using VHDL or Verilog HDL.	K6
CO 5	Interpret timing diagrams and analyze digital logic circuit performance	K5

Course Content:		
Module -I	**Combinational Logic Design:**	

	Review of Boolean algebra and DeMorgan's theorem, Standard representations of logic functions, k map representation (upto 6 variables) of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms, don't care conditions, Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Adders and subtractor, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De- multiplexers and their use in combinational logic designs, Decoders, demultiplexer trees.	
Module-II	**Sequential Logic Design and VHDL basic:** Flip flop basics, Building blocks of SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Synchronous and ripple Counters (ring counters, twisted ring counters), Sequence Generators, up/down counters, Clock Skew, Clock jitter, Effect on synchronous designs; Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.	12 hrs

Module-III	**Logic Families** Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immModuley, operating temperatures and power supply requirements; TTL logic: Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs; Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL; Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L, DCTL.	8 hrs
Module-IV	Programmable Logic Devices and Semiconductor Memories Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.	10 hrs

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.1**
[CO1]	2											
[CO2]	3	3	3									
[CO3]	3	3	3									
[CO4]			3		3							
[CO5]		3		2								
Avg	**1.6**	**1.8**	**1.8**	**.4**	**.6**							

Text Books:

1. R.P. Jain, "Modern digital electronics", 3rd edition, 12threprint Tata McGraw Hill Publication, 2007.
2. M. Morris Mano, "Digital Logic and Computer Design" 4th edition, Prentice Hall of India, 2013.
3. P. Albert Malvino and A. Jerrald Brown, "Digital Computer Electronics" Glencore Publishers.
4. R. J. Tocci, N. S. Widmer and G. L. Moss, "Digital Systems, Principles and Applications", Pearson Publishers.

Reference Books:

1. **W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.**
2. **A. Kumar, "Fundamentals of digital circuits" 1st edition, Prentice Hall of India, 2001.**

Electromagnetic Wave and Transmission Line ()		
Teaching Scheme	Examination Scheme	Credits allocated
Theory 3 hrs/week	End of semester Examination-60 marks	Theory-3
Course Prerequisite: Linear Algebra, Calculus, Vector analysis		
Course Objective: This course is intended to introduce the concept of electromagnetic waves and it's application to the students. The course will develop understanding of the principles underlying time-varying fields and Maxwell's equations, describe plane electromagnetic waves and develop its mathematical model for different media for its interaction with interfering planes.		
Course Outcomes: On completion this course, students will be able to		
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COURSE OUTCOMES		Bloom's Knowledge Level
CO 1	Explain the fundamentals of electrostatics, magnetostatics, and Maxwell's equations.	K2
CO 2	Analyze the behavior of electromagnetic waves in different media.	K4
CO 3	Apply Maxwell's equations to solve boundary value problems.	K3
CO 4	Analyze the characteristics and propagation of transmission lines.	K4
CO 5	Evaluate the impedance matching and reflection coefficient in transmission lines.	K5

Level	Bachelor	
Course Content:		
Module -I	Static Electric Field: Co-ordinate System, line, Curl, Divergence and Gradient, Stokes theorem, Divergence theorem, Coulomb's Law, Principle of Superposition, Electric Field, Electric Scalar Potential, Dipole, Electric Flux Density, Gauss Law.	9 hrs
Module-II	Static Magnetic Field: Biot-Savart Law, Magnetic Field intensity due to a finite and infinite wire carrying a current, Magnetic field intensity on the axis of a circular and rectangular loop carrying a current, Ampere's circuital law, Magnetic flux density, Lorentz force equation for a moving charge, Magnetic moment, Magnetic Vector potential	12 hrs
Module-III	Electric and Magnetic Fields in Materials: Poisson's and Laplace's equation, Electric Polarization, dielectric materials, Capacitance, Electrostatic energy, Boundary conditions, Electric current, point form of ohm's law, continuity equation for current, Inductance, Inductance of loops and solenoids, mutual inductance, magnetic materials, magnetization and permeability, magnetic boundary conditions. Time Varying Electric and Magnetic Fields: Maxwell's equations, Faraday's law, Displacement current, Ampere's circuital law, modified Ampere's circuital law, Maxwell's equations in different form, Maxwell's equation in Phasor form, Poynting theorem, Instantaneous average and Complex Poynting Vector.	15 hrs
Module-IV	Electromagnetic Wave: Wave Equation, Uniform Plane Waves, Plane waves in free space and in homogenous material, Wave equation for a conducting medium, Plane waves in lossy dielectrics, Skin effect, Linear, Elliptical and circular polarization, Plane Wave interaction with different media, normal incidence and oblique incidence.	9 hrs

Internal assessment		
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	20 Marks
Part B	ESE: Term Exam	60 Marks

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	2											
[CO2]	3	3										
[CO3]	3	3		2								
[CO4]	3	3	2									
[CO5]	3	2		2								
Avg	**2.8**	**2.2**	**.4**	**.8**								

Text/Reference Books:

1. Mathew N.O Sadiku, "Elements of Electromagnetics", Oxford University press, New Delhi
2. William H. Hayt , "Engineering electromagnetics" Tata-McGraw Hill, New Delhi.
3. N.N. Rao, "Fundamentals of Electromagnetics for Engineering", Pearson education, New Delhi.
4. E.C Jordan and K.G Balman , "Electromagnetic waves and radiating system", Pearson Education, New Delhi.

DIGITAL ELECTRONICS & LOGIC DESIGN (BTECE405)

Subject Code	**BTEEE405**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	45	**CREDITS**	03

Course Objective:

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To prepare students to perform the analysis and design of various digital electronic circuits.

Module I

Binary Codes and Boolean algebra Analog and Digital, Binary Number System. Addition, Subtraction, Multiplication, Division of binary numbers, Subtraction using 2's complement method. Binary codes: weighted and non-weighted codes, self-complementary codes, BCD, Excess-3, Gray codes, Alphanumeric codes, ASCII Codes. Boolean algebra Boolean Laws and Expression using Logic Gates, Realization of different gates using Universal gates, DE Morgan's Theorem, Duality Theorems.

Hours-05

Module II

Boolean function minimization Techniques Standard forms: SOP, POS, Simplification of Switching function & representation (Maxterm & Minterm), Boolean expression & representation using logic gates, Propagation delay in logic gate. Karnaugh map: K-map(up to 5 variables), mapping and minimization of SOP and POS expression, Don't care condition, conversion from SOP to POS and POS to SOP form using K-map, Minimization of multiple output circuits, Quine Mc-cluskey method minimization technique, prime implicate table, Don't care condition.

Hours-05

Module III

Combinational Circuits Design Adder & Subtract or (Half and Full), Parallel Binary adder, BCD Adder, Binary multipliers, Code Converters, parity bit generator, Comparators, Decoder, BCD to 7segment Decoder, Encoders, Priority Encoders, Multiplexers, De Multiplexers

Hours-05

Module IV

Sequential Circuits Elements Introduction to sequential circuit, Flip-flop & Timing Circuits: SR latch, Gated latch string state logic, Edge triggered flip-plop: - D, JK, T Flip-flop, flip-flop asynchronous inputs ,characteristic table of Flip-flop, excitation table of Flip-flop, master slave JK flip flop, inter conversion of Flip-flop. Study of timing parameters of flip-flop. Shift registers: buffer register, controlled buffer register. Data transmission in shift resistor SISO, SIPO, PISO, PIPO, Bidirectional shift register, universal shift registers. Counter: Classification, Ripple or asynchronous counter, Effect of propagation delay in ripple counters, up-down counter, Design of Mod-n counter, synchronous counter, Ring counter, Johnson counter. Introduction to FSM. Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator**.**

Hours-15

Module V

Logic Families and VLSI Design flow Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA, Logic implementation using Programmable Devices VLSI Design flow. Design entry, Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL Constructs and codes for combinational and sequential circuits

Hours-15

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Understand and apply fundamental concepts and techniques used in digital electronics.	K2,K3
CO2	Analyze and examine the structure of various number systems and their applications in digital design	K4
CO3	Analyze, design, and implement various combinational and sequential circuits.	K4
CO4	Identify the basic requirements for a design application and propose a cost-effective solution.	K5
CO5	Identify and prevent various hazards and timing problems in digital designs	K4, K5

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	2	3	2	1	2	2	3	2	3	2
[CO2]	3	3	3	2	2	1	2	2	3	2	2	2
[CO3]	3	3	3	3	3	2	3	3	3	3	2	2
[CO4]	3	2	3	3	3	3	2	2	3	3	3	3
[CO5]	3	3	3	2	3	2	3	3	3	3	2	2
Avg	**3**	**2.8**	**2.8**	**2.6**	**2.6**	**1.8**	**2.4**	2.4	3	**2.6**	**2.4**	**2.2**

Text Books:

4. Kharate “Digital Electronics” OXFORD Publication
5. Anand Kumar ‘Fundamentals of Digital Circuits’. PHI Publications
6. R.P. Jain-‘Modern Digital Electronics’ IIIrd Edition- Tata Mc Graw Hill, Publication
7. Douglas Perry, “VHDL”, Tata McGraw Hill, 4th edition, 2002.
8. Charles Roth, “Digital System Design using VHDL”, Tata McGraw Hill 2nd edition
9. Bhaskar VHDL BASED DESIGN ,PEARSON EDUCATION

Signal and System (BTECE)		
Teaching Scheme	Examination Scheme	Credits allocated
Theory 3 hrs/week	End of semester Examination-60 marks	Theory-3

Course Prerequisite: 10+2 mathematics, linear algebra and calculus.

Course Objective: This course introduces the basics concepts of continuous and discrete time signal representation, Linear Time Invariant Systems (LTI), Fourier series representation of periodic signals, continuous and discrete time Fourier transform, Laplace and Z-transforms and their application to the student. This course discusses the different properties of discrete time system and continuous time system.

Course Outcomes:

COURSE OUTCOMES		Bloom's Level	
[CO1]	Representthevarioustypesofsignals&systemsandcanperformmathematical operations on them.	K1	
[CO2]	AnalyzetheresponseofLTIsystemtoFourierseriesandFouriertransformandto evaluate their applications to network analysis.	K2	
[CO3]	Analyze the properties of continuous time signals and system using Laplace transform and determine the response of linear system to known inputs.	K2	
[CO4]	Implement the concepts of Z transform to solve complex engineering problems using difference equations	K2	
[CO5]	Developandanalyzetheconceptofstate-spacemodelsforSISO&MIMOsystem.	K2	

CO-PO Matrix

Course Outcome	[PO.1]	[PO.2]	[PO.3]	[PO.4]	[PO.5]	[PO.6]	[PO.7]	[PO.8]	[PO.9]	[PO.10	PO 11	PO 12	[PO.11]	[PO
[CO1]	2	1	1	1										1
[CO2]	2	2	1	2										3
[CO3]	2	2	1	2										3
[CO4]	2	2	1	2										3
[CO5]	2	3	2	2	1									3
Avg	2.00	2.00	1.20	1.80	1.00									2.60

Level	Bachelor	
Course Content:		
Module -I	Discrete-Time Signals: Some Elementary Discrete-Time	10 hrs

	signals, Classification of Discrete-Time Signals, Simple Manipulation; Discrete-Time Systems: Input-Output Description, Block Diagram Representation, Classification, Interconnection; Analysis of Discrete-Time LTI Systems: Techniques, Response of LTI Systems, Properties of Convolution, Causal LTI Systems, Stability of LTI Systems; Discrete-Time Systems Described by Difference Equations; Implementation of Discrete-Time Systems; Correlation of Discrete-Time Signals: Cross-correlation and Autocorrelation Sequences, Properties.	
Module-II	Properties of Continuous-Time Systems: Block Diagram and System Terminology, System Properties: Homogeneity, Time Invariance, Additivity, Linearity and Superposition, Stability, Causality; The Continuous-Time Fourier Series: Basic Concepts and Development of the Fourier Series, Calculation of the Fourier Series, Properties of the Fourier Series. Continuous-Time Fourier Transform: Basic Concepts and Development of the Fourier Transform, Properties of the Continuous-Time Fourier Transform.	12 hrs
Module-III		12 hrs

	The Z-Transform and Its Application to the Analysis of LTI Systems: Direct Z- Transform, Inverse Z-Transform; Properties of the Z-Transform; Rational Z-Transforms: Poles and Zeros, Pole Location and Time-Domain Behavior for Causal Signals, System Function of a Linear Time-Invariant System; Inversion of the Z- Transforms: using Power Series Expansion and Partial-Fraction Expansion; one sided Z- Transform.	
Module-IV	The Discrete Fourier Transform: Its Properties and Applications: Frequency Domain Sampling: The Discrete Fourier Transform; Properties of the DFT: Periodicity, Linearity, and Symmetry Properties, Multiplication of Two DFTs and Circular Convolution, Additional DFT Properties.	10 hrs

Internal assessment		
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	20 Marks
Part B	ESE: Term Exam	60 Marks

Text/Reference Books:

1. B.P. Lathi, "Principles of Signal Processing and Linear Systems" Oxford.
2. Alan V. Oppenheim, Alan S. Wilsky and Hamid Nawab S., "Signals & Systems", Prentice Hall, New Delhi, 2005.
3. Rodger E Zaimer and William H Tranter, "Signals & Systems – Continuous and Discrete", McMillan Publishing Company, Bangalore ,2005.
4. Simon Haykin and Barry Van Veen, "Signals & Systems", John Wiley and Sons Inc., New Delhi, 2008
5. John. G. Proakis, "Digital Signal Processing Principles, Algorithms and Applications , Prentice Hall, New Delhi 2006.

DATA STRUCTURE AND ITS ALGORITHM (BTEEE406)

Subject Code	**BTEEE406**	**IA Marks**	30
Number of Lecture Hours/Week	04	**Term End Exam Marks**	70
Total Number of Lecture Hours	45	**CREDITS**	03

Course Objective:

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Write programs using object-oriented design principles.
- Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, tournament trees, binary search trees, and graphs and writing programs for these solutions.
- Solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound and writing programs for these solutions.

Module I

Basic concepts and notations: Data structures and data structure operations, Complexity Analysis: Mathematical notation and functions, algorithmic complexity and time space trade off, Big O Notation, The best, average & worst cases analysis of various algorithms. Arrays: Linear & Multidimensional Arrays, Representation & traversal. Sorting algorithms: Bubble sort, Selection sort, Insertion sort, Merge sort and Quick sort, Counting Sort. Linear search and Binary search on Sorted arrays.

Hours-15

Module II

Abstract Data Types (ADTs) Stack: Push; Pop, stack representation using array and linked list, Applications of Stack, Recursion. Queue: Representation using array and linked list, Insertion and Deletion operations, circular queue, DE queue, priority queue. Linked Lists & their types. (Single, Double, Circular linked lists), Operations on Varieties of Linked Lists (Search and Update) with applications

Hours-10

Module III

Introduction to Trees, Binary tree - definitions and properties; binary tree traversal algorithms with and without recursion., Binary Search Tree - creation, insertion and deletion operations, Threaded tree (One way and Two way). AVL tree balancing; B-tree.

Hours-05

Module IV

Graph Algorithms: Graphs and their Representations, Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS), Applications of BFS and DFS, Minimum Spanning Trees (MST), Prim's and Kruskal's algorithms for MST, Connected Components Dijkstra's Algorithm for Single Source Shortest Paths, Floydd's Algorithm for All-Pair Shortest Paths Problem

Hours-10

Module V

Hashing techniques, Hash function, Address calculation techniques- common hashing functions Collision resolution, Linear probing, quadratic probing, double hashing, Bucket addressing. Rehashing.

Hours-05

COURSEOUTCOMES		**Bloom's Knowledge Level**
CO1	Understand and apply basic data structures and their operations (Arrays, Stacks, Queues, Linked Lists, Trees).	K2,K3
CO2	Analyze and implement sorting and searching algorithms (Bubble sort, Selection sort, Merge sort, Quick sort, Binary search).	K3,K4
CO3	Demonstrate knowledge and application of ADTs (Stack, Queue, Linked List) and use them in practical scenarios.	K3,K4
CO4	Apply tree-based data structures and graph algorithms (Binary Search Tree, AVL Tree, BFS, DFS, Minimum Spanning Tree, Dijkstra's Algorithm).	K3,K4
CO5	Analyze and implement hashing techniques and collision resolution strategies (Linear probing, quadratic probing, double hashing, Bucket addressing).	K3,K4

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	3	2	2	2	1	2	2	3	2	3	2
[CO2]	3	3	3	2	2	2	3	2	3	3	2	2
[CO3]	3	2	3	3	3	2	3	2	3	3	3	3
[CO4]	3	3	3	3	3	3	3	3	3	3	2	3
[CO5]	2	2	3	2	3	3	3	2	3	3	3	2
Avg	**2.8**	**2.6**	**2.8**	**2.4**	**2.6**	**2.2**	**2.8**	**2.2**	**3**	**2.8**	**2.6**	**2.4**

TextBooks/References:

4. Data Structures Using C – A.M. Tenenbaum (PHI)
5. Introduction to Data Structures with Applications by J. Tremblay and P. G. Sorenson (TMH)
6. Data Structures, Algorithms and Application in C, 2nd Edition, Sartaj Sahni
7. Data Structures and Algorithms in C, M.T. Goodrich, R. Tamassia and D. Mount, Wiley India.
8. Data Structure and Program Design in C by C.L. Tondo.
9. Data Structures with C++, J. Hubbard, Schaum's Outlines, and TMH.
10. Data Structures and Algorithms in C, M.T. Goodrich, R. Tamassia and D. Mount, Wiley India.
11. Data Structures and Algorithm Analysis in C, 3rd Edition, M.A. Weiss, Pearson.
12. Classic Data Structures, D. Samanta, 2nd Edition, PHI.
13. Data Structure Using C by Pankaj Kumar Pandey.
14. Data Structure with C, Tata McGraw Hill Education Private Limited by Seymour Lipschutz.
15. Data Structure through C in Depth, BPB Publication, by S.K. Srivastava.
16. Data Structure and algorithm Analysis in C 2nd Edition, PEARSON Publishing House, Mark Allen Weiss

Third Year

SEMESTER V

VLSI Design and Technology (ECE401)		
Teaching Scheme	**Examination Scheme**	**Credits allocated**
Theory 3 hrs/week	**End of semester Examination- 70 marks.**	**Theory-3**
	Internal assessment: 30 marks	
		Total-3
Course Prerequisite: Students should have basic knowledge on Digital Electronics, and Electronic devices and circuits.		
Course Objective: 1. To study HDL based design approach. 2. To learn digital CMOS logic design. 3. To nurture students with CMOS analog circuit designs. 4. To realize importance of testability in logic circuit design. **5.** To overview SoC issues and understand PLD architectures with advanced features**.**		
Module -I	**HDL based design**: Data objects, Data types, Entity, Architecture & types of modeling, Sequential statements, Concurrent statements, Packages, Sub programs, Attributes, VHDL Test bench, Test benches using text files. VHDL modeling of Combinational, Sequential logics & FSM, Meta-stability	10 hrs
Module-II		12 hrs

	Basics of logic devices for design: PROM, PLA, PAL: Architectures and applications. Software Design Flow, CPLD Architecture, Features, Specifications, Applications. FPGA Architecture, Features, Specifications and Applications, Interconnect routing techniques; wire parasitic, Signal integrity issues. I/O architecture, pad design. Architectures for low power.	
Module-III	**MOS devices:** MOS Capacitor, MOS Transistor theory, C-V characteristics, Non ideal I-V effects, Technology Scaling. CMOS inverters, DC transfer characteristics, Power components, Power delay product. Transmission gate. CMOS combo logic design. Delays: RC delay model, Effective resistance, Gate and diffusion capacitance, Equivalent RC circuits; Linear delay model, Logical effort, Parasitic delay, Delay in a logic gate, Path logical efforts.	8 hrs
Module-IV	**VLSI Technology:** Clean room and safety requirements, Wafer cleaning processes and wet chemical etching techniques; Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles; Oxidation Technologies in VLSI and ULSI; Characterization of oxide films; Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI; Mask generation.	10 hrs

Internal assessment		
Part A	CIA-I: Module I and II	
	CIA-II: Module III and IV	

Text Books:

M. H. Rashid, ―Power Electronics circuits devices and applications‖, PHI 3rd edition, 2004 edition, New Delhi.

1. Dr. P.S. Bhibhra, "Power Electronics", Khanna Publishers, Delhi
2. M. S. Jamil Asghar, "Power Electronics", PHI, 2004, New Delhi.

Reference Books:

1. V.R.Moorthi, "Power Electronics", Oxford University Press.

COURSE OUTCOMES		**Bloom's Level**
[CO 1]	Understand the fundamentals of VLSI design flow and CMOS technology	**K1**
[CO 2]	Analyze MOSFET characteristics and basic CMOS logic gates.	**K2**
[CO 3]	Design combinational and sequential logic circuits using CMOS technology.	**K4**
[CO 4]	Simulate and synthesize VLSI circuits using EDA tools.	**K3**
[CO 5]	Evaluate performance metrics like delay, power, and area in digital circuits	**K5**

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO .12]**
[CO1]	3	2	1									
[CO2]	3	3	2									
[CO3]	2	3	3						1			
[CO4	1	2	3	2	2				1			
[CO5]	2	2	3	2	2							
Avg	2.2	2.4	2.4	.8	.8				.4			

CONTROL SYSTEM ENGINEERING (BTECE502)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70marks**	**Theory-3**

Course Prerequisite: Knowledge of 10+2 Math, Fourier and Laplace Transforms.

Course Objective:

1. To introduce the elements of control system and their modeling using various techniques.
2. To introduce methods for analyzing the time response, the frequency response and the stability of systems.
3. To understand the compensation technique that can be used to stabilize the control system.
4. To introduce the state variable analysis method.

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

	COURSE OUTCOMES		Bloom's Level
	[CO 1]	Understand the basic concepts of control systems and their applications	**K2**
	[CO 2]	Derive and analyze transfer functions of linear systems	**K4**
	[CO 3]	Determine time response of first and second-order systems.	**K3**
	[CO 4]	Analyze stability using Routh-Hurwitz and Root Locus techniques.	**K4**
	[CO 5]	Design and analyze frequency response using Bode plots and Nyquist criteria	**K5**

Level	Bachelor	
Course Content:		
Module -I	**Control Systems and Components:** Systems and their representation: Basic elements in control systems, open and closed loop systems, Electrical analogy of mechanical systems, Transfer function, Block diagram reduction techniques, Signal flow graphs- AC and DC servomotor, synchro-, stepper motor.	10 hrs
Module-II	**Time Response Analysis and Design Specifications:** Time response: Time domain specifications, Types of test input, I and II order system response, Error coefficients, Generalized error series, Steady state error, P, PI, PD and PID compensation.	12 hrs
Module-III	**Frequency Response Analysis:**	12 hrs

	Frequency response: Bode plot, Polar plot, frequency domain specifications, Correlation between frequency domain and time domain specifications, Introduction to the design of lead, lag and lag-lead compensators.	
Module-IV	**Concepts of Stability:** Stability Analysis: Characteristics equation, Location of roots in S plane for stability, Routh Hurwitz criterion, Root locus diagram and its application, Dominant poles-Nyquist stability criterion, relative stability.	10 hrs
Internal assessment		
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	20 Marks
Part B	EoSE: Term Exam	60 Marks

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO .12]**
[CO1]	3	2	1	1	1					1		
[CO2]	3	2	2	2	1					1		
[CO3]	3	2	3	2	2				1	1	1	
[CO4	3	3	3	2	2				1	2	1	
[CO5]	3	3	3	3	2				1	2	2	1
Avg	3	2.4	2.4	2	1.6				.6	1.4	.8	.2

Text/Reference Books:

1. **Norman S. Nise, "Control Systems Engineering", 4th Ed, John Wiley, New Delhi, 2007.**
2. **K. Ogata, "Modern Control Engineering", 4th Ed, PHI, New Delhi, 2002.**
3. **J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 2003.**
4. **Benjamin C. Kuo, "Automatic Control Systems", Pearson Education, New Delhi, 2003.**

Elective-I

Digital Signal Processing (ECE503X)		
Teaching Scheme	**Examination Scheme**	**Credits allocated**
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**
Course Prerequisite: An undergraduate level course on Signals and Systems		
Course Objective: This course introduces the basics concepts of Discrete fourier transform, digital filter design and application of digital signal processing. The design of IIR and FIR filter, their structure and implementation is also addressed in this course. DSP processor is also discussed in this course.		

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

COURSE OUTCOMES		Bloom's Level
[CO 1]	Understand the fundamentals of discrete-time signals and systems	K2
[CO 2]	Analyze discrete-time systems using z-transform and Fourier analysis	K4
[CO 3]	Design and implement digital IIR and FIR filters.	K3
[CO 4]	Understand and apply the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) algorithms	K3
[CO 5]	Evaluate filter performance and spectral characteristics using DSP tools	K5

CO-PO Matrix												
Course Outcome	[PO.1]	[PO.2]	[PO.3]	[PO.4]	[PO.5]	[PO.6]	[PO.7]	[PO.8]	[PO.9]	[PO.10]	[PO.11]	[PO .12]
[CO1]	3	2	1	1	1					1		
[CO2]	3	3	2	2	1					1		
[CO3]	3	2	3	2	2				1	2	1	1
[CO4	3	3	2	2	2				1	2	1	1
[CO5]	3	3	2	3	2				1	2	1	1
Avg	3	2.6	2	2	1.6				.6	1.6	.6	.6

Level	Bachelor	
Course Content:		
Module -I	Discrete Fourier Transforms (DFT): Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation,	12 hrs

	Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties. Linear filtering methods based on the DFT: Use of DFT in Linear Filtering, Filtering of Long data Sequences, Fast-Fourier-Transform (FFT) algorithms, Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT--decimation in-time and decimation-in-frequency algorithms.	
Module-II	Design of FIR Filters: Characteristics of practical frequency -selective filters, Symmetric and Ant symmetric FIR filters, Design of Linear-phase FIR filters using windows-Rectangular, Hamming, Hanning, Bartlett windows. Design of FIR filters using frequency sampling method. Structure for FIR Systems: Direct form, Cascade form and Lattice structures.	12 hrs
Module-III	IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Low pass prototype transformation. Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II.	10 hrs
Module-IV	Digital Signal Processors: DSP Architecture, DSP Hardware Modules, Fixed point format, Floating point Format, IFixed Point digital signal processors, Floating point processors. Application of Digital Signal Processors.	9 hrs

Internal assessment

Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10Marks
Part B	ESE: Term Exam	70Marks

Text/Reference Books:

1. Proakis & Manolakis, "Digital Signal Processing- Principles Algorithms &Applications", 4th Edition, Pearson education, New Delhi, 2007. ISBN: 81-317- 1000-9.
2. Oppenheim & Schaffer, "Discrete Time Signal Processing" ,PHI, 2003.
3. Sanjit K Mitra, "Digital Signal Processing, A Computer Based Approach", 4th Edition. McGraw Hill Education, 2013.
4. D.Ganesh Rao and Vineeth P Gejji, "Digital Signal Processing" Cengage India Private Limited, 2017, ISBN: 9386858231

Antenna and Wave Propagation (ECE504)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**

Course Prerequisite: Undergraduate course on Electromagnetic wave and transmission line.

Course Objective: This course introduces the basics of antennas and wave propagation to the students which focused on introductory study of wave radiation, different parameters to characterize an antenna, and various types of antennas. The course covers three types of antenna types, basic antennas, broadband and directive antennas and planar antennas. Various antennas are discussed which can be used to radiate electromagnetic waves of
different polarization. An introduction to the antenna arrays is covers in this course.

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

COURSE OUTCOMES		**Bloom's Level**
[CO 1]	Explain the basic concepts and parameters of antennas and wave propagation	**K2**
[CO 2]	Analyze different types of antennas and radiation patterns	**K4**
[CO 3]	Design basic antenna structures for specified applications	**K6**
[CO 4]	Evaluate the performance characteristics of antennas in practical scenarios	**K5**
[CO 5]	Apply knowledge of wave propagation to real-world communication systems.	**K3**

Level	Bachelor	
Course Content:		
Module -I	Fundamental Concepts: Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions, Radiation from Wires and Loops, Infinitesimal dipole, finite-length dipole, crossed dipole antenna, small circular loop.	10 hrs

Module-II	Aperture and Reflector Antennas: Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas, Monopole antenna	12 hrs
Module-III	Broadband and Directive Antennas- Log-periodic and Yagi-Uda antennas, Helix antenna, eggbeater antenna, frequency independent antennas, broadcast antennas, wideband standard horn antenna. Microstrip Antennas, feeding methods, methods of analysis, design of rectangular, circular and elliptical patch antennas, circularly polarized microstrip patch antennas.	12 hrs
Module-IV	Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.	10 hrs

Internal assessment

Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	ESE: Term Exam	70 Marks

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11**	**PO12**
[CO1]	3	2	1	1	1							
[CO2]	2	3	2	2	1							1
[CO3]	2	2	3	2	2				1		1	2
[CO4	2	3	2	3	2						1	2

[CO5]	2	2	2	2	2	1	1				2		
Avg	2.2	2.4	2	2	1.6	.2	.2		.2		.8	1	

Text/Reference Books:

1. C.A. Balanis, "Antenna Theory: Analysis and Design", John Wiley, 1982.
2. AR. Harish and M. Sachidananda, "Antennas and Wave Propagation", Oxford Higher Education, 2007
3. J. D. Kraus, "Antennas", McGraw Hill, 1988.
4. R.E. Collin, "Antennas and Radio Wave Propagation", McGraw Hill, 1985.
5. I.J. Bahl and P. Bhartia, "Micro Strip Antennas", Artech House, 1980.

DIGITAL COMMUNICATION AND SYSTEM (BTECE505)

Teaching Scheme	**Examination Scheme**	**Credits allocated**
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**

Course Prerequisite: Knowledge of 10+2 Math, Linear Algebra, Fourier and Laplace Transforms.

1. To understand the building blocks, principles, techniques and limitations of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system.
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To understand concept of spread spectrum communication system.

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

	COURSE OUTCOMES		**Bloom's Level**
	[CO 1]	Explain the basic concepts of digital communication systems	**K2**
	[CO 2]	Analyze the performance of various digital modulation techniques.	**K4**
	[CO 3]	Evaluate signal-to-noise ratio and error probabilities for digital systems.	**K5**

	[CO 4]	Design digital communication systems based on bandwidth and noise considerations	**K6**
	[CO 5]	Compare different source and channel coding techniques for data transmission	**K4**

Level	Bachelor	
Course Content:		
Module -I	**Digital Communication Basics:** Fundamentals of Digital communication system, analog vs. digital communication, Limitations of communication systems; Block Diagram and transformations, Basic Digital Communication Nomenclature: Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, adaptive delta modulation, Delta Sigma Modulation.	12 hrs
Module-II	**Digital Modulation Techniques:** Digital Modulation formats, Coherent binary modulation techniques (BPSK, BFSK), Passband transmission, Coherent and non-coherent detection of signals in noise, Generation and detection of PSK, DPSK, QPSK, OOK, FSK, QAM and MSK differential phase shift keying, differential encoded PSK, QPSK, Quadrate Amplitude shift keying (QASK), power spectra, bandwidth efficiency; BER for BPSK.	12 hrs
Module-III	**Data Transmission:**	11 hrs
Course Objective:		

	Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers, synchronization: Bit Synchronization, Scramblers, Frame Synchronization, Equalization, Base band signal receiver, probability of error, the optimum filter, and white noise-the matched filter, probability of error of the matched filter, coherent reception: correlation, application of coherent reception in PSK and FSK. Correlation receiver for QPSK.	
Module-IV	**Information Coding and Decoding:** Coding for error detection and correction, Block coding – coding, anticoding, Hadamard code, Hamming code, Cyclic Codes, Convolution coding and decoding, Viterbi algorithm, Shannon Fano and Hoffman Codes.	10 hrs

Internal assessment

Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	EoSE: Term Exam	70 Marks

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**PO 11**	**PO 12**
[CO1]	3	2	1	1	1							
[CO2]	3	3	2	2	2							1
[CO3]	3	3	2	2	2							1
[CO4	2	2	3	2	3				1		1	2
[CO5]	2	3	2	2	2					1		2
Avg		1.6	2	1.8	2				.2	.2	.2	1.2

Text/Reference Books:

1. P Ramkrishna Rao, Digital Communication, McGraw Hill Publication
2. Ha Nguyen, Ed Shwedyk, ―A First Course in Digital Communication‖, Cambridge University Pres
3. B P Lathi, Zhi Ding ―Modern Analog and Digital Communication System‖, Oxford University Press, Fourth Edition.
4. Bernard Sklar, Prabitra Kumar Ray, ―Digital Communications Fundamentals and Applications‖ Second Edition, Pearson Education.

MICROPROCESSORS & MICROCONTROLLER (BTECE506)

Subject Code	BTEEE504	IA Marks	30
Number of Lecture Hours/Week	04	Term End Exam Marks	70
Total Number of Lecture Hours	45	CREDITS	03

Course Objective:

4. To understand the concepts of Architecture of 8086 microprocessor
5. To understand the design aspects of I/O and Memory Interfacing circuits
6. To understand the architecture and programming of ARM processor

Module-I

THE 8086 MICROPROCESSOR - Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming
- Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.
Hours-8

Module-II
8086 SYSTEM BUS STRUCTURE - 8086 signals – Basic configurations – System bus timing – System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure - Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

Hours-8

Module-III

MICROCONTROLLER - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Programming 8051 Timers – Interfacing Microcontroller - Serial Port Programming - Interrupts Programming – LCD & Keyboard - External Memory Interface- Stepper Motor.

Hours-9

Module-IV

INTRODUCTION TO EMBEDDED SYSTEMS - Complex systems and microprocessors– Embedded system design process – Instruction sets preliminaries - ARM Processor – CPU: programming input and output supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance.

Hours-10

Module-V

EMBEDDED COMPUTING PLATFORM DESIGN AND OPTIMIZATION The CPU - Bus-Memory
devices and systems–Designing with computing platforms – platform level performance analysis - Components for embedded programs-Models of programs Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Analysis and optimization of program size- Program validation and testing.

Hours-10

COURSE OUTCOMES		**Bloom's Knowledge Level**
CO1	Understand the architecture and working of the 8086 microprocessor and perform assembly language programming, including modular programming, stacks, procedures, and macros	K1, K2, K3
CO2	Analyze and design a system based on the 8086 microprocessor, including system bus structure, signal configurations, and IO programming, with an introduction to multiprogramming and multiprocessor configurations.	K3, K4
CO3	Understand the architecture and working of the 8051 microcontroller, including programming the microcontroller with various interfacing devices like timers, LCD, keyboard, and stepper motor.	K1, K2,K3
CO4	Understand the concepts and design processes involved in embedded systems, including ARM processors, CPU programming, memory mechanisms, and performance optimization techniques	K1,K2,K4
CO5	Design and optimize embedded computing platforms with performance analysis, program optimization, and testing techniques for effective software validation.	K3,K4,K5

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2	3	2	3	2	2	3	2	3	2	3
[CO2]	3	2	3	3	2	2	3	2	3	3	2	3
[CO3]	3	3	3	3	3	2	2	2	2	3	2	2
[CO4]	3	3	3	3	2	2	3	3	2	3	3	3

[CO5]	3	3	3	3	3	3	3	3	2	3	3	3
Avg	**3**	**2.6**	**3**	**2.8**	**2.6**	**2.2**	**2.6**	**2.6**	**2.2**	**3**	**2.4**	**2.8**

Textbooks/References:

7. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007
8. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2 nd Edition, Pearson Education, 2011
9. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012

SEMESTER VI

MICROELECTRONICS AND VLSI DESIGN

Course Code	Title of the course	Program Core (PCR) / Electives (PEL)	Total Number of contact hours : 40				Credit
			Lecture (L)	Tutorial (T)	Practical (P)	Total Hours	
EC2012	**VLSI Systems Design**	PEL	4	0	0	4	4

Pre-requisites:	Course Assessment methods: (Continuous (CT), Mid-semester assessment (MA) and end assessment (EA)):
Digital and Analog IC/VLSI Design	Assignments, Quiz, Mid-semester Examination and End Semester Examination

Course Objectives	To illustrate the basic concepts of modern VLSI circuit design Describe the fundamental principles underlying digital design using CMOS logic and analyse the performance characteristics of these digital circuits. Design the synthesizable digital sub-system components using Verilog HDL Verify that a design meets its functionally, timing constraints, both manually and through the use of computer-aided design tools.

Course Outcomes	**COURSE OUTCOMES**		**Bloom's Level**
	[CO 1]	Recall fundamental semiconductor device principles and fabrication techniques	**K1**
	[CO 2]	Explain MOSFET operation and CMOS inverter characteristics.	**K2**
	[CO 3]	Apply VLSI design rules and layout techniques using CAD tools.	**K3**
	[CO 4]	Analyze the performance of combinational and sequential CMOS circuits	**K4**
	[CO 5]	Evaluate power, delay, and area trade-offs in VLSI systems.	**K5**

Syllabus/Topics Covered

Total Lecture hours: 40

Module-I:(L – 07)
Design Methodology: Structured design techniques; Programmable logic; Gate array and sea of gates design; cell based design; full custom design; Design flow; Design Economics.

Module-II:(L – 05)
Data path Subsystems: Adders; One/zero Detectors; Comparators; Counters; Shifters; Multipliers; Power and Speed Trade-off.

Module-III:(L – 05)
Memory and Array Subsystems: Memory controller and management, SRAM, DRAM, ROM, Serial access memories; CAM, PLAs; Array yield, reliability; Power dissipation in Memories.

Module-IV:(L – 05)

Special purpose Subsystems: Packaging; power distribution; I/O pads;

Module-V:(L – 05)
Interconnect: Interconnect parameters; Electrical wire models, capacitive parasitics; Resistive parasitics; Inductive parasitic; Crosstalk; Advanced Interconnect Techniques.

Text / Ref. Books

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11**	**PO, 12**
[CO1]	3	2	1									1
[CO2]	3	2	3		1							2
[CO3]	3	2	2	2	3				1	1	1	2
[CO4	3	3	3	3	3			1		1	1	2
[CO5]	3	3	3	3	3			1		1	1	2
Avg	3	2.4	2.4	1.6	2			.4	.2	.6	.6	1.8

Text Books:

1. **Neil H. E. Weste, David. Harris and Ayan Banerjee, "CMOS VLSI Design" - Pearson Education, Third Edition, 2004.**
2. **Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits" Pearson Education, Second Edition.**

References:

1. **Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits" TMH, Third Edition, 2003**
2. **Wayne Wolf, "Modern VLSI Design ", 2nd Edition, Prentice Hall, 1998.**

Analog Communication System (BTECE602)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**

Course Prerequisite: Knowledge of 10+2 Math, Linear Algebra, signal and systems, and Fourier Transforms.

Course Objective: This course represents various forms of analog communication such as amplitude modulation, angle modulation etc. Noise has a great importance in communication systems. Different forms of noise have been covered here. Pulse amplitude modulation has also been discussed in which students could be benefitted for the study digital communications.

1. Study and analyze the mathematical techniques of generation, transmission and reception of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals.
2. Evaluation of the performance levels (Signal-to-Noise Ratio) of AM, FM and PM systems in the presence of additive white noise.

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

	COURSE OUTCOMES		Bloom's Level
	[CO 1]	Recall the basic concepts of analog modulation techniques and radio frequency spectrum.	**K1**
	[CO 2]	Explain the working principles of AM, FM, and PM systems.	**K2**
	[CO 3]	Apply mathematical analysis for modulation, demodulation, and spectral characteristics	**K3**
	[CO 4]	Analyze performance of analog communication systems in presence of noise.	**K4**
	[CO 5]	Evaluate and compare modulation schemes based on power and bandwidth efficiency	**K5**

Level	Bachelor	
Course Content:		
Module -I	**Introduction:** Introduction to Communication Process, Communication Channels,	08 hrs

	Modulation, Need for modulation; Review of Signals and Systems, Frequency domain representation of signals; Transmission of Random Process through an LTI Filter, Multiplexing: FDM and TDM.	
Module-II	**Amplitude Modulation:** Amplitude Modulation (AM), Generation of AM and its spectrum, Modulation Index, Envelop Detection, Power relations applied to sinusoidal signals, Limitations of AM, DSB-SC Modulation, Coherent Detection; SSB- SC, ISB & VSB, their generation methods & Comparison, AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection.	14 hrs
Module-III	**Angle Modulation:** Concept of Angle Modulation, frequency spectrum & Eigen Values, Frequency Modulation, Narrowband & wideband FM, Modulation index, Bandwidth Generation of FM, Detection of FM, Phase Modulation (PM), Generation of PM, Bessel's Function and its mathematical analysis, Comparison of FM and PM, Generation of FM (Direct & Indirect Method), FM detection using Slope detector, Balanced Slope detector etc. Block diagram of FM Transmitter and Receiver.	12 hrs
Module-IV	**Noise:** Noise concept, Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Behavior of Baseband	10 hrs

	systems and Amplitude modulated systems i.e.DSBSC and SSBSC in presence of noise.	
Internal assessment		
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	EoSE: Term Exam	70 Marks

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO .12]**
[CO1]	3	2										1
[CO2]	3	2										2
[CO3]	3	3	2	2	2				1		1	2
[CO4	3	3	2	3	2					1	1	2
[CO5]	3	3	3	3	3			1		1	1	2
Avg	3	2.6	1.4	2.5	1.4			.2	.2	.2	.6	1.8

Text/Reference Books:

1. S. Haykin.and M. Moher, "Communications Systems, 5th Edition", John Wiley and Sons, 2009.
2. Sanjay Sharma, “Analog Communication Systems” Katson publication.
3. B.P lathi, “Modern Digital and Analog Communication Systems, 3rd Edition”, Oxford University press 2010.
4. H. Taub and D.L. Schilling, "Principles of Communication Systems”, Tata McGraw Hill, 2013.
5. G. Kennedy, “Electronic Communication Systems” 5th Edition, McGraw-Hill.
6. D. Roddy & Coolen, “Electronic Communication”,4th Edition, Prentice Hall

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Power Electronics (BTECE603)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**
	Internal assessment: 40 marks	
		Total-3

Course Prerequisite: Students should have basic knowledge on Basic Electronics, and Electronic devices and circuits.

Course Objective:

- To give a details concept to students of working & analysis of controlled rectifiers for different loads, inverters, DC choppers, AC voltage controllers and resonant converters.
- To study the different motor drives, various power electronics applications like UPS, SMPS, etc. and some protection circuits.
- To introduce the students on various power devices: operations their construction, characteristics and turning on circuits.

Course Outcomes:

COURSE OUTCOMES		Bloom's Level
[CO1]	Demonstrate the characteristics as well as the operation of BJT, MOSFET, IGBT, SCR, TRIAC and GTO and identify their use in the power switching applications	**K4**
[CO2]	Comprehend the non-isolated DC-DC converters and apply their use in different Power electronics applications.	**K3**
[CO3]	Analyze the phase-controlled rectifiers and evaluate their performance parameters	**K5**
[CO4]	Apprehend the working of single-phase ac voltage controllers, cyclo-converters and their various applications	**K3**
[CO5]	Explainthesingle-phaseandthreephasebridgeinvertersdifferentiatebetween CSI and VSI and apply PWM for harmonic reduction.	**K4**

Course Content:

Module -I	**Semiconductor Power Devices** Construction, Steady state characteristics & Switching characteristics of SCR, SCR	10 hrs

	ratings: IL, IH, VBO, VBR, dv/dt, di/dt, surge current & rated current. Gate characteristics, Gate drive requirements, Construction, power MOSFET and IGBT, Gate drive circuits for Power MOSFET & IGBT, opto isolator driving circuits for SCR. Series and parallel operations of SCR's. Applications of above power devices as a switch, TRIAC, MOS controlled Thyristor (MCT), Power Integrated Circuit (PIC).	
Module-II	**Power Converter and Choppers:** Concept of line & forced commutation, Single phase Semi & Full converters for R, R-L loads, Performance parameters, Effect of freewheeling diode, Three phase Semi & Full converters for R load, effect of source inductance; Single phase bridge inverter for R and R-L load using MOSFET / IGBT, single phase PWM inverters. Three Phase voltage source inverter for balanced star R load with 120° and 180 mode of operation, Device utilization factor, Harmonics Elimination/Modulation Techniques; Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper.	12 hrs
Module-III	**Single-phase inverters:** Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at	8 hrs

	output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.	
Module-IV	**Switching Power Supplies:** Analysis of fly back, forward converters for SMPS, resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter; Applications: Power line disturbances, EMI/EMC, power conditioners; Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS.	10 hrs
Internal assessment		
Part A	CIA-I: Module I and II	
	CIA-II: Module III and IV	

Text Books:

1. M. H. Rashid, ―Power Electronics circuits devices and applications‖, PHI 3rd edition, 2004 edition, New Delhi
2. Dr. P.S. Bhibhra, "Power Electronics", Khanna Publishers, Delhi
3. M. S. Jamil Asghar, "Power Electronics", PHI, 2004, New Delhi.

Reference Books:

1. V.R.Moorthi, "Power Electronics", Oxford University Press.

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	2	1	1	1		1						2
[CO2]	2	2	2	2	1							2

[CO3]	3	3	3	1	2	1						3
[CO4	2	2	2	1	1							2
[CO5]	3	2	3	1	2	1	1					2
Avg	2.40	2.00	2.20	1.20	1.50	1.00	1.00					2.20

Microwave Theory and Techniques (BTECE605)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**

Course Prerequisite: An undergraduate level course on Electromagnetic Wave and Transmission Line.

Course Objective: This course introduces the basics of microwave theory and techniques to the students which focused on introductory study of microwave engineering, different passive and active microwave components used in the high frequency systems such as LNA, transmission lines, filter, power divider, mixer, RF switch etc. The course is heavily oriented towards the high frequency circuit analysis and design covering low power components and high-power components. This course also covers the design and analysis of planar
microwave passive components used in modern communication systems.

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

COURSE OUTCOMES		Bloom's Level
[CO 1]	Recall microwave frequency bands, applications, and basic concepts	**K1**
[CO 2]	Explain wave propagation in waveguides and microwave components.	**K2**
[CO 3]	Apply S-parameters to analyze microwave networks and components	**K3**
[CO 4]	Analyze microwave passive and active devices such as couplers, circulators, and amplifiers	**K4**
[CO 5]	Evaluate microwave measurement techniques and system performance.	**K5**

Level	Bachelor
Course Content:	

Module -I	Introduction to Microwaves: Microwave Frequency bands, Applications of Microwaves, Waveguide (rectangular and circular), Microwave Transmission Lines, coaxial line, Strip line, Micro strip line, Smith chart, Microwave Network Analysis, Network parameters for microwave circuits, Scattering Parameters.	10 hrs
Module-II	Passive and Active Microwave Devices: Microwave waveguide components, waveguide Tee, Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator, Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Amplifier and Oscillator	12 hrs
Module-III	Microwave Tubes: Introduction to Klystron, TWT, Magnetron and their design.	12 hrs

Module-IV	Microwave Passive Components Design: Impedance transformation, Microwave Filter Design, Microwave Mixer, directional coupler, power divider.	9 hrs

Internal assessment

Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	ESE: Term Exam	70 Marks

Text/Reference Books:

1. Rober.E.Collin, "Foundations of Microwave Engineering", John Wiley, 3/e, 2001
2. D.M.Pozar, "Microwave engineering", John Wiley, 3/e, 2005
3. Samuel Y.Liao, "Microwave Devices and Circuits", 3/e, PHI, New Delhi,1987.
4. K.C. Gupta and I.J. Bahl, "Microwave Circuits", Artech house.

CO-PO Matrix

Course Outcome	[PO.1]	[PO.2]	[PO.3]	[PO.4]	[PO.5]	[PO.6]	[PO.7]	[PO.8]	[PO.9]	[PO.10]	[PO.11]	[PO.12]
[CO1]	3	2										1
[CO2]	3	2			1							2
[CO3]	3	3	2	2	3				1	1		2
[CO4	3	3	2	3	3					1		2
[CO5]	3	3	3	3	3			1		1		2
Avg	3	2.6	1.4	2.2	2			.2	.2	.6		1.8

Embedded Systems and IOT(BTECE606)

Course Code		L	T	P	C
CS3691	EMBEDDED SYSTEMS AND IOT	3	0	2	4

COURSE OBJECTIVES:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ openplatform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING 9

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations– Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee– GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation –Smart Agriculture – Smart Cities – Smart Healthcare.

COURSE OUTCOMES:

COURSE OUTCOMES		**Bloom's Level**
[CO 1]	Recall the fundamentals of embedded systems and IoT architecture	**K1**
[CO 2]	Explain microcontroller architecture and communication protocols used in IoT.	**K2**
[CO 3]	Apply programming skills to interface sensors and actuators with embedded systems.	**K3**
[CO 4]	Analyze real-time operating system (RTOS) features and interrupt handling	**K4**
[CO 5]	Evaluate performance and security issues in IoT systems.	**K5**

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO .12]**
[CO1]	3	2			1							2
[CO2]	3	2	1		2					1		2
[CO3]	3	3	3	2	3					1	1	2
[CO4	3	3	2	3	3					1	1	2
[CO5]	3	3	2	3	2	1	1	1		1	1	2
Avg	3	2.6	1.6	2.5	2.8	.2	.2	.2		.8	.6	2

TEXTBOOKS TOTAL:75 PERIODS

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi,Rolin D.McKinlay―The8051 Microcontroller and Embedded Systems‖, Pearson Education, Second Edition, 2014

2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, ―IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things‖, CISCO Press, 2017.

REFERENCES

1. Michael J. Pont, ―Embedded C‖, Pearson Education, 2007.

2. Wayne Wolf, ―Computers as Components: Principles of Embedded Computer SystemDesign‖, Elsevier, 2006.

3. Andrew N Sloss, D. Symes, C. Wright, ―Arm System Developer's Guide‖, MorganKauffman/ Elsevier, 2006.

4. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, UniversitiesPress, 2015

ELECTIVE-II (WIRELESS COMMUNICATION-BTECE6042)

Course Code	Course Title	Lecture Periods	Tutorial Periods	Practical Periods	Credit

EC8652	Wireless Communication	3	0	0	3

COURSE OBJECTIVES:

- Know the characteristic of wireless channel
- Learn the various cellular architectures
- Understand the concepts behind various digital signaling schemes for fading channels
- Be familiar the various multipath mitigation techniques
- Understand the various multiple antenna systems

COURSE OUTCOMES:

COURSE OUTCOMES		**Bloom's Level**
[CO 1]	Recall wireless communication basics, frequency bands, and multiple access techniques	**K1**
[CO 2]	Explain cellular concepts, propagation models, and system design considerations	**K2**
[CO 3]	Apply modulation techniques and diversity schemes in wireless systems	**K3**
[CO 4]	Analyze interference, fading, and mobility management in wireless networks.	**K4**
[CO 5]	Evaluate performance metrics of modern wireless technologies (e.g., 4G, 5G).	**K5**

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO .12]**
[CO1]	3	2			1							2
[CO2]	3	2	1	1	2	1	1			1		2
[CO3]	3	3	3	2	3				1	1	1	2
[CO4	3	3	2	3	3					1	1	2
[CO5]	3	3	2	3	3	1	1	1		1	1	2
Avg	3	2.6	1.6	2.4	2.4	.4	.4	.2	.2	.8	.6	2

SYLLABUS:

UNIT I WIRELESS CHANNELS 9

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters- Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

UNIT II CELLULAR ARCHITECTURE

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement.

UNIT III DIGITAL SIGNALING FOR FADING CHANNELS 9

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT IV MULTIPATH MITIGATION TECHNIQUES 9

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver

UNIT V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL : 45 PERIODS

ADDITIONAL TOPICS:

- Gigabit, Ethernet
- Zigbee OFDM applications
- 4G and 5 G systems
- Vehicular Networks
- Massive MIMO, Multiuser MIMO

CURRICULUM GAP-CONTENT BEYOND SYLLABUS:

- Simulation, Ethics of wireless communication systems

TEXT BOOKS:

1. Rappaport,T.S., —Wireless communications‖, Pearson Education, Second Edition, 2010.(UNIT I, II, IV)
2. Andreas.F. Molisch, —Wireless Communications‖, John Wiley – India, 2006. (UNIT III,V)

REFERENCES:

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, —OFDM for wireless multimedia communications, Artech House, 2000
3. David Tse and Pramod Viswanath, —Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4. Upena Dalal, —Wireless Communication‖, Oxford University Press, 2009

SEMESTER VII

Optical Fiber Communication (BTECE701)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	End of semester Examination-70 marks	Theory-3

Course Prerequisite: Knowledge of 10+2 mathematics, linear algebra and calculus.

Course Objective: This course covers basic of optical fiber communication, optical sources and detectors, and optical networks in details. The student will be able to understand basics of signal propagation through optical fibers, fiber impairments, components and devices, and
optical network design.

Course Outcomes:

COURSE OUTCOMES		Bloom's Level
[CO 1]	Understand the general principles of optical fiber communication, its advantages, and the components involved.	K2

[CO 2]	Apply the concepts of signal distortion in optical fibers, including losses and dispersion.	**K3**	
[CO 3]	Analyze the characteristics of optical sources such as LEDs and laser diodes.	**K4**	
[CO 4]	Evaluate the performance of optical detectors and receivers in optical communication systems.	**K5**	
[CO 5]	Design optical communication systems, considering factors such as signal power budget, multiplexing, and link considerations.	**K6**	

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2	1	2	1	2	1	1	1	2	1	2
[CO2]	3	3	2	3	2	2	1	1	2	3	2	2
[CO3]	3	3	3	2	3	1	1	1	2	2	1	1
[CO4]	3	3	2	3	3	2	1	1	1	2	2	1
[CO5]	3	3	3	3	3	3	2	2	3	3	3	3
Avg	3	2.8	2.2	2.6	2.4	2	1,2	1.2	1.8	2.4	1.8	1.8

Level	Bachelor	
Course Content:		
Module -I	**Overview of Optical Fiber Communications:** **Introduction**: Optical fiber communication, Optical spectral bands, advantages and disadvantages. **Optical Fiber waveguides:** Introduction, Ray theory transmission, Total internal reflection, acceptance angle, numerical aperture, skew rays. **Types of optical fibers:** Cylindrical Fiber: modes, mode coupling, step index fibers, Graded index fibers, Single mode Fiber: Cut-off wavelength,	12 hrs

Module-II	**Losses in Optical Fiber:** Attenuation, Material absorption losses in silica glass fibers, linear and non-linear scattering losses, fiber bend loss,	10 hrs
	Dispersion, Chromatic dispersion, intermodal dispersion, overall fiber dispersion, Dispersion shif ted and dispersion flattened fibers, Polarization, Non-linear effects (Scattering effects and Kerr nonlinearity).	
Module-III	**Optical Sources and Detectors:** **Sources:** LED- LED structures, surface emitting LED, Edge emitting LED, quantum efficiency and LED power, light source materials, modulation of LED, LASER diodes- modes and threshold conditions, Rate equations, external quantum efficiency, resonant frequencies, structures and radiation patterns, single mode laser, external modulation, temperature effort. **Detectors:** PIN photo detector, Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects-comparisons of photo detectors.	10 hrs

Module-IV	**Optical Receiver, Measurements and Coupling:** **Optical Receiver:** Fundamental receiver operation, digital signal transmission, error sources, Front-end amplifier, digital receiver performance, probability of error, receiver sensitivity, quantum limit, Eye Diagram, Eye Pattern Features, BER and Q Factor Measurement. **Optical fiber measurements:** Attenuation measurement, Dispersion measurement, Fiber cut-off Wave length Measurements, Fiber Numerical Aperture Measurements, Fiber diameter measurements, **Power Launching and couplings:** Source to Fiber Power Launching, Lensing Schemes for Coupling Management, Fiber to Fiber Joints, LED Coupling to Single Mode Fibers, Fiber Splicing, Optical Fiber connectors.	12 hrs
Part B	EoSE: Term Exam	70 Marks
	Internal assessment	
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks

Text/Reference Books:

1. Optical Fiber Communication Principles & Practice by John M.Senior, PHI Publication (3rd Edition).
2. Optical Fiber Communications by Gerd Keiser, Mc Graw Hill.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996
6. Muhammad Ali Mazidi**,** Janice Gillespie Mazidi and Rollin D. McKinlay**,** "The 8051 Microcontroller and Embedded Systems using assembly and C"**,** Pearson, 2006.

ELECTIVE-III
Mobile Communication and Network (BTECE7031)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**

Course Prerequisite: Knowledge of 10+2 mathematics, basic analog and digital communication systems.

Course Objective: This course covers basics of mobile communication. The student will be able to understand the basics of GSM and other mobile technologies. The frequency management and handoff concepts that are used in mobile cellular networks will be discussed in detail.

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

	COURSE OUTCOMES	Bloom's Level
CO 1	Understand the basic concepts of mobile communication systems and cellular architecture.	K_2
CO 2	Analyze various mobile communication technologies such as GSM, CDMA, LTE, and 5G.	K_4
CO 3	Apply radio propagation models for wireless communication system design.	K_3
CO 4	Evaluate the performance of different mobile network protocols and handoff techniques	K_5
CO 5	Design mobile network components for efficient data communication	K_6

Level	Bachelor	
Course Content:		
Module -I	**Introduction**: **Cellular concepts:** Basic cellular	10 hrs

	systems, Performance criteria, Uniqueness of mobile radio environment, Operation of cellular systems, analog & digital cellular systems. **Cellular System Design Fundamentals:** Concept of frequency reuse channels, Co-channel interference reduction factor, Desired C/I from a normal case in an omnidirectional antenna system, Handoff mechanism, Cell splitting.	
Module-II	**Interference in Cellular Mobile System:** Channel & co-channel interference, Channel antenna system design considerations, umbrella pattern effect, Adjacent-channel interference, Near- end – far-end interference, Effect on near-end mobile Modules.	08 hrs
Module-III	**Frequency management, channel assignment and handoffs:**	10 hrs

	Frequency management, Frequency- spectrum utilization, Set-up channels, Fixed channel assignment schemes, Non-fixed channel assignment schemes, Concept of handoff, Initiation of a hard handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power difference, handoffs, Mobile assisted handoff, Soft handoffs, Cell-site handoff, Intersystem handoff, dropout calls.	
Module-IV	**GSM system overview:** GSM system architecture, GSM radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM, GPRS and EDGE, CDMA 2000, Wireless Local Loop, IMT 2000 and UMTS, Long Term Evolution (LTE), Mobile data networks, Introduction to 4G and concept of NGN.	10 hrs

Internal assessment

Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	EoSE: Term Exam	70 Marks

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2	1	1	1	1	1	1	1	2	1	2
[CO2]	3	3	2	2	2	1	1	1	1	2	1	2
[CO3]	3	2	3	3	3	1	1	1	2	2	2	3
[CO4]	3	3	2	3	2	2	1	2	2	3	2	3
[CO5]	3	2	3	2	3	2	1	2	3	3	3	3
Avg	**3**	**2.4**	**2.2**	**2.2**	**2.2**	**1.4**	**1**	**1.4**	**1.8**	**2.4**	**1.8**	**2.6**

Text/Reference Books:

1. Mobile Cellular Telecommunications: Analog and Digital Systems by William C. Y. Lee; Tata McGraw Hill Publication.

2. Wireless Communications: Principles and Practice by Theodore S. Rappaport; Pearson/PHI Publication.

3. Wireless Communications and Networks: 3G and Beyond by Iti Saha Misra; Tata McGraw Hill Publication.

4. Wireless and Digital Communications by Dr. Kamilo Feher; PHI Publication
.
5. T L Singal ,"Wireless Communications ", McGraw Hill Education.

Satellite Communication (BTECE704)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	End of semester Examination-70 marks	Theory-3

Course Prerequisite: Knowledge of 10+2 physics, basic analog and digital communication systems.

Course Objective: This course covers basics of satellite communication. The student will be able to understand the orbital mechanism and satellite sub-systems. The satellite links and modulation techniques used in satellite communication will be discussed.

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

	COURSE OUTCOMES	Bloom's Level
CO 1	Understand the fundamentals and need for satellite communication systems	K_2
CO 2	Analyze satellite orbits and orbital parameters relevant to communication	K_4
CO 3	Calculate and design link budgets for satellite communication systems	K_3
CO 4	Describe and evaluate the satellite subsystems (antenna, transponder, power, TT&C)	K_5
CO 5	Apply multiple access techniques like FDMA, TDMA, CDMA in satellite networks	K_3

Level	Bachelor	
Course Content:		
Module -I	**Orbital Mechanism**: Satellite orbit and orbital equations, Kepler"s laws of planetary motion, locating satellite in the orbit, locating satellite with respect to earth, Look angle calculation, coverage angle and slant range, orbital perturbations, satellite launching, orbital effects in communication subsystem performance.	10 hrs
Module-II	**Satellite Sub-Systems:**	08 hrs

	Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.	
Module-III	**Satellite Link Design:** Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.	10 hrs
Module-IV	**Modulation and Multiple Access Schemes:** Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.	10 hrs
	Internal assessment	
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	EoSE: Term Exam	70 Marks

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**PO11**	**PO12**
[CO1]	3	2								1		
[CO2]	3	3		2	1							2
[CO3]	3	2	3	3	2						1	
[CO4]	2	2			1					1		
[CO5]	2	2	2		2	1			1	2		1
Avg	**2.6**	**2.2**	**1**	**1**	**1.2**	**1**	**1**	**0**	**1**	**.8**	**1**	**.6**

Text/Reference Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002.
2. Tri T. Ha: Digital Satellite Communications: (Second Edition) Tata McGraw Hill, 2009.
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009.
4. G S Rao, "Global Navigation Satellite Systems," Tata McGraw Hill.
5. G.D. Gordon and W.L. Morgan, Principles of Communication Satellites, John Wiley & Sons, Inc.

Image Processing (BTECE705)

Teaching Scheme (Credits and Hours)

Teaching scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
04	00	02	06	5	3	70	30	20	30	150

Learning Objectives:

- To understand the sensing, acquisition and storage of digital images.
- To study the image fundamentals and mathematical transforms necessary for image processing.
- To understand the digital processing systems and corresponding terminology.

- To understand the base image transformation domains and methods.
- To have an understanding of colour models, type of image representations and related statistics.
- To study the image enhancement techniques.
- To study image compression procedures.
- To study image segmentation and representation techniques.
- To study image restoration.

Outline of the Course:

Sr. No	Title of the Unit	Minimum Hours
1	Introduction to computer graphics	4
2	Image processing fundamentals	6
3	Image Enhancement	10
4	Image Restoration	10
5	Colour Image Processing	12
6	Image Compression	10
7	Morphological Image Processing – Overview	8

Total hours (Theory): 70

Total hours (Lab): 30

Total hours: 100

COURSE OUTCOMES		Bloom's Level
CO1	Explain the fundamentals of digital image processing and its components	K_2
CO2	Apply various spatial and frequency domain techniques for image enhancement	K_3
CO3	Analyze image transformation techniques like Fourier and Wavelet transforms	K_4
CO4	Implement segmentation, morphological operations, and edge detection algorithms	K_3
CO5	Evaluate image compression and restoration methods	K_5

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12**
[CO1]	3	2			1					1		1
[CO2]	3	2	2	2	2					1		2
[CO3]	3	3	2	3	2					2		2
[CO4]	3	3	3	2	3					2		2
[CO5]	2	3	2	3	2	1				2		2
Avg	**2.4**	**2.6**	**1.8**	**2**	**2**	**.2**				**1.6**		**1.8**

Detailed Syllabus:

Sr. No	Topic	Lecture Hours	Weightage(%)
1	**Introduction to Computer Graphics:** • Introduction of Coordinate representation and Pixel • Raster Scan & Random Scan systems • Video controller and raster scan display processor.	4	8
2	**Introduction to image processing:** • Fundamentals • Applications • Image processing system components • Image sensing and acquisition • Sampling and quantization • Neighbors of pixel adjacency connectivity • regions and boundaries • Distance measures.	6	12
3	**Image Enhancement:** • Frequency and Spatial Domain • Contrast Stretching • Histogram Equalization • Low pass and High pass filtering.	10	16
4	**Image Restoration:** • Noise models • mean, order—statistics • adaptive filters • Band reject, Band pass and notch filters	10	16
5	**Colour Image Processing:** • Colour models • Pseudo colour Image processing • Colour transformation and segmentation.	12	20
6	**Image Compression:** • Fundamentals • Models • Error free and lossy compression • Standards.	10	16
7	**Morphological Image Processing: Overview** • Boundary extraction • Region filtering • Connected component extraction • Convex hull • Thinning; Thickening; skeletons; pruning; Image segmentation.	8	12
	Total	**70**	**100**

Instructional Method and Pedagogy:

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lecture and laboratory which carries 10 marks in overall evaluation.
- One internal exam will be conducted as a part of internal theory evaluation.
- Assignments based on the course content will be given to the students for each unit and will be evaluated at regular interval evaluation.
- Surprise tests/Quizzes/Seminar/tutorial will be conducted having a share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

Learning Outcome:

On successful completion of the course, the student will:

- Be able to understand basic concepts image processing, image storage and types of transformations that can be applied to images.
- Be able to compare the domains and methods of image processing.
- Be able to check the correctness of algorithms using inductive proofs and loop invariants.
- Learn Image Restoration & Enhancement techniques, colour image processing.
- Be able to make proper use of image processing tools.
- Familiar with morphological image processing.

Text Book:

1. Digital Image Processing, Second Edition by Rafel C. Gonzalez and Richard E. Woods, Pearson Education

Reference books:

1. Digital Image Processing by Bhabatosh Chanda and Dwijesh Majumder, PHI
2. Fundamentals of Digital Image Processing by Anil K Jain, PHI
3. Digital Image Processing Using Matlab, Rafel C. Gonzalez and Richard E. Woods, Pearson Education

DATABASE MANAGEMENT SYSTEMS BTECE(702)

Unit – I	**Introduction to Databases and Transactions**
	What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management,
Unit- II	**Data Models**
	The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.
Unit-III	**Database Design ,ER-Diagram and Unified Modeling Language**
	Database design and ER Model:overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML **Relational database model:** Logical view of data, keys, integrity rules. Relational Database design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).
Unit- IV	**Relational Algebra and Calculus**
	Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.
Unit- V	**Constraints, Views and SQL**
	What is constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers.
Unit-VI	**Transaction management and Concurrency control**
	Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks),Time stamping methods, optimistic methods, database recovery management.

COURSE OUTCOMES		Bloom's Level
CO1	Describe the fundamental elements of relational data base management systems	K2
CO2	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL	K3
CO3	Design ER-model store present simple database application scenarios	K3
CO4	Convert the ER model to relational tables, populate relational database and formulate SQL queries on data .	K3
CO5	Improve the data base design by normalization.	K4

CO-PO Matrix												
Course Outcome	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	1			1							
CO2	2	2				2						
CO3		3	3		3							
CO4		3	3	3	3							
CO5		2	2		2							
Avg	**1.5**	**2.2**	**2.6**	**3**	**2.25**	**2**						

Books: A Silberschatz, H Korth, S Sudarshan, "*Database System and Concepts*", *fifth Edition* McGraw-Hill , Rob, Coronel, "*Database Systems*", *Seventh Edition*, Cengage Learning.

SEMESTER-VIII

FINANCIAL ENGINEERING – BT801

1 Objective: This course aims at providing the knowledge of financial market, risk attached, and financial derivatives on underlying asset

2. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	**Introduction**	Some basic definitions and terminology: Basic Notions and Assumptions, No-Arbitrage Principle, One-Step Binomial Model, Risk and Return, Forward and Futures Contracts, Call and Put Options, Managing Risk with Options.	**06**
2	**Risk-Free Assets**	Time Value of Money; Simple Interest, Periodic Compounding, Streams of Payments, Continuous Compounding, How to Compare Compounding Methods. Money Market; Zero-Coupon Bonds, Coupon Bonds, yield, Money Market Account.	**06**
3	**Risky Assets**	Dynamics of Stock Prices; Return, Expected Return. Binomial Tree Model; Risk-Neutral Probability, Martingale Property.	**06**
4	**Discrete Time Market Models**	Stock and Money Market Models; Investment Strategies, The Principle of No Arbitrage, Application to the Binomial Tree Model, Fundamental Theorem of Asset Pricing.	**06**
5	**Options: General Properties**	Definitions, Put-Call Parity, Bounds on Option Prices, Variables Determining Option Prices, Time Value of Options.	**06**
6	**Option Pricing and Financial Engineering**	European Options in the Binomial Tree Model, American Options in the Binomial Tree Model, Black–Scholes Formula. Hedging Option Positions, Hedging Business Risk, Speculating with Derivatives.	**09**
		Total	**39**

COURSE OUTCOMES		Bloom's Knowledge Level
CO1	Understand needs, functions, roles, scope, and evolution of Management.	K2
CO2	Understand importance, purpose of Planning, hierarchy of planning, and also analyze its types	K2, K4
CO3	Discuss Decision Making, Organizing, Staffing, Directing, and Controlling	K2, K3
CO4	Select the best economic model from various available alternatives	K3, K4
CO5	Understand various interest rate methods and implement the suitable one	K2, K3

CO-PO Matrix												
Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	2					3	2					
[CO2]		3		3								2
[CO3]			3						3	3		
[CO4]	2				3			2				
[CO5]				3		2	2					
Avg	**2**	**3**	**3**	**3**	**3**	**2.5**	**2**	2	3	**3**	**0**	**2**

Textbook:

1. M. Capinski and T. Zastawniak, Mathematics for Finance: An Introduction to Financial Engineering, 2nd Ed., Springer, 2010.

2. S. Shreve, Stochastic Calculus for Finance, Vol. I, Springer, 2004.

Reference books:

1. J. C. Hull, Options, Futures and Other Derivatives, 10th Ed., Pearson, 2018.
2. J. Cvitanic and F. Zapatero, Introduction to the Economics and Mathematics of Financial Markets, Prentice-Hall of India, 2007.
3. S. Roman, Introduction to the Mathematics of Finance: From Risk Management to Options Pricing, Springer, 2004.
4. D. G. Luenberger, Investment Science, 2nd Ed., Oxford University Press, 2013.
5. N. J. Cutland and A. Roux, Derivative Pricing in Discrete Time, Springer, 2012.

Biomedical Electronics (BTECE802X)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**

Course Prerequisite: An undergraduate level course on Signals and Systems, EDC.

Course Objective: This course introduces the students to the concept of biomedical electronics and instrumentation. To understand role of electronics in biology.

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

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	COURSE OUTCOMES	Bloom's Level
CO 1	Understand the working principles of biomedical sensors and transducers	K_2
CO 2	Analyze bioelectrical signals and interpret their physiological significance	K_4
CO 3	Design basic biomedical amplifier circuits for ECG, EMG, and EEG	K_6
CO 4	Evaluate safety standards and regulations in biomedical instrumentation	K_5
CO 5	Demonstrate the integration of biomedical devices in diagnostic systems	K_3

Level	Bachelor	
Course Content:		
Module -I	Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and biopotential amplifiers for ECG, EMG, EEG, etc.	10 hrs
Module-II	Measurement of blood temperature, pressure and flow. Impedanceple thysmography. Ultrasonic, X-ray and nuclear imaging; Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped, Safety aspects.	12 hrs
Module-III	Preamplifier, Signal conditioning: Differential amplifier, current to voltage converter, instrumentation amplifier; biomedical filters: LPF, HPF, bandpass, band stop (Notch filter); source of noise in low level measurement, Recording systems for ECG, PCG, EEG and EMG	12 hrs

Module-IV	EEG Instrumentation requirements: EEG electrode, frequency bands, recording systems; EMG basic principle: block diagram of a recorder, Bed side monitor, block diagram- measuring parameters, cardiac tachometer, X-ray imaging, ultrasonic imaging systems, Magnetic resonance imaging system.	12 hrs
Internal assessment		
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	ESE: Term Exam	70 Marks

Text/Reference Books:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

CO-PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2										1
[CO2]	3	3		2	1							1
[CO3]	3	2	3	2	3						1	1
[CO4]	2					3	2	3				1
[CO5]	3	2	2		3				2	2	1	2
Avg	**2.8**	**1.8**	**1**	**.8**	**1**	**.6**	**.4**	**.6**	**.4**	**.4**	**.4**	**1.2**

Nano electronics-BTECE8031 (Elective-IV)

Teaching Scheme	Examination Scheme	Credits allocated
Theory 45hr	**End of semester Examination-70 marks**	**Theory-3**

Course Prerequisite: An undergraduate level course on Physics and Basic Electronics.

Course Objective:

1. To introduce the students to the concept of Nano electronics, Nano devices, spintronicsand molecular electronics.
2. To identify quantum mechanics behind Nano electronics.
3. To describe the principle and the operation of Nano electronic devices.

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

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COURSE OUTCOMES		Bloom's Level
[CO1]	Explain the principles of quantum mechanics relevant to nanoelectronic devices	,K2
[CO2]	Describe the structure and operation of MOSFETs, FinFETs, and other nanoscale devices	K1,K2,
[CO3]	Analyze electrical characteristics of nanoscale devices using quantum models	K4,
[CO4]	Evaluate performance limitations and scaling issues in nanoelectronics	K5
[CO5]	Design and simulate simple nanoelectronic circuits using EDA tools	K6

Level	Bachelor	
Course Content:		
Module -I	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	10 hrs
Module-II		12 hrs
	Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets,Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).	
Module-III	Electrons in low-dimensional structure: Electrons in	12 hrs.

	quantum wells, Electrons in quantum wires, Electrons in quantum dots; Fabrication of nanostructures: Crystal growth, Nanolithography, Nanotube growth, Characterization of nanostructures.	
Module-IV	Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.	12 hrs.

Internal assessment		
Part A	CIA-I: Module I, and II	20 Marks
	CIA-II: Module III, and IV	10 Marks
Part B	ESE: Term Exam	70 Marks

Text/Reference Books:

1. Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications, Vladimir V. Mitin, Viatcheslav A. Kochelap and Michael A. Stroscio
2. Fundamentals of Nanoelectronics, Pearson India; 1st edition (1 January 2009) George W. Hanson.

CO PO Matrix

Course Outcome	**[PO.1]**	**[PO.2]**	**[PO.3]**	**[PO.4]**	**[PO.5]**	**[PO.6]**	**[PO.7]**	**[PO.8]**	**[PO.9]**	**[PO.10]**	**[PO.11]**	**[PO.12]**
[CO1]	3	2										1
[CO2]	3	2										1
[CO3]	3	3		2	2							1
[CO4]	2	3		3	1	2						2
[CO5]	2	2	3	2	3				2	1	1	2
Avg	**2.6**	**3**	**.6**	**1.4**	**1.2**	**.4**			**.4**	**.2**	**.2**	**1.4**