I B. Tech I Semester Course structure for the Academic Year 2018-2019

Common for ECE/CSE/IT

S. No.	Subject Code	Subject title	L	T	P	C
1	18CMMAT1010	Engineering Mathematics-I	3	1	0	4
2	18ECPHT1020, 18CSPHT1020, 18ITPHT1020	Engineering Physics	3	1	0	4
3	18CMCST1030	Programming for problem solving	3	0	0	3
4	18CMMEL1040	Engineering Graphics	1	0	4	3
5	18ECPHL1050, 18CSPHL1050, 18ITPHL1050	Engineering Physics Lab	0	0	3	1.5
6	18CMCSL1060	Programming for problem solving lab	0	0	4	2
7	18CMMEL1070	Work Shop/ Manufacturing practice	0	0	3	1.5
8	18CMCHN1080	Environmental Science (Non - Credit course)	3	0	0	0
					Total Credits	**19**

I B. Tech II Semester Course structure for the

Academic Year 2018-2019

Common for ECE/CSE/IT

S. No.	Subject Code	Subject title	L	T	P	C
1	18CMEGT2010	Technical English	3	0	0	3
2	18CMMAT2020	Engineering Mathematics II	3	1	0	4
3	18CMCHT2030	Engineering Chemistry	3	1	0	4
4	18CMEET2040	Basic Electrical Engineering	3	1	0	4
5	18CMEGL2050	English Communication skills lab	0	0	2	1
6	18CMCHL2060	Engineering Chemistry Lab	0	0	3	1.5
7	18CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
8	18CMMSN2080	Constitution of India, professional ethics & human rights (Non - Credit course)	3	0	0	0
Total Credits						**19**

ENGINEERING MATHEMATICS-I SEMESTER - I			
Subject Code	18CMMAT1010	Internal Marks	30
Number of Lecture Hours/Week	3+ 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
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:

1. To solve first order differential equations.
2. To solve linear differential equations with constant coefficients.
3. To find the extrema of a function.
4. To solve partial differential equations
5. To evaluate multiple integrals
6. To verify vector integral theorems

Unit -1	
First order and first degree Ordinary Differential Equations Exact, reducible to exact, linear and Bernoulli's differential equations. Orthogonal trajectories in Cartesian and polar form. Simple problems on Newton's law of cooling. Law of natural growth and decay.	**Hours – 10**
Unit -2	
Linear differential equations with constant coefficients: Solutions of second and higher order differential equations - inverse differential operator methods, Method of variation of parameters. Application: LCR Circuits	**Hours – 8**
Unit – 3	
Partial derivatives – Definition and Euler's theorem (without proof), total derivatives, partial differentiation of composite functions. Jacobian - Functional dependence. Taylor's and Maclaurin's theorems for	**Hours – 10**

function of two variables (statement only). Maxima and minima- Lagranges method of undetermined multipliers	
Unit – 4	
First order Partial differential equations: Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and non linear (standard type) equations **Higher order Partial differential equations:** Solutions of Homogeneous and Non Homogeneous partial differential equations with constant coefficients – Classification of partial differential equations.	**Hours – 10**
Unit – 5	
Double and triple integrals: Evaluation of double and triple integrals. Evaluation of double integrals by changing the order of integration and by changing into polar co-ordinates. Beta and gamma functions and their properties **Vector Calculus** – Gradient – Divergence - Curl - Line integrals-definition and problems, surface and volume integrals definition, Green's theorem in a plane, Stokes and Gauss-divergence theorems (without proof) and problems.	**Hours – 12**
Course outcomes: On completion of this course, students are able to 1. Solve first order differential equations. 2. Solve linear differential equations with constant coefficients. 3. Find the extrema of a function. 4. Solve partial differential equations 5. Evaluate multiple integrals 6. Verify vector integral theorems	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question carrying 1 mark each. 2. Two questions from each unit should present.	

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 44th edition, 2016.
2. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 9th edition, 2013.

Reference Books:

1. B.V. Ramana, **"Higher Engineering M athematics"**, 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. RajnishVerma, **"Higher Engineerig Mathematics"**, S.Chand publishing, 1st edition, 2011.

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-

ENGINEERING PHYSICS (Introduction to Electromagnetic Theory) SEMESTER - I			
Subject Code	18ECPHT1020	Internal Marks	30
Number of Lecture Hours/Week	3+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 4			

Course objectives:

The objectives of this course, help the students:

- To impart the knowledge of Electrostatics and Magneto statics in vacuum and in dielectric medium.
- To impart the knowledge of Maxwell's equations to understanding the propagation of EM waves.

Unit -1	
Electrostatics in vacuum: Calculation of electric field and electrostatic potential for a charge distributions; Divergence and curl of electrostatic field; Energy of a charge distribution and its expression in terms of electric field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution, Method of images; Boundary conditions of electric field and electrostatic potential.	**Hours – 11**
Unit -2	
Electrostatics in a linear dielectric medium: Electrostatic field and potential of a dipole, Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the center of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.	**Hours – 9**
Unit – 3	
Magnetostatics: Biot- Savart's law, Magnetic field on the	**Hours**

axis of a current loop, Magnetic field induction due to a solenoid, Divergence and curl of static magnetic field; Vector potential and calculating it for a given magnetic field using Stokes' theorem; Equation for the vector potential and its solution for given current densities. Ampere's circuital law, Amperian loop, Differential form of Ampere's circuital law, Motion of charged particle in electrical field and in magnetic field, Hall effect.	**–11**
Unit – 4	
Faraday's law: Faraday's law in terms of EMF produced by changing magnetic flux; Equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; Energy stored in a magnetic field. **Displacement current, Magnetic field due to time-dependent electric field** Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; Displace current and magnetic field arising from time dependent electric field; Calculating magnetic field due to changing electric fields in quasi static approximation.	**Hours – 10**
Unit – 5	
Maxwell's equations: Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples, Qualitative discussion of momentum in electromagnetic fields. **Electromagnetic waves:** The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; Relation between electric and magnetic fields of an electromagnetic wave; Energy carried by electromagnetic waves and examples, Momentum carried	**Hours – 9**

by electromagnetic waves and resultant pressure, Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.	

COURSE OUTCOMES:

On completion of the course student will able to

1. Calculate the electric field intensity and electrostatic potential for a charge distribution.
2. Solve the electrostatics problems in presence of dielectrics.
3. Calculate the magnetic field induction using the Biot-Savart's law.
4. Calculate the magnetic fields due to time varying electrical fields.
5. Derive the relation between electrical field intensity and time varying magnetic fields.
6. Apply Maxwell's equations to understanding the propagation of EM wave in vacuum and non-conducting medium.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one sentence answer questions, each carrying 1 mark.
2. Two questions from each unit should be designed.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each question carries 12 marks.

Each full question comprises sub questions covering all topics under a unit.

TEXT BOOKS:

1. Saroj K. Dash, Smaruti R. Khuntia, Fundamentals of Electromagnetic theory.
2. David Griffiths, Introduction to Electrodynamics.

REFERENCE BOOKS:

1. Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning.
2. W. Saslow, Electricity, magnetism and light.
3. S.L Gupta& D.L. Gupta, Unified physics.

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	1	3	-	-	-	-	-	-	-	-	-	-	-
3	3	2	1	3	-	-	-	-	-	-	-	-	-	-	-
4	3	2	1	3	-	-	-	-	-	-	-	-	-	-	-
5	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
6	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
Course	3	2	3	1	-	-	-	-	-	-	-	-	-	-	-

PROGRAMMING FOR PROBLEM SOLVING SEMESTER - I			
Subject Code:	18CMCST1030	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Unit-I: Introduction to computer systems and programming	**Teaching Hours**
History & Hardware: Computer Hardware, components, Types of Software, Memory units. **Introduction to Problem solving:** Algorithm, characteristics of Algorithms, Basic operations of algorithms, Pseudocode, Flowchart, Types of languages, Relation between Data, Information, Input and Output. **Basics of C:** History and Features of C, Importance of C, Procedural Language, Compiler versus Interpreter, Structure of C Program, Program development steps, programming errors.	**Hours- 08**
Unit-II: C Expressions, evaluation and control statements	
Overview of C: Character Set, C-Tokens, Data Types, Variables, Constants, Operators, Operator precedence and Associativity, converting mathematical expressions to C-expressions, evaluation of C-expressions, Input/output functions. **Conditional Branching:** if statement, if...else statement, Nested if...else statement, if…else…if ladder, switch statement. **Unconditional Branching:** goto. **Control flow statements:** break, continue. **Looping Constructs:** do-while statement, while statement, for statement.	**Hours- 12**
Unit-III: Arrays and Functions	

Arrays: Introduction, 1-D Arrays, Character arrays and string representation, 2-D Arrays (Matrix), Multi-Dimensional Arrays. **Functions**: Basics, necessity and advantages, Types of functions, Parameter passing mechanisms, Recursion, Storage Classes, Command Line Arguments, Conversion from Recursion to Iteration and vice-versa. **Strings:** Working with strings, String Handling Functions (both library and user defined).	**Hours -10**
Unit-IV: Derived and User Defined Data types	
Pointers: Understanding Pointers, Pointer expressions, Pointer and Arrays, Pointers and Strings, Pointers to Functions. **Dynamic Memory Allocation:** Introduction to Dynamic Memory Allocation malloc, calloc, realloc, free. **Structures and Unions:** Defining a Structure, typedef, Advantage of Structure, Nested structures, Arrays of Structures, Structures and Arrays, Structures and Functions, Structures and Pointers, Defining Unions, Union within union, Structure within union, Union within structure, self-referential structures, bitfields, enumerations.	**Hours -12**
Unit-V: Preprocessing and File Handling	
Preprocessing Directives: Macro Substitution, File Inclusion, conditional compilation and other directives **File Management in C:** Introduction to File Management, Modes and Operations on Files, Types of files, Error Handling During I/O Operations.	**Hours -08**
Text Books: 1. Computer Programing ANSI C, E Balagurusamy, Mc Graw Hill Education(Private), Limited (TB1) 2. Programming in C, Reema Thareja, Second Edition, Oxford Higher Education (TB2) **Reference Books:** 1. Computer Basics and C Programming, V Raja Raman, Second Edition, PHI (RB1)	

Course Outcomes:

Student can able to

1) formulate algorithms, translate them into programs and correct program errors.
2) choose right control structures suitable for the problem to be solved.
3) decompose reusable code in a program into functions.
4) make use of arrays, pointers, structures and unions effectively.
5) store and retrieve data from permanent storage.
6) learn file operations

Question paper pattern:

Section A:

1. This section contains ten
2. one or two-line answer question carrying 1 mark each.
3. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	3	1	-	3	-	-	-	-	-	-	-	-	-
2	2	3	3	-	1	-	-	-	-	-	-	-	-	-
3	3	2	3	-	1	-	-	-	-	-	-	-	-	-
4	2	2	3	-	1	-	-	-	-	-	-	-	-	-
5	2	2	2	-	-	-	-	-	-	-	-	-	-	-
6	2	2	2	-	1	-	-	-	-	-	-	-	-	-
Cour se	2	2	3	-	2	-	-	-	-	-	-	-	-	-

ENGINEERING GRAPHICS SEMESTER - I			
Subject Code	18CMMEL1040	Internal Marks	30
Number of Lecture Hours/Week	1(L)+04(P)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES:

1. Students should be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students should be able to read, interpret and construct plain scales, diagonal scales and vernier scales
3. Student should be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students are should be able to apply various concepts to solve practical problems related to engineering.
4. Student should be able to draw sections and sectional views of Solids
5. Student should be able to draw isometric view of lines, plane figures and simple solids. Student should be able to convert given isometric views into orthographic views. Students should be able to apply various concepts to solve practical problems related to engineering
6. Student should be able to draw objects using draw and modify toolbars of AutoCAD

Unit -1	
Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections – Ellipse, Parabola, Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;	**Hours– 10**

Unit -2	
Projections of Points and lines inclined to both planes; Projections of planes inclined to one plane	**Hours– 08**
Unit – 3	
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes	**Hours– 10**
Unit – 4	
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone	**Hours– 10**
Unit – 5	
Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions **Introduction to AUTOCAD**-The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows	**Hours– 12**

COURSE OUTCOMES:

1. Students will be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students will be able to read, interpret and construct plain scales, diagonal scales and vernier scales
3. Student will be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students will be able to apply various concepts to solve practical problems related to engineering.
4. Student will be able to draw sections and sectional views of Solids
5. Student will be able to draw isometric view of lines, plane figures and simple solids. Student will be able to convert given isometric views into orthographic views. Students will be able to apply various concepts to solve practical problems related to

engineering
6. Student will be able to draw objects using draw and modify toolbars of AutoCAD

QUESTION PAPER PATTERN:

SECTION A: (14M)

1. This section contains four questions carrying different weightage.

SECTION B: (4x14=56M)

1. This section will have 5 questions with internal choice.
2. Each full question carries 14 marks.
3. Each full question will have sub question covering all topics under a unit.

Text/Reference Books:

1. Engineering Drawing by N.D. Bhatt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers
3. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
4. Engineering Graphics for Degree by K.C. John, PHI Publishers

Course outcomes to Program outcomes mapping:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	2	_	3	_	_	_	_	_	_	3	_	2	_	_	_
2	2	_	3	_	_	_	_	_	_	3	_	2	_	_	_
3	2	_	3	_	_	_	_	_	_	3	_	2	_	_	_
4	2	_	3	_	_	_	_	_	_	3	_	2	_	_	_
5	2	_	3	_	_	_	_	_	_	3	_	2	_	2	_
6	2	_	3	_	_	_	_	_	_	3	_	2	_	2	_
Over all	2	-	3	-	-	-	-	-	-	3	-	2	-	2	-

ENGINEERING PHYSICS LABORATORY SEMESTER - I			
Subject Code	18ECPHL1050	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

The objectives of this course, help the students

- To apply the theoretical knowledge of Physics through hands on the experimental instruments
- To improve the experimental knowledge in the later studies
- To understand the basic need of experiments.
- To know how to measure the different physical quantities.
- To gain the knowledge about different electrical components and basic electrical circuits.

List of Experiments

1. To determine the static potentials and the accompanying electric field intensities of different diameters of electrically charged conducting sphere.
2. To determine the strength of the uniform electric field produced between the charged plates of a plate capacitor.
3. To determine the dielectric constant of a medium (plastic or glass) filling between the plates of the capacitor of a plate capacitor.
4. To measure the magnetic field induction of circular coil-Stewart-Gee's experiment.
5. To measure the spatial distribution of the field strength between a pair of coils in the Helmholtz arrangement.
6. To investigated the relation between magnetic field strength and coils of different dimensions using Hall probe (Tesla meter).
7. To determine Self Inductance of a Coil by Anderson's Bridge using AC.

8. To study the motion of charged particle in electric and magnetic fields and determine the value of e/m by magnetic focusing.
9. To determine Hall coefficient and estimate the concentration of charge carriers using Hall Effect.
10. To study the interaction of EM waves with matter and determine value of Planck's constant using LEDs of at least 4 different colors.

COURSE OUTCOMES:

On completion of the course student will able to

1. Determine the electrostatic field and static potentials.
2. Apply the Biot- Savart's law in case of circular coils.
3. Determine the self inductance of a coil.
4. Measure e/m value of a charged particle in electrical and magnetic fields.
5. Determine the Hall coefficient using the phenomenon of Hall Effect.
6. Understand the particle behavior of EM wave when it interacts with matter.

Course Outcomes to Program Outcomes Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
1	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-
2	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-
3	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-
4	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-
5	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-
6	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-
Course	3	1	-	3	-	-	-	-	-	-	-	-	-	-	-

PROGRAMMING FOR PROBLEM SOLVING LAB SEMESTER - I			
Subject Code	18CMCSL1060	Internal Marks	50
Number of Practice Hours/Week	04	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits - 02			

Objectives:

- To apply programming for basic mathematical functions
- To design and program mathematical concepts.
- To create and use the functions and library functions
- Able to apply the theoretical knowledge of formatting of documents
- To create and apply user defined types to the real world problems.
- To create files and shapes of the concepts.

List of Experiments

Exercise 1 (Familiarization with programming environment)

a) Familiarization of CODE BLOCKS C++ Editor to edit, compile, execute, test and debugging C programs.
b) Familiarization of RAPTOR Tool to draw flow charts and understand flow of control.
c) Acquittance with basic LINUX commands.

Exercise 2 (Simple computational problems using arithmetic expressions)

a) Write a C Program to display real number with 2 decimal places.
b) Write a C Program to convert Celsius to Fahrenheit and vice versa.
c) Write a C Program to calculate the area of triangle using the formula

$$\text{area} = \sqrt{s(s-a)(s-b)(s-c)} \text{ where } s = \frac{a+b+c}{2}$$

d) Write a C program to find the largest of three numbers using ternary operator.
e) Write a C Program to swap two numbers without using a

temporary variable.

Exercise 3 (Problems involving if-then-else structures)

a) Write a C Program to check whether a given number is even or odd using bitwise operator, shift operator and arithmetic operator.
b) Write a C program to find the roots of a quadratic equation.
c) Write a C Program to display grade based on 6 subject marks using if…else…if ladder.
d) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then
e) prints the result using switch control statement. (Consider the operators +, -, *, /, %)

Exercise 4 (Iterative problems)

a) Write a C Program to count number of 0's and 1's in a binary representation of a given number.
b) Write a C program to generate all the prime numbers between two numbers supplied by the user.
c) Write a C Program to print the multiplication table corresponding to number supplied as input.

Exercise 5 (Iterative problems)

a) Write a C Program to Find Whether the Given Number is
i) Armstrong Number ii) Palindrome Number
b) Write a C Program to print sum of digits of a given number

Exercise 6 (Series examples)

a) Write a C Program to calculate sum of following series
b) 1+2+3+…. N b)1+1/2+1/3+……+1/n c)$1+x+x^2+x^3……+x^n$

Exercise 7 (1D Array manipulation)

a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to search an element in an array (linear search).
c) Write a C Program to print the following pattern using a character array

S
SA
SA
S
SASI

Exercise 8 (Matrix problems, String operations)

a) Write a C program to add two matrices.
b) Write a C program to multiply two matrices if they are compatible or print an error message "incompatible matrix sizes" otherwise.
c) Write a C program to check given matrix is symmetric or not.
d) Implement the following string operations with and without library functions.
i) copy ii) concatenate iii) length iv) compare

Exercise 9 (Simple functions)

a) Write a C Program demonstrating the following function types
i. With arguments and with return value.
ii. With arguments and without return value
iii. Without arguments and without return value.
iv. Without arguments and with return value.
b) Write a C Program illustrating call by reference

Exercise 10 (Recursive functions)

Write a C Program illustrating the following with Recursion without Recursion

a) Factorial b) GCD c) Power d) Fibonacci

Exercise 11(Pointers and structures)

a) Write a C program to find sum of n elements entered by user. To perform this program,
allocate memory dynamically using malloc () function.
b) Write a C program to find sum of n elements entered by user. To perform this program,
allocate memory dynamically using calloc () function.
Note: Understand the difference between the above two programs.
c) Write a C Program to read and print student details using structures.

Exercise 12 (File operations)

a) Write a C program to open a file and to print it contents on screen.
b) Write a C program to copy files

c) Write a C program merges two files onto a new file.
d) Write a C program to delete a file.

COURSE OUTCOMES:

1. Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems.
2. Examine and analyze alternative solutions to a problem.
3. Design an algorithmic solution to a problem using problem decomposition and step-wise refinement.
4. Demonstrate conversion of iterative functions to recursive and vice-versa.
5. Implement the concepts of arrays.
6. Implement the structures, Unions and files.

Course outcomes to Program outcomes mapping:

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	3	3	3	-	3	-	-	-	-	-	-	-	-	-
2	2	3	3	-	2	-	-	-	-	-	-	-	-	-
3	2	3	3	-	2	-	-	-	-	-	-	-	-	-
4	2	3	3	-	2	-	-	-	-	-	-	-	-	-
5	2	3	3	-	2	-	-	-	-	-	-	-	-	-
6	2	3	3	-	2	-	-	-	-	-	-	-	-	-
Cou rse	2	3	3	-	2	-	-	-	-	-	-	-	-	-

WORKSHOP/MANUFACTURING PRACTICE SEMESTER - I			
Subject Code	18CMMEL1070	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

1. Students should be able to learn the basic manufacturing processes, study the various tools and equipment used and gain hands-on experience in different trades.
2. Students should be able to learn the engineering and technology involved in carpentry, fitting, black smithy, foundry, welding, machining and plastic moulding.
3. Students should understand the workmanship required, working of machinery or equipment necessary.

i. Lectures & videos: (10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical & Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

ii. Workshop Practice:

Sl. NO.	Name of Shop floor	Exercises
1.	Blacksmithy	1. S-Hook
		2. Square Rod To Round Rod
2.	Carpentry	1. T-Lap Joint
		2. Cross Lap Joint
3.	Foundry	1. Mould for a Solid
		2. Mould for a Split Pattern.

4.	Fitting	1. Square Fitting
		2. V-Fitting
5.	Welding	1. Butt Joint
		2. Lap Joint
6.	Machine Tools	1. Turning
		2. Knurling
7.	Plastic Moulding	1. Key chain

COURSE OUTCOMES:

1. Students will be able to make use of basic carpentry joints to make furniture.
2. Students will be able to fabricate mechanical engineering assemblies using fitting joints.
3. Students will be able to produce various machine components by using foundry, black smithy, machining and plastic moulding techniques.

Course outcomes to Program outcomes mapping:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	-	-	-	1	-	-	-	1	-	-	-	-	-	-
Course	3	-	-	-	1	-	-	-	1	-	-	-	-	-	-

ENVIRONMENTAL SCIENCE SEMESTER - I			
Subject Code	18CMCHN1080	Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 00			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Know the importance of Environmental studies and the measures to be taken to overcome global environmental challenges.
2. Understand the concept of ecosystem and its diversity.
3. Gain knowledge on natural resources.
4. Understand the concept of biodiversity.
5. Gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

Unit -1	
MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES **Environment -** Definition, Introduction - Scope and Importance - Global environmental challenges, global warming & climate change - Acid rains, ozone layer depletion - Carbon credits - Sustainability, Stockholm & Rio Summit - Population growth & explosion - Role of Information Technology in Environment and human health. **Ecosystem** - Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the different	**Hours – 10**

ecosystems	
Unit -2	
NATURAL RESOURCES Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation - Timber extraction – Mining, dams and other effects on forest and tribal people Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	**Hours – 12**
Unit – 3	
BIODIVERSITY AND ITS CONSERVATION Introduction - Definition: genetic, species and ecosystem diversity. – Biogeographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss - Endangered and endemic species of India – Conservation of biodiversity: In-situ	**Hours – 6**

and Ex-situ conservation of biodiversity.	
Unit – 4	
ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of : a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution. - Pollution case studies.	**Hours – 12**
Unit – 5	
SOCIAL ISSUES AND THE ENVIRONMENT Urban problems related to energy -Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people its problems and concerns. Environment Protection Act - Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness. **Field work:** Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. -Study of simple ecosystems - pond, river, hill slopes, etc.	**Hours – 10**

COURSE OUTCOMES:

On completion of the course student will be

1. Able to know the importance of Environmental studies and the measures to be taken to overcome global environmental challenges.
2. Able to understand the concept of ecosystem and its diversity.
3. Able to gain knowledge on natural resources.
4. Able to understand the concept of biodiversity.
5. Able to gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer question carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

1. E. Bharucha (2003), “Environmental Studies”, University Publishing Company, New Delhi.
2. J.G. Henry and G.W. Heinke (2004), “Environmental Science and Engineering”, Second Edition, Prentice Hall of India, New Delhi
3. G.M. Masters (2004)” Introduction to Environmental Engineering and Science”, Second Edition, Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS Publishers, Vijayawada.

3. Environmental Studies, P.N. Paliniswamy, P. Manikandan, A. Geeta and K. Manjula Rani, Pearson Education, Chennai.

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	**3**	-	-	-	-	-	-	-	-
2	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-
4	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-
6	-	**3**		-	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**3**	**3**	-	-	-	**3**	-	-	-	-	-	-	-	-

TECHNICAL ENGLISH SEMESTER - II			
Subject Code	18CMEGT2010	Internal Marks	30
Number of Lecture Hours/ Week	03	External Marks	70
Total Number of Lecture Hours	50	Exams Hours	03
Credits -03			

Course Objectives:

To enable the students to learn and apply fundamental principles in Technical English & Communication by focusing on:

1. Technical English Vocabulary
2. Writing Skills
3. Common Errors in Writing
4. Nature and Style of Sensible Technical Writing
5. Writing Technical Reports and Letters
6. Providing an inspiring reading experience from the biography of a renowned technocrat.

Unit I	
Principles of Scientific Vocabulary ● **Principles of Scientific vocabulary**: short and simple words-compact substitutes for wordy phrases-redundant words and expressions-Avoid hackneyed and stilted phrases, verbosity and incorrect use of words ● The role of roots in word building,prefixes and suffixes, confusing words and expressions. Non-detailed text-Karmayogi: 1-4 chapters, Page No 1-53	10 hours

Unit II	
Writing Skills ● Distinguishing between academic and personal styles of writing ● Use of clauses in technical phrases and sentences ● Techniques of Sentence and paragraph writing	10 hours

● Measuring the clarity of a text through Fog Index or Clarity Index Non-detailed text- Karmayogi: 5-8 chapters, Page No 54-100	
Unit III	
Common Errors in Writing ● Subject-verb agreement and concord of nouns, pronouns and possessive adjectives ● Common errors in the use of articles, prepositions, adjectives and adverbs ● Punctuation ● Technical Guidelines for Communication ● **Avoiding the pitfalls** Non-detailed text-Karmayogi: 9-12 chapters, Page No101-151	10 hours
Unit IV	
Nature and Style of Sensible Technical Writing ● Academic Writing Process ● Describing, processes and products ● Defining, Classifying ● Effective use of charts, graphs, and tables Non-detailed text- Karmayogi: 13-16 chapters, Page No 152-203	10 hours
Unit V	
Report writing and Letter writing ● Writing Technical Reports ● Précis writing ● Letter Writing ● Essay writing Non-detailed text- Karmayogi: 13-16 chapters, Page No 204-250	10 Hours
COURSE OUTCOMES On Completion of the course student will acquire 1. Ability to understand Scientific vocabulary and use them	

confidently
2. Familiarity with the basic principles of writing clear sentences and paragraphs
3. Ability to write error free simple technical passages
4. Knowledge of writing different writing styles
5. Confidence to write letters and technical reports clearly and coherently
6. Get inspired by achievements and values upheld by a renowned technocrat.

Question Paper Pattern

Section –A

1. 10 questions carrying one mark each
2. Five questions each from Units I and III

Section –B

1. 5 questions carrying 12 marks each (one compulsory question from non-detailed text)
2. Each question will have two or three sub questions covering all the units

Text Books

1. Effective Technical Communication by Barun K Mitra, Oxford University Publication

Non-detailed Text

1. Karmayogi: A Biography of E Sreedharan by M S Ashokan

Reference Books

1. *Communication Skills* by Sanjay Kumar &PushpaLatha, OUP
2. Study Writing by Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.
3. Remedial English Grammar by F T Wood, Macmillian 2007
4. *Practical English Usage* by Michael SwanOxford University Press
5. *English Collocations in Use* by Michael McCarthy & Felicity O'Dell
6. *Effective Technical Communication* by Arsahf Rizvi,
7. *Essential English Grammar by Raymond Murphy, CUP, 2017*

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-

ENGINEERING MATHEMATICS-II SEMESTER - II			
Subject Code	18CMMAT2020	Internal Marks	30
Number of Lecture Hours/Week	3(L)+ 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course objectives:

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

- To solve system of linear equations
- To find eigen values and eigen vectors of a matrix
- To solve initial value problems by using Laplace transforms
- To find the solution of algebraic/ transcendental equations and also interpolate the functions.
- To evaluate numerical integration and to solve ordinary differential equations by using numerical methods.
- To find Fourier series of a periodic function and to determine the Fourier transform of a function

Unit -1	
Linear Algebra: Rank of a matrix by elementary transformations, solution of system of linear equations - Gauss-elimination method, Gauss-Jordan method – Jacobi method and Gauss-Seidel method – Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors - Linear transformation, Diagonalisation of a square matrix. Cayley-Hamilton theorem (without proof) - Reduction of Quadratic form to Canonical form.	**10 Hours**

Unit -2	
Laplace Transforms: Laplace transforms of standard functions-Shifting theorems - Transforms of derivatives and integrals – Unit step function –Dirac's delta function Inverse Laplace transforms– Convolution theorem (without proof).	**10 Hours**

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms	
Unit – 3	
Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method. Finite differences: Error functions – Forward, backward and central differences, Newton's forward and backward interpolation formulae. Gauss`s forward and backward interpolation formulae - Lagrange's interpolation formula (all formulae without proof)	**10 Hours**
Unit – 4	
Numerical integration: Trapezoidal rule - Simpson's (1/3)rd and (3/8)th rules. Numerical solutions of ordinary differential equations-Taylors series method-Picard's method-Eulers method-Modified Eulers method-Runge-Kutta methods	**8 Hours**
Unit – 5	
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period. Fourier series of even and odd functions, Half range Fourier Series. **Fourier Transforms**: Infinite Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms.	**12 Hours**
Course outcomes: On completion of this course, students are able to, 1. Solve system of linear equations 2. Find eigen values and eigen vectors of a matrix 3. Solve initial value problems by using Laplace transforms 4. Find the solution of algebraic/ transcendental equations and also interpolate the functions. 5. Evaluate numerical integration and to solve ordinary differential equations by using numerical methods. 6. Find Fourier series of a periodic function and to determine the Fourier transform of a function	

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 44th Edition, 2016.
2. Kreyszig, "Advanced Engineering Mathematics " - Wiley, 9th Edition, 2013.

Reference Books:

1. B.V.Ramana "Higher Engineering M athematics" Tata Mc Graw-Hill, 2006
2. N P Bali and Manish Goyal, "A text book of Engineering mathematics", Laxmi publications, 7th edition.
3. H. K Dass and Er. Rajnish Verma ,"Higher Engineerig Mathematics", S. Chand publishing,1st edition, 2011.
4. Dr.K.V.Nageswara Reddy and Dr.B.Rama Bhupal Reddy, “Engineering Mathematics, Volume II” Scitech Publications, 2017.

course outcomes to program outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	-	-	-	-	-	-	-	-	-	-
2	2	3	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-

ENGINEERING CHEMISTRY SEMESTER - II			
Subject Code	18CMCHT2030	Internal Marks	30
Number of Lecture Hours/Week	3(L) + 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Rationalize periodic properties like ionization potential, electronegativity and oxidation states.
2. Apply the concepts of electrochemistry.
3. Analyze bulk properties and processes using thermodynamic considerations.
4. List major chemical reactions that are used in the synthesis of molecules.
5. Understand the concepts of atomic and molecular orbitals.
6. Know various spectroscopic techniques.

Unit -1	
PERIODIC PROPERTIES Effective nuclear charge of fluorine and magnesium, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, oxidation states, coordination numbers 2 & 3 and geometries, hard soft acids and bases.	**Hours – 10**
Unit -2	
USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA **Thermodynamic functions:** State and Path functions, First and second laws of thermodynamics, Gibbs	**Hours – 10**

Helmholtz Equation, concept of entropy and enthalpy. **Electro chemistry:** Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes, Nernst equation and applications. **Water chemistry:** Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, break point chlorination. **Corrosion:** Wet chemical theory, control methods – proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection.	
Unit – 3	
STEREOCHEMISTRY Principles of stereochemistry, representations of 3 dimensional structures of organic compounds, geometrical and stereoisomers, configuration and symmetry, enantiomers. **ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE** Introduction to reactions involving Substitution – SN^1 & SN^2 with mechanism, Addition – Free radical, Elimination – E1 & E2 with examples (mechanism is not involved), Synthesis of aspirin drug molecule.	**Hours – 10**
Unit – 4	
ATOMIC, MOLECULAR STRUCTURE AND ADVANCED MATERIALS Schrodinger equation. Particle in a box solution and their applications for conjugated molecules. **Nanoparticles**: Introduction, preparation methods – Sol-gel method, Chemical reduction method – properties and applications. **Surface properties:** Determination of surface tension and viscosity of liquids. **Ceramics:** Classification, examples and applications. Crystal field theory and the energy level diagrams for transition metal ions.	**Hours – 10**

Unit – 5	
SPECTROSCOPIC TECHNIQUES Regions of electromagnetic spectrum - Principles of vibrational and rotational spectroscopy. Vibrational and rotational spectroscopy of diatomic molecules: Rigid diatomic molecules - selection rule - simple Harmonic Oscillator - diatomic vibrating rotator. Nuclear magnetic resonance – Principle and Instrumentation. Principles of chromatography – TLC & Paper.	**Hours – 10**

COURSE OUTCOMES:

On completion of the course student will be

1. Able to rationalise periodic properties like ionization potential, electro negativity and oxidation states.
2. Able to know the nature and working of various electrodes.
3. Able to analyze bulk properties and processes using thermodynamic considerations.
4. Able to synthesize organic molecules using different types of chemical reactions.
5. Able to understand the concepts of atomic and molecular orbitals.
6. Able to gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer questions carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

1. Stereochemistry of Carbon Compounds by Ernest Eliel; McGraw Hill Education.
2. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
3. Concise Inorganic Chemistry, J.D.Lee, 5th Edition; Wiley India.
4. Engineering Chemistry – Fundamentals and applications by Shikha Agarwal; Cambridge University Press
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp
6. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publishing Company

REFERENCE BOOKS:

1. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan.
2. Physical Chemistry, by P. W. Atkins.
3. Physical Chemistry, by Glasstone, S
4. Advanced inorganic chemistry by Wilkinson G and Cotton FA

Course outcomes to Program outcomes mapping:

CO	PO1	PO2	PO3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

BASIC ELECTRICAL ENGINEERING SEMESTER - II			
Subject Code	18CMEET2040	Internal Marks	30
Number of Lecture Hours/week	3(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable student to :

- Describe the basics electrical circuit concepts and how to apply the various theorems for given electrical network
- Describe the representation of sinusoidal waveform and also analysis of single phase ac circuit with various elements
- Describe the principle and operation of ac and dc electrical machines
- Describe the basic operation of different converters circuits
- Describe the necessity of the batteries and importance of the basic switch gear unit

Module -1	
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenins and Norton Theorems (Simple numerical problems). Time-domain analysis of first-order RL and RC circuits.	**Hours-10**
Module – 2	
AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.	**Hours-10**

Module – 3	
Transformers Magnetic materials, BH characteristics, ideal and practical transformer , equivalent circuit , losses in transformers,OC and SC tests, regulation and efficiency. Auto transformer and three-phase transformer connections.	**Hours-10**
Module – 4	
Electrical Machines: Ac machines- Generation of rotating magnetic fields, construction details and working of three phase induction motor, significance of torque – slip characteristics. Loss components and efficiency, starting and speed control of induction motor. Single phase induction motor. Construction and working of synchronous generators. **DC machines-** Construction, working, torque- speed characteristics and speed control of dc shunt motor.	**Hours-10**
Module – 5	
Power Converters and Electrical Installations DC – DC Buck and boost converters, duty ratio control, PWM techniques, single phase voltage source inverters. Classification of batteries and Low Voltage switch gear.	**Hours-10**

Course outcomes:

On completion of the course student will be

1. Able to analyze DC circuits by using KCL, KVL and Network theorems
2. Able to analyze AC circuits
3. Able to explain the operation and compute performance of transformer
4. Able to explain the construction and working of rotating electrical machines
5. Able to describe DC-DC and DC-AC converters
6. Able to explain about types of LV switch gear and types of batteries

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.(Two questions from each unit)
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under unit
4. The student will have to answer 5 full questions selecting one full question from each unit.

Test books.

T1. E. Hughes, *"Electrical and Electronics Technology"*, Pearson, 2010.

T2.D.C. Kulshreshtha, *"Basic Electrical Engineering"*, McGraw Hill, 2009.

T3.D.P. Kothari, I.J. Nagrath, *"Basic Electrical Engineering"*, Tata McGraw Hill, 2010.

T4. J.P. Tewari, *"Basic Electrical Engineering"*, New Age International Publishers, 2003.

References

R1. M.D. Singh, *"Power Electronics"*, 2nd edition.

R2. *"Battery Energy Storage for Smart Grid Applications"*, Eurobat 2013.

R3. L.S. Bobrow, *"Fundamentals of Electrical Engineering"*, Oxford University Press, 1996.

R4. V.D. Toro, *"Electrical Engineering Fundamentals"*, Prentice Hall India, 1989.

R5. R.M. Dell, D.A.J. Rand, *"Understanding Batteries"*, 2001.

R6. Bhavesh Bhalja, R.P., Maheshwari, Nilesh G. Chothani, *"Protection and Switchgear"*, Oxford University Press, 5th impression, 2014.

Course Outcomes to Program Outcomes mapping

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	3	1	-	-	-	-	-	-	-	-	-	-	-
2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Cours e	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

English Language Communication Skills Lab SEMESTER - II			
Subject Code	18CMEGL2050	Internal Marks	50
Number of Practical Hours/Week	02	External Marks	50
Total Number of Practical Hours	32	Exam Hours	03
Credits – 01			

Objectives: To enable the students to learn communication skills of Listening, Speaking, Reading and Writing by focusing on:

- Listening Comprehension
- Pronunciation
- Functional English in formal and Informal Situations
- Interpersonal Communication Skills
- Presentation Skills

List of Experiments

UNIT I

Listening Comprehension

UNIT II

Pronunciation , Stress, Intonation & Rhythm

UNIT III

Common Everyday Situations: Conversations & Dialogues, Communication at Workplace

UNIT IV

Interpersonal Communication Skills- Group discussions and debates

UNIT V

Formal Presentations

Outcomes:

By the end of the course the students will be able to acquire basic Proficiency in English by practicing the following:

- Listening Comprehension
- Pronunciation
- Dialogues
- Interpersonal Communication Skills

• Presentation Skills • Discussions and Debates
Learning Resources: • Interact – English Lab Manual for Undergraduate Students by Orient BlackSwan • Ted Talks, Interviews with Achievers and select movies • Toastmaster's speeches and table topics • Book Reviews and movie reviews • Exercises in Spoken English Parts: I-III, CIEFL, Hyderabad. • Oxford Guide to Effective Writing and Speaking by John Seely • https://www.ted.com/talk

Course Outcomes Vs Program Outcomes Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	-	-	-	-	-	-	-	-	-	2	-	-
2	-	-	-	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	-	-	-	3	-	-
4	-	-	-	-	-	-	-	-	-	2	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-
6	-	-	-	-	-	-	-	-	-	2	-	-

ENGINEERING CHEMISTRY LABORATORY SEMESTER - II			
Subject Code	18CMCHL2060	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Measure molecular properties like surface tension and viscosity
2. Determine chloride content of water of given water sample.
3. Familiarize the synthesis of a simple drug.
4. Determine rate constant as a function of time.
5. Determine the strength of acids using conductivity meter.
6. Determine amount of Fe (II) using potentiometer.

List of Experiments

(Any 10 experiments must be conducted)

1. Determination of surface tension
2. Determination of viscosity of a liquid by Ostwald viscometer
3. Thin layer chromatography
4. Determination of chloride content of water
5. Determination hardness of water by EDTA.
6. Determination of the rate constant of first order reaction (Ester hydrolysis)
7. Determination of strength of strong acid using conductometeric titration.
8. Determination of strength of weak acid using conductometeric titration .
9. Determination of Ferrous iron using potentiometer.
10. Synthesis of a drug – Aspirin
11. Determination of the partition coefficient of a substance

between two immiscible liquids

12. Determination of strength of acetic acid using charcoal adsorption.

Demonstration Experiments:

1. Preparation of lattice structure and determination of atomic packing factor.
2. Chemical oscillations- Iodine clock reaction
3. Synthesis of Phenol formaldehyde resin
4. Saponification of oil

COURSE OUTCOMES:

On completion of the course student will be

1. Able to measure molecular properties like surface tension and viscosity
2. Able to determine chloride content of given water sample.
3. Able to synthesize a drug.
4. Able to determine rate constant as a function of time.
5. Able to determine strength of acids using conductivity meter.
6. Able to determine amount of Fe (II) using potentiometer.

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
1	-	3	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-
4	3	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-
6	-	3	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-

BASIC ELECTRICAL ENGINEERING LAB SEMESTER - II			
Subject Code	18CMEEL2070	Internal Marks	50
Number of Practice Hours/Week	3P	External Marks	50
Total Number of Practice Hours	32	Exam Hours	03
Credits – 1.5			

The objectives of this course, help the students to

1. Learn how to find the frequency response and resonance of RL & RC circuits
2. Learn how to verify the given networks using theorems
3. Learn how to measure the power and determination of efficiency of a single phase transformer and how to measure the power in three phase transformer
4. Learn how to determine the Torque-slip characteristics of a dc shunt and induction motors.
5. Learn how to find the regulation of an alternator
6. Learn the operation of different converter circuits and know about the switch gear system

List of Experiments (Any Ten experiments must be conducted)

1. Study of R-L,R-C,R-L-C circuits.
2. Verification of superposition theorem.
3. Verification of Thevenin's and Norton's theorems.
4. Series and Parallel resonance of RL and RC circuits.
5. Open circuit & Short circuit tests on a single phase transformer.
6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
7. Speed control of DC shunt motor.
8. Torque Speed Characteristic on single phase induction motor
9. Regulation of Alternator.
10. Demonstration of Buck and Book converter
11. Demonstration of Voltage Source Inverter

12. Demonstration of Low Voltage Switch gear.

COURSE OUTCOMES:

On completion of this course, students are

1. Able to determine the time response and resonance of given RL, RC and RLC circuits
2. Able to determine the response using Superposition, Norton and Thevinins.
3. Able to determine the power , efficiency and regulation of ac machines
4. Able to determine the speed torque characteristics of dc and induction motors
5. Able to analyze the operation of Buck and boost converter and voltage source inverter.
6. Able to analyze the operation of LV Switch gear system.

Course outcomes to Program outcomes mapping:

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	2	2	-	2	-	-	-	-	-	-	-	-	-	-	-
2	2	2	-	2	-	-	-	-	-	-	-	-	-	-	-
3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Cours e	2	2	1	1	-	-	-	-	-	-	-	-	-	-	-

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS SEMESTER - II			
Subject Code	18CMMSN2080	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 00			

COURSE OBJECTIVES:

The objectives of this course help the students to

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Unit -1	
Lesson: Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**Hours – 10**
Unit -2	
Lesson: Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**Hours – 10**
Unit – 3	
Lesson: State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	**Hours – 10**
Unit – 4	
Lesson: Special Provision for SC & ST Special Provision for Women, Children & Backward Classes	**Hours –10**

Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co - Operative Societies.	
Unit – 5	
Lesson: Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	**Hours – 10**

COURSE OUTCOMES:

On completion of the course student will

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
5. Understand Engineering ethics and responsibilities of Engineers
6. Understand Engineering Integrity & Reliability

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer questions carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

Text Books:

1. Durga Das Basu: **"Introduction to the Constitution on**

India", (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins **"Engineering Ethics"** Thompson Asia, 2003-08-05.

REFERENCE BOOKS:
1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, **"Engineering Ethics",** Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
3. Brij Kishore Sharma,**" Introduction to the Constitution of India"**, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Latest Publications of Indian Institute of Human Rights, New Delhi

Website Resources

- www.nptel.ac.in
- www.hnlu.ac.in
- www.nspe.org
- www.preservearticles.com

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	1	-		-	-	-	-	-	-	-
4	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
5						3									
6	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Course	-	-	-	-	-	3	-	1	-		-	-	-	-	-

Course Structure for

B.Tech. (Electronics and Communication Engineering)

Semester III (Second year)

S. No	Course Code	Course Title	L	T	P	C
1	18CMMAT3010	Engineering Mathematics-III	3	1	0	4
2	18ECECT3020	Electronic Devices	3	0	0	3
3	18ECECT3030	Network Theory	3	0	0	3
4	18ECECT3040	Signals & Systems	3	0	0	3
5	18ECECT3050	Probability & Stochastic Processes	3	0	0	3
6	18ECECL3060	Electronic Devices Lab	0	0	3	1.5
7	18ECECL3070	Network Theory Lab	0	0	3	1.5
8	18ECECN3080	Pulse & Digital Circuits (MC)	3	0	0	0
					Total Credits	19

Course Structure for
B.Tech. (Electronics and Communication Engineering)
Semester IV (Second year)

S. No	Course Code	Course Title	L	T	P	C
1	18ECECT4010	Digital System Design	3	0	0	3
2	18CMMET4020	Engineering Mechanics	3	1	0	4
3	18ECECT4030	Electro Magnetic Waves & Transmission Lines	3	0	0	3
4	18ECECT4040	Analog Circuits	3	0	0	3
5	18ECECT4050	Analog & Digital Communications	3	0	0	3
6	18ECECL4060	Digital System Design Lab	0	0	3	1.5
7	18ECECL4070	Analog Circuits Lab	0	0	3	1.5
8	18ECECL4080	Analog & Digital Communications Lab	0	0	3	1.5
					Total Credits	20.5

ENGINEERING MATHEMATICS – III SEMESTER - III			
Subject Code	18CMMAT3010	Internal Marks	30
Number of Lecture Hours/Week	3(L) + 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

- Find the function of a complex variable
- Evaluate complex integration and expand functions using Taylor & Maclaurin's series
- Evaluate integrals using Residues
- Find the statistical parameters for distributions
- Test the hypothesis

Unit -1	**Hours**
Function of a complex variable Introduction –continuity –differentiability- analyticity – properties – Cauchy –riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.	**10**
Unit -2	
Integration and series expansions Complex integration: Line integral – Cauchy's integral theorem, Cauchy's in integral formula, generalized integral formula (all without proofs) Radius of convergence – expansion in Taylor's series, Maclaurin's series and Laurent series	**10**
Unit – 3	
Singularities and Residue Theorem Zeros of an analytic function, Singularity, Isolated singularity, Removable singularity, Essential singularity, pole of order m, simple pole, Residues, Residue theorem, Calculation of residues, Residue at a pole of order m**,**	**10**

Evaluation of real definite integrals: Integration around the unit circle**,** Integration around semi circle, Indenting the contours having poles on the real axis.	
Unit – 4	
Discrete Random variables and Distributions: Introduction-Random variables- Discrete Random variable-Distribution function- Expectation. Discrete distributions: Binomial, Poisson and Geometric distributions and their fitting to data. **Continuous Random variable and distributions:** Introduction-Continuous Random variable-Distribution function- Expectation-Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution	**10**
Unit – 5	
Test of Significance: Introduction - Population and samples- Sampling distribution of means (σ-known) t-distribution- Sampling distribution of means(σ-unknown), chi-square and F- test Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors –Level of significance - One tail and two-tail tests- Tests concerning one mean and proportion, two means- Proportions and their differences - ANOVA for one – way and two – way classified data	**10**
Course outcomes: On completion of this course, students are able to 1. Find the function of a complex variable 2. Evaluate complex integration and expand functions using Taylor & Maclaurin's series 3. Evaluate integrals using Residues 4. Find the statistical parameters for discrete distributions 5. Find the statistical parameters for continuous distributions 6. Test the hypothesis	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question carrying 1 mark each.	

2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. B.S. Grewal,**"Higher Engineering Mathematics"**, Khanna publishers, 44th edition, 2016.
2. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 9th Edition, 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, 7th Edition.
3. H.K. Dass and Er. RajnishVerma, **"Higher Engineerig Mathematics"**, S.Chand publishing, 1st edition, 2011.
4. Dr. B.Rama Bhupal Reddy**, "Probability and Statistics for Engineers",** Research India Publications (DELHI), 2015.

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ELECTRONIC DEVICES SEMESTER III			
Subject Code	18ECECT3020	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Engineering Physics	Credits – 03	

Course Objectives:

This course will enable the students to :

- Provide insight of intrinsic and extrinsic semiconductors, semiconductor diodes, special purpose diodes
- Learn about rectifier circuits using diodes.
- Introduce the construction and operation of BJT, JFET and MOSFET and their biasing techniques
- Learn the small signal analysis of BJT, JFET and MOSFET.

Unit -1	**Hours**
Semiconductor Physics: Insulators, Semi conductors, and Metals classification using energy bands, mobility and conductivity, electrons and holes in intrinsic semi conductors and extrinsic semi conductors, drift and diffusion, charge densities in semiconductors, Hall effect, continuity equation, law of junction, Fermi level in intrinsic and extrinsic Semiconductors. **Junction Diode:** Open circuited p-n junction, current components in p-n Diode, diode equation, V-I Characteristics, Diode resistance, Diode capacitance.	**10**
Unit -2	
Special Semiconductor Diodes: Zener Diode, Breakdown mechanisms, Photo diode, LED. Construction, operation and characteristics of all the devices are to be considered. **Applications of Diode:** Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter,	**12**

Capacitor filter, comparison of various filter circuits in terms of ripple factors.	
Unit – 3	
BJT: Transistor current components, Transistor equation, Characteristics of CB, CE and CC configurations, punch through/ reach through, Photo transistor. **FET:** Basic structure and operation of JFET & MOSFET characteristics, parameters, comparison between FET and BJT.	**08**
Unit – 4	
Transistor Biasing and Thermal Stabilization: Operating point, load line analysis, BJT biasing- methods: fixed bias, collector to base bias, self-bias, Stabilization against variations in Ico, V_{BE}, and β, Stability factors, (S, S', S''), Thermal runaway, Thermal stability.	**08**
Unit – 5	
Small Signal Low Frequency Transistor Amplifier Models: **BJT:** Two port network, Transistor hybrid model, h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers, Comparison of transistor amplifiers. **FET:** Small signal model of a MOSFET, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.	**12**
Course outcomes: On completion of the course student will be able to: 1. Understand the basic concepts of semiconductor physics. 2. Understand the construction and operating principle of p-n junction diode and special semiconductor diodes 3. Apply diodes as rectifiers and analyze characteristics with and without filters 4. Understand the construction and principle of operation of BJT and FET w.r.t V-I characteristics. 5. Analyze various biasing techniques for BJT and FET. 6. Analyze BJT and FET using small signal analysis.	

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Jacob Millman, C. Halkies, C.D.Parikh, **"Integrated Electronics"**, Tata Mc-Graw Hill, 2009.
2. G. Streetman and S. K. Banerjee, **"Solid State Electronic Devices",** 2nd edition, Pearson, 2014.

Reference Books:

1. Robert L Boyelstad, Lovis Nashelsky, **"Electronic Devices & Theory",** 10th edition
2. David A Bell, **"Electronic Devices and Circuits",** 5th edition, Oxford Publications
3. J. Millman, C. Halkias, **"Electronic Devices and Circuits",** 3rd Edition, Tata Mc-Graw Hill.
4. Salivahanan, Kumar, Vallavaraj, **"Electronic Devices and Circuits",** 2nd Edition, Tata Mc-Graw Hill.

Web References:

1. http://nptel.ac.in/video.php?subjectId=117103063
2. https://nptel.ac.in/courses/122106025/2

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
3	3	2	-	-	-	-	-	-	-	-	-	-	2	-	2
4	2	1	1	-	-	-	-	-	-	-	-	-	1	-	-
5	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
6	2	2	-	-	-	-	-	-	-	-	-	-	1	-	2
Course	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**

S.No	Unit Name	Text Book / Reference	Chapter No.
1	Semi Conductor Physics & Junction Diode	T1	2, 3 &19
		T2	3
		R4	4
2	Special Semiconductor Diodes & Applications of Diode	T1	3, 4 &18
		R1	2
3	BJT & FET	T1	5 & 10
		T2	6,7
		R3	7 & 12
4	Transistor Biasing and Thermal Stabilization	T1	9
		R2	5
5	Small Signal Low Frequency Transistor Amplifier Models	T1	8 & 10
		R4	9

NETWORK THEORY SEMESTER III			
Subject Code	18ECECT3030	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	---	Credits – 03	

Course Objectives:
This course will enable students to:

- Analyze the electrical circuits using various circuit analysis techniques
- Determine the transient response of R-L-C Networks
- Analyze two port networks and determine filter

Unit -1	**Hours**
Introduction to Electrical Circuits: Review on Mesh analysis and Nodal analysis problem solving for AC Circuits. **Network Topology:** Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule. Star-Delta and Delta - Star conversions	**9**
Unit -2	
Network Theorems: Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition, Max Power Transfer, Tellegens theorems problem solving for AC circuits	**10**
Unit – 3	
Transients: First order differential equations, Evaluating initial conditions procedure, Definition of time constants, R-L circuit, R-C circuit with DC excitation and AC excitation, second order differential equations, homogeneous, non homogenous, problem solving using R-L-C elements with DC excitation and AC excitation.	**11**
Unit – 4	
Two-port networks: Relationship of two port networks,	**10**

Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also.	
Unit – 5	
Filters & Attenuators: **Filters:** Classification Filters, Filter Networks, Equations of Filter Networks, Classification of Pass Band and Stop Band, Constant - K Low Pass Filter, Constant - K High Pass Filter, m-Derived T-Section, Band Pass Filter, Band Elimination Filter **Attenuators:** T-Type Attenuator, π - Type Attenuator, Lattice Attenuator, Bridged -T Attenuator, L-Type Attenuator	**10**

Course outcomes:

On completion of the course student will be able to

1. Analyze basic electrical networks using mesh, nodal techniques.
2. Analyze basic electrical networks using topological description of the network.
3. Apply and analyze various network theorems for DC and AC circuits.
4. Analyze the transient response of R-L, R-C and R-L-C networks
5. Analyze two port networks.
6. Analyze the characteristics of Filters and Attenuators.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.

3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Van, Valkenburg, **"Network analysis"**, 3rd Edition, Prentice hall of India, 2000.
2. A William Hayt, **"Engineering Circuit Analysis",** 8th Edition, McGraw-Hill Education
3. Sudhakar, A., Shyammohan, S. P, **"Circuits and Network"**, Tata McGraw-Hill New Delhi,1994

Reference Books:

1. John. D. Ryder, **"Network lines and Fields"**, 2nd edition, Asia publishing house.
2. D R Cunninghan, **"Basic Circuit Analysis"**, Jaico Publishers.
3. Chadha, **"Network Analysis and Filter Design"**, Umesh Publications.

Web References:

1. http://www.nptelvideos.in/2012/11/circuit-theory.html
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring - 2007/video-lectures/lecture-2/
3. http://www.infocobuild.com/education/audio-video courses/electronics/ CircuitTheory-IIT-Delhi/lecture-

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
2	2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	-

S.No.	Unit Name	Text Book /Reference	Chapter No.
1	Introduction to Electrical Circuits & Network Topology	T1	2 & 3
		T3	1&2
		R1	1
		R2	4
2	Network Theorems	T1	9
		T3	3
		R1	1
		R2	11
3	Transients	T2	8 & 9
		T3	12
		R2	8
4	Two-port networks	T1	11
		T3	15
5	Filters & Attenuators	T3	16
		R1	4

SIGNALS & SYSTEMS SEMESTER III			
Subject Code	18ECECT3040	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Engineering Mathematics-II	Credits – 03	

Course Objectives:
This course will enable students to:
- Know the concepts of signals and systems and perform operations on LTI systems.
- Analyze the signals and systems by using transforms.
- Know the process of sampling.

Unit -1	**Hours**
Introduction: Definition of Signals and Systems, Singularity functions and related functions. Complex exponential and sinusoidal signals. Classification of Signals, Operations on signals. Classification of Systems, System Properties. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions.	**12**
Unit -2	
Fourier Series & Fourier Transform: Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms. Introduction to Hilbert Transform.	**12**
Unit – 3	
Sampling Theorem: Representation of a CT signal by its	**8**

samples: The Sampling theorem, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling. Review of Laplace Transforms, Properties, Relation between L.T and F.T of a signal.	
Unit – 4	
Analysis of Linear Systems: Linear Time Invariant systems, impulse response, Response of a linear system, Transfer function of a LTI system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution. Cross-correlation and auto-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation. Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.	**10**
Unit – 5	
Z–Transforms: Discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal. Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence, constraints on ROC for various classes of signals, Properties of Z-transforms, Inverse Z-transform.	**8**
Course outcomes: On completion of the course student will be able to 1. Understand various signals and systems and demonstrate their properties. 2. Interpret Fourier analysis of continuous-time Signals. 3. Apply sampling theorem for signal conversion from continuous-time signals to discrete-time. 4. Analyze continuous time signals by using Laplace transforms. 5. Understand various operations on LTI systems. 6. Apply z-transform to analyze discrete-time signals and systems.	

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, **"Signals and Systems"**, 2nd Edition, PHI, 2009.
2. B.P. Lathi, **"Signal Processing & Linear Systems"**, 1st Edition, Oxford University Press, 2006.

Reference Books

1. Simon Haykin and Van Veen, **"Signals & Systems"**, 2nd Edition, John Wiley India, 2011.
2. M. J. Roberts**, "Analysis using Transform methods and MATLAB"**, 1st Edition, TMH, 2005.
3. T K Rawat , **"Signals and Systems"**, 1st Edition, Oxford University press, 2014

Web References:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-videos/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/
3. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
4. https://nptel.ac.in/courses/117104074/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
5	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Introduction	T1	1
		T2	3
		R2	2
2	Fourier Series & Fourier Transform	T1	3 & 4
		T2	3 & 4
		R1	3
		R2	4 & 5
3	Sampling Theorem	T1	7 & 9
		T2	11 & 5
4	Analysis of Linear Systems	T2	6 & 12
		R2	8
5	Z–Transforms	T1	10
		R1	7
		R2	11 & 12

PROBABILITY & STOCHASTIC PROCESSES SEMESTER III			
Subject Code	18ECECT3050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	---	Credits – 03	

Course Objectives:

This course will enable students to

- Understand the concept of distribution, density functions of different random variables
- Apply statistical operations on 1-d and multiple random variables.
- Classify the random processes and analyze the LTI systems with random process

Unit -1	**Hours**
Review of Probability Theory: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, independent Events. **The Random Variable:** Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.	**12**
Unit -2	
Operation on One Random Variable – Expectations : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating	**10**

Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non monotonic Transformations of Continuous Random Variable.	
Unit – 3	
Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions. **Operations on Multiple Random Variables**: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.	**10**
Unit – 4	
Random Processes – Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, N^{th}-order and Strict-Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.	**8**
Unit – 5	
Random Processes – Spectral Characteristics: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and	**10**

Cross-Correlation Function. **Linear Systems With Random Inputs:** Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output	

Course outcomes:

On completion of the course student will be able to

1. Understand the axiomatic formulation of Probability Theory
2. Demonstrate the concept of random variable and its distribution, density functions
3. Apply statistical operations and transformations on 1-D random variable
4. Extend the concept of 1-d random variable to multiple random variables
5. Analyze random processes by understanding its temporal and Spectral characteristics
6. Analyze linear Time Invariant systems with random inputs

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Peyton Z. Peebles, Probability, **"Random Variables & Random Signal Principles"**, 4th Edition, TMH, 2001.
2. Papoulis, S.Unnikrisha, **"Probability, Random Variables and Stochastic Processes"**, 4th Edition, PHI, 2002.

Reference Books:

1. Henry Stark and John W. Woods, **"Probability and Random Processes with Applications to Signal Processing"**, 3rd Edition, Pearson Education.
2. Gardener W.A, **"Introduction to Random Processes with Applications to Signals and Systems"**, 2nd Ed, McGraw-Hill.

Web References:

1. https://nptel.ac.in/courses/117105085/
2. https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
3	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	1	-	-	-	-	-	-	-	-	-	-	-	2	-
Course	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**

S.No.	Unit Name	Text Book / Reference	Chapter No.
1	Review of Probability Theory & The Random Variable	T1	1 & 2
		T2	1,2 & 4
		R1	1 & 2
		R2	1 & 2
2	Operation on One Random Variable – Expectations	T1	3
		T2	5
		R1	3 & 4
3	Multiple Random Variables	T1	4 & 5
		T2	6
		R2	4

4	Random Processes – Temporal Characteristics	T1	6
5	Random Processes – Spectral Characteristics & Linear Systems With Random Inputs	T1	7 & 8

ELECTRONIC DEVICES LAB SEMESTER - III			
Subject Code	18ECECL3060	Internal Marks	50
Number of Lecture	03	External Marks	50
Total Number of	36	Exam Hours	03
Credits – 1.5			

Course objectives:

The objectives of the course are to make students to

- Provide insight of intrinsic and extrinsic semiconductors, semiconductor diodes, special purpose diodes
- Learn about rectifier circuits using diodes.
- Introduce the operation of BJT, JFET and MOSFET and their biasing techniques
- Learn the small signal analysis of BJT, JFET and MOSFET.

List of Experiments:	**Hours**
Electronic Workshop Practice: 1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang Condensers, Relays, Bread Boards. 2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT. 3. Soldering Practice- Simple circuits using active and passive components. 4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function Generator, Regulated Power Supply and CRO **List of Experiments :** 1. P-N Junction Diode Characteristics 2. Zener Diode Characteristics without and with Regulator 3. Half-wave Rectifier (without and with C-filter)	**36**

4. Full-wave Rectifier (without and with C-filter) 5. BJT Characteristics (CE Configuration) Part A: Input Characteristics Part B: Output Characteristics 6. FET Characteristics (CS Configuration) Part A: Drain Characteristics Part B: Transfer Characteristics 7. Transistor Biasing 8. BJT-CE Amplifier 9. Emitter Follower-CC Amplifier 10. FET-CS Amplifier	

Course outcomes:

After completing this course, students will be able to:

1. Analyze the characteristics of Semiconductor devices.
2. Design and verify the biasing circuit for BJT
3. Design and analyze BJT and FET Amplifier Circuits

Question paper pattern:

Ten questions are given, and student should choose one question (blind option), which carries 50 marks in total.

a. 15 marks are allotted for procedure including circuit diagrams and model graphs.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

NETWORK THEORY LAB SEMESTER - III			
Subject Code	18ECECL3070	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course objectives:

The course objective is make students to

- Understand the concepts of design and analysis of Electrical circuits.
- Analyze the electrical circuits using various circuit analysis techniques
- Determine the transient response of R-L-C Networks
- Analyze two port networks and determine filter characteristics

The students are required to design the electrical circuits to verify the laws, theorems, two port parameters, time response of AC circuits and have to experimentally find the results. Experimental results should be verified with theoretical values.	**Hours**
Part-A: Computation of two port network parameters and transients 1. Two port network parameters – Z-Y Parameters and analytical verification. 2. Two port network parameters – Hybrid & ABCD parameters, Analytical verification. 3. Transient response of RL & RC Networks for DC and AC Inputs 4. Transient response of RLC Circuit for DC and AC inputs	**12**

Part-B: Simulation of electrical networks using PSPICE 1. Introduction to PSPICE and verification of Kirchhoff's laws for basic electrical networks. 2. Simulation of DC Electrical circuits and verification using Kirchhoff's laws 3. Simulation of AC Electrical circuits and verification using Kirchhoff's laws 4. Verification of Thevenin's and Norton's equivalent circuits using PSPICE. Verification on DC with Resistive loads 5. Verification of Thevenin's and Norton's equivalent circuits using PSPICE. Verification on AC with Reactive loads 6. Transient Response of RLC Circuits for DC and AC Inputs 7. Determination of Two port network parameters 8. Low pass and High Pass Filter characteristics	**24**
For the above circuits verify all the characteristics and laws experimentally and compare with theoretical calculations	

Course outcomes:

After studying this course, students will be able to:

1. Analyze complex DC and AC linear circuits
2. Apply concepts of electrical circuits across engineering
3. Analyze the given electrical network by using PSPICE Simulation tool

Question paper pattern:

Ten questions are given and student should choose one question (blind option), which carries 50 marks in total.

a. 15 marks are allotted for procedure including circuit diagrams and model graphs.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

Hardware/Software Requirements:

- Regulated Power supplies
- Cathode Ray Oscilloscopes
- Function Generators
- Digital Multimeters
- Decade Résistance Boxes/Rheostats
- Decade Capacitance Boxes
- Ammeters (Analog or Digital)
- Voltmeters (Analog or Digital)
- Active & Passive Electronic Components 10.PSPICE Software

PULSE & DIGITAL CIRCUITS (Mandatory Course) SEMESTER III			
Subject Code	18ECECN3080	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	--	Credits – 0	

Course Objectives:
This course will enable students to
- Understand Wave shaping circuits.
- Analyze switching characteristics of electronic devices.
- Design multivibrators and time base generators.

Unit -1	**Hours**
Linear Wave Shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator; Attenuators , its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.	**10**
Unit -2	
Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper; Clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers.	**12**
Unit – 3	
Switching Characteristics of Devices: Diode as a switch, piecewise linear diode characteristics, Design and analysis of Transistor as a switch, Break down voltage consideration of transistor, saturation parameters of Transistor and their variation with temperature, Design of transistor switch, transistor-switching times. **Bistable Multivibrator:** Analysis And Design of Fixed	**12**

Bias, Self Bias Bistable Multi Vibrator, Collector Catching Diodes, Commutating Capacitors, Triggering of Binary Circuits, Emitter Coupled Bistable Multivibrator (Schmitt Trigger).	
Unit – 4	
Monostable Multivibrator: Analysis and Design of Collector Coupled Monostable Multi vibrator, Triggering of Monostable Multivibrator, Applications of Monostable Multivibrator. **Astable Multivibrator:** Analysis and Design of Collector Coupled Astable Multivibrator, Application of Astable Multivibrator as a Voltage to Frequency Converter.	**9**
Unit – 5	
Voltage Time Base Generators: General features of a time base signal, Methods of generating time base waveform Exponential Sweep Circuits, Negative Resistance Switches, basic principles in Miller and Bootstrap time base generators, Transistor Miller time base generator, Transistor Bootstrap time base generator.	**7**
Course outcomes: On completion of the course, student will be able to 1. Analyze linear wave shaping circuits with different inputs. 2. Design Non linear wave shaping circuits. 3. Design switching circuits. 4. Analyze different Multivibrators. 5. Design different multivibrators. 6. Understand different types of time base generators	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question carrying 1 mark each. 2. Two questions from each unit should present. **Section B:** 1. This Section will have 10 questions, 2 from each unit 2. Each full question carry 12 marks.	

3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. A. Anand Kumar, **"Pulse and Digital Circuits"**, PHI, 2005

Reference Books:

1. J. Millman and H. Taub, Mothiki S Prakash Rao, **"Pulse, Digital and Switching Waveforms"**, McGraw-Hill, Second Edition, 2007.
2. Venkata Rao,K,Ramasudha K, Manmadha Rao,G, **"Pulse & Digital Circuits"**, Pearson,2010
3. J. Millman and H. Taub, Pulse, **"Digital and Switching Waveforms"**, McGraw-Hill

Web References:

1. http://www.iitg.ac.in/apvajpeyi/ph218/Lec-18.pdf
2. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html
3. http://www.allaboutcircuits.com/video-lectures/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	1
2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	1
3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	2
4	3	3	2	-	-	-	-	-	-	-	-	-	-	-	2
5	3	3	3	-	-	-	-	-	-	-	-	-	-	-	2
6	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

S.No.	Unit Name	Text Book / Reference	Chapter No.
1	Linear Wave Shaping	T1	1
		R1	2
2	Non-Linear Wave Shaping	T1	2
		R1	5,6
3	Switching Characteristics of Devices, Bistable Multivibrator	T1	3,4
		R2	6
4	Monostable & Astable Multivibrators	T1	4
		R2	7,8
5	Voltage Time Base Generators	T1	5
		R3	14,15

DIGITAL SYSTEM DESIGN SEMESTER IV			
Subject Code	18ECECT4010	Internal Marks	30
Number of Lecture Hours/ Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Electronic Devices	Credits -03	

Course Objectives:

This course will enable students to

- Introduce the concepts and techniques associated with the number systems and Boolean algebra.
- Design various combinational circuits, sequential circuits and memories using logic gates and PLDs
- Know various logic families
- Understand the use of VHDL in Digital systems design

Unit -1	**Hours**
Number Systems And Boolean Algebra: Number representation of different radix, conversion of bases, r-l's complements and r's complements of signed and unsigned numbers, weighted and non-weighted codes; Boolean theorems, principle of complementation & duality, De-morgans theorems, Basic logic operations and gates, Standard SOP and POS Forms, Minimization of logic functions using Boolean theorems and K-Map.	10
Unit -2	
Combinational Circuit Design: Design with basic logic gates, Design of Half adder, full adder ,4 bit parallel adder, BCD Adder, Carry look ahead adder circuit, adder-subtractor circuit, comparators, multiplexer, demultiplexer, priority encoder, decoders, comparators, realization of Boolean functions using decoders and multiplexers.	10
Unit -3	
Sequential Circuit Design: Memory elements and their excitation functions SR, JK, T, and D latches and flip-	11

flops, Conversion from one flip-flop to another flip-flop, master slave JK flip-flop, edge-triggered flip-flop, Design of synchronous and asynchronous counters, Design of registers, finite-state machine, Realization of circuits using various flip-flops, minimization and transformation of sequential machines,.	
Unit -4	
Logic Families: Introduction to logic families, CMOS logic, CMOS steady state electrical behavior, CMOS dynamic electrical behavior, CMOS logic families, Bipolar logic, Transistor logic, TTL families, CMOS/TTL interfacing, Emitter coupled logic. Memories – PAL, PLA, PROM, ROM Architecture, Types of ROMS &Applications, RAM Architecture, Static & Dynamic RAMs.	9
Unit -5	
Hardware Description Language: Design flow, program structure, types and constants, functions and procedures, libraries and packages, Structural design elements, data flow design elements, behavioral design elements. VHDL implementation of Carry look ahead adder, Decoder and Priority encoder, Synchronous counter, Universal shift register, Sequence Detector.	10
Course outcomes: Upon completion of the course, students will be able to 1. Understand the basic number systems, conversions and Boolean algebra. 2. Design digital systems using combinational circuits. 3. Design digital systems using sequential circuits. 4. Understand the concepts of logic families and corresponding logic levels. 5. Design digital system using PLDs and Understand the construction and working of memories 6. Design digital systems using VHDL	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question	

carrying 1 mark each.
2. Two questions from each unit should present.

Section B:
1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

TEXT BOOKS:
1. John F. Wakerly, "Digital Design Principles & Practices", 3rd Edition PHI/ Pearson Education Asia, 2005.
2. Morris Mano, Michael D Ciletti , "Digital Design" , 4th Edition, PEA

Reference Books:
1. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", 2nd Edition, PHI, 2006.
2. Charles H.Roth Jr, "Fundamentals of Logic Design", 5th Edition, Jaico Publishers. 2008
3. D.V. Hall, "Digital Circuits and Systems", 1st Edition, Tata McGraw Hill, 1989.
4. Charles Roth, "Digital System Design using VHDL", 2nd Edition Tata McGraw Hill, 2012.
5. Stephen Brown and ZvonkoVramesic, "Fundamentals of Digital Logic with VHDL Design", 2nd Edition, McGraw Hill, 2005.

Web References:
1. http://www.nptelvideos.in/2012/12/digital-systems-design.html
2. https://www.coursera.org/learn/digital-systems
3. https://www.iare.ac.in/sites/default/files/lecture_notes/stld%20notes%20final.pdf
4. http://www.notesvillage.com/upload/FUNDAMENTALS%20OF%20SWITCHING%20THEORY%20AND%20LOGIC%20DESIGN_2.pdf

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	-	3
2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
3	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2
4	3	3	3	-	-	-	-	-	-	-	-	-	-	-	3
5	2	2	2	-	2	-	-	-	-	-	-	-	-	-	2
6	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
Course	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Number Systems And Boolean Algebra	T2	1,2 & 3
		R1	1 & 3
2	Combinational Circuit Design	T2	4 & 5
		R2	5 & 6
3	Sequential Circuit Design	T2	6,7,8 & 9
		R5	8
4	Logic Families & Memories	T1	3 & 10
		R1	5
		R4	3
5	Hardware Description Language	T1	4 & 5
		R4	2 & 8

ENGINEERING MECHANICS SEMESTER - IV			
Subject Code	18CMMET4020	Internal Marks	30
Number of Lecture Hours/Week	03(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable students to:

- Gain knowledge on system of forces and moments
- Describe the various types of friction
- Draw free-body diagrams and solve statics problems
- Acquire knowledge on centre of gravity and moment of inertia for different sections.
- Calculate velocity and acceleration of particles having rectilinear or curvilinear motion.
- Analyze the problems on work energy method and impulse-momentum method.

Unit -1	**Hours**
Introduction to Engg. Mechanics – Basic Concepts. **Systems of Forces:** Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. **Friction:** Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, cone of friction	**10**
Unit -2	
Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, and Spatial Systems for concurrent forces. Lamis Theorm, graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces, condition of equilibrium, analysis of plane trusses (Method of joints only)	**8**

Unit – 3	
Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its applications. **Area Moment of Inertia:** Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.	**10**
Unit – 4	
Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Bodies – Types and their analysis in Planar Motion. **Kinetics:** Analysis of a Particle and Rigid Body in Translation– Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.	**12**
Unit-5	
Work – Energy Method: Equations for Translation, Work-Energy Application to Particle Motion, Connected System - Fixed Axis Rotation and Plane Motion, Impulse momentum method.	**10**

Course Outcomes:

On completion of the course student will be able to

1. Determine the resultant force and moment for a given system of forces
2. Apply laws of friction to simple mechanisms with consideration of friction
3. Draw free-body diagrams and solve statics problems
4. Determine centroid and moment of inertia of simple and composite bodies
5. Calculate the motion characteristics of a body subjected to a given force system
6. Solve the problems using work energy method and impulse-momentum method.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Engg. Mechanics - S.Timoshenko&D.H.Young., 4th Edn - , Mc Graw Hill publications.
2. Engineering Mechanics-Statics and Dynamics by A Nelson, Tata McGraw HillEducation Private Ltd, New Delhi, 2009.

Reference Books:

1. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11th Edn – Pearson Publ.
2. Engineering Mechanics, statics – J.L.Meriam, 6th Edn – Wiley India Pvt Ltd.
3. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.
4. Mechanics For Engineers, statics - F.P.Beer & E.R.Johnston – 5th Edn Mc Graw Hill Publ.
5. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston –5th Edn Mc Graw Hill Publ.
6. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best& W.G. McLean, 5th Edn – Schaum's outline series - Mc Graw Hill Publ.
7. Singer's Engineering Mechanics: Statics And Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, Bs Publications
8. Engineering Mechanics, Fedinand . L. Singer, Harper – Collins.

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

ELECTROMAGNETIC WAVES & TRANSMISSION LINES SEMESTER IV			
Subject Code	18ECECT4030	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Engineering Physics	Credits – 03	

Course Objectives:
This course will enable students to
- Learn the concepts of transmission lines
- Familiarize with the rectangular and circular waveguides

Unit -1	**Hours**
Electromagnetic Wave Characteristics: Review of Maxwell's equations, Uniform Plane Waves: Introduction, Wave equations for conducting and perfect dielectric, Relation between E & H, Sinusoidal Wave equations, Wave Propagation in lossless and conducting media, Wave propagation in good Conductors and good dielectrics, Skin Effect, Poynting Vector and Poynting Theorem – Applications, Power loss in plane conductor, Wave polarization and its types. Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Illustrative Problems.	**12**
Unit -2	
Transmission Lines-1: Introduction, Types of transmission lines, Parameters, Transmission Line Equations, Primary & Secondary Constants, Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts, Lossless lines, Low Loss lines, Distortion less lines and Minimum Attenuation lines, Loading - Types of Loading. Illustrative Problems.	**08**

Unit – 3	
Transmission Lines-II: Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. UHF Lines as Circuit Elements; λ/4, λ /2, λ/8 Lines – Impedance Transformations. Smith Chart – Configuration and Applications, Single and Double Stub Matching. Illustrative Problems.	**08**
Unit – 4	
Microwave Transmission Lines: **Rectangular Waveguides**: Introduction, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide, Impossibility of TEM mode.	**11**
Unit – 5	
Circular Waveguides: Introduction, Nature of Fields, Characteristic Equation, Dominant and Degenerate Modes. Impossibility of TEM mode. **Microstrip Lines–** Introduction, Zo Relations, Effective Dielectric Constant, Losses, Q factor. **Cavity Resonators–** Introduction, Rectangular and Cylindrical Cavities, Dominant Modes and Resonant Frequencies, Q factor and Coupling Coefficients. Related Problems.	**11**
Course outcomes: On completion of the course student will be able to 1. Analyze wave equations in different mediums 2. Understand the reflection and refraction mechanism of plane waves with normal and oblique incidences 3. Demonstrate types of transmission lines and its fundamental characteristics 4. Apply the characteristics of transmission lines to analyze	

the impedance matching
5. Understand TE/TM/TEM modes of propagation in rectangular waveguides
6. Demonstrate the working mechanism of Micro strip and cavity resonators

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. E. C. Jordan and K.G. Balman**, "Electromagnetic Waves and Radiating systems",** 2nd Edition, PHI.
2. Matthew N.O. Sadiku, **"Elements of Electromagnetics"** , 3rd Edition , Oxford Univ. Press, 2004

Reference Books:

1. R.K. Shevgaonkar, **"Electromagnetic Waves"**, Tata McGraw Hill India, 2005
2. Umesh Sinha,Satya Prakashan, **"Transmission Lines and Networks"**, Tech. India Publications, New Delhi, 2001.
3. K.D. Prasad, Satya Prakashan, **"Antennas and Wave Propagation"**, Tech India Publications, New Delhi, 2001.
4. Samuel Y. Liao, **"Microwave Devices and Circuits",** 3rd Edition, PHI, 1994.

Web References:

1. http://nptel.ac.in/courses/117101056/
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-632-electromagnetic-wave-theory-spring-2003/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	1	-
2	3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	3	-	-	-	-	-	-	-	-	-	-	-	1	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	1	-
6	3	3	-	-	-	-	-	-	-	-	-	-	-	1	-
Course	**3**	**3**	**1**	-	-	-	-	-	-	-	-	-	-	**1**	-

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Electromagnetic Wave Characteristics	T1	5 & 6
		T2	10
2	Transmission Lines-1	T1	7
		T2	11
		R1	02
		R3	12
3	Transmission Lines-II	T1	7
		T2	11
		R1	02
		R3	12
4	Rectangular Waveguides	T1	8
		T2	12
		R4	4
		R3	13
5	Circular Waveguides , Microstrip Lines & Cavity Resonators	T1	8
		R3	13
		R4	4

ANALOG CIRCUITS SEMESTER IV			
Subject Code	18ECECT4040	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Electronic Devices	Credits – 03	

Course Objectives:
This course will enable the students to understand:

- the working of single stage and multistage amplifiers
- different feedback amplifiers, power amplifiers and oscillator circuits.
- Demonstrate op-amp and 555 timer applications and Data Converters

Unit -1	**Hours**
Small Signal High Frequency Transistor Amplifier models: **BJT:** Transistor at high frequencies: Hybrid- π CE transistor model, Hybrid π conductance, Hybrid π capacitances, validity of hybrid π model, CE short circuit current gain, current gain with resistive load, cut-off frequencies, single stage CE transistor amplifier response and gain bandwidth product. **FET:** Analysis of common Source and common drain Amplifier circuits at high frequencies.	**12**
Unit -2	
Feedback Amplifiers: Classification of Amplifiers, Feedback concept, feedback topologies, General Characteristics of negative feedback amplifiers, Method of analysis of feedback amplifiers. **Oscillators:** Condition for oscillations, RC-phase shift and Wien bridge oscillators with BJT and analysis, General form of oscillator circuit, Hartley and Colpitts oscillators with BJT and analysis.	**08**

Unit – 3	
Power Amplifiers: Transformer coupled Class A power Amplifier and its efficiency, Class B amplifier and its efficiency, Class AB amplifier, Complementary symmetry push pull amplifier, Class-C power amplifier, Thermal stability and Heat sinks. **Differential Amplifier:** DC and AC analysis of differential amplifier, Circuits for improving CMRR.	**12**
Unit – 4	
Operational Amplifier: The ideal Operational Amplifier, Operational Amplifier Internal Circuit **Operational Amplifier Characteristics**: DC Characteristics, AC Characteristics. **Operational Amplifier Applications:** Basic OP-Amp Applications, Instrumentation Amplifier, AC Amplifier, V to I and I to V Converter, OP-Amp Circuits Using Diodes, Log and Antilog Amplifier. Differentiator, integrator.	**08**
Unit – 5	
555 Timer & Phase Locked Loops: 555 timer, functional diagram, applications of 555 timers. PLL: Basic principles, phase detector, VCO, Low pass filter, PLL applications **D-A and A-D:** Weighted resistor DAC, R-2R ladder DAC, R-2R Ladder DAC, parallel Comparator A/D Converter, Counter type A/D Converter, successive approximation ADC and dual slope ADC.	**10**

Course outcomes:

On completion of the course student will be able to:

1. Analyze and design single and multistage amplifiers at low, mid and high frequencies.
2. Understand the concept of feedback and design different oscillator circuits.
3. Analyze and design different types of feedback amplifiers
4. Design different Power amplifiers and evaluating the efficiency.
5. Demonstrate linear and non-linear applications of operational

amplifiers.
6. Demonstrate 555 timer applications and different Data Converters

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. A.S. Sedra and K.C. Smith, **"Microelectronic Circuits"**, 5th edition
2. D. Roy Choudhury, **"Linear Integrated Circuits",** New Age International (p) Ltd,

Reference Books:

1. Jacob Millman, C. Halkies, **"Integrated Electronics",** Tata McGraw HillElectronic
2. David A. Bell, **"Electronic Devices and Circuits",** 5th Edition Oxford University press
3. K Venkatarao, K Rama Sudha, **"Electronic Devices and Circuits",** Tata Mc-Graw Hill
4. David A Bell, **"Operational Amplifiers & Linear ICs",** 3rd Edition, Oxford Uni. Press,

Web References:

1. https://nptel.ac.in/courses/117101106/
2. https://nptel.ac.in/courses/108102095/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	2
2	3	2	-	-	-	-	-	-	-	-	-	-	-	-	1
3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	1
4	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
6	2	2	2	-	-	-	-	-	-	-	-	-	-	-	2
Course	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	**1**

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Small Signal High Frequency Transistor Amplifier models	T1	3 & 4
		R1	10 & 11
2	Feedback Amplifiers & Oscillators	T1	7 & 11
		R3	9 & 10
3	Power Amplifiers	T1	12
		T2	2
		R1	18
4	Operational Amplifier	T1	9
		T2	2, 3 & 4
		R3	14 & 15
5	555 Timer & Phase Locked Loops D-A and A-D	T2	8, 9 & 10
		R3	21

ANALOG & DIGITAL COMMUNICATIONS SEMESTER IV			
Subject Code	18ECECT4050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Signals & Systems	Credits – 03	

Course Objectives:
The student will be able to

- Understand the concept of modulation and learn continuous wave modulation and pulse modulation techniques.
- Measure the effect of noise in different modulation schemes.
- Study the Digital Modulation techniques.

Unit -1	**Hours**
Amplitude Modulation : Introduction to communication system, Need for modulation, Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, square law Modulator, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector.	**10**
Unit -2	
DSB & SSB Modulation: Double side band suppressed carrier modulators, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator, Coherent detection of DSB-SC Modulated waves, COSTAS Loop, Frequency discrimination and Phase discrimination method for generating AM SSB Modulated waves, Demodulation of SSB Waves, Vestigial side band modulation: Generation of VSB Modulated wave, Comparison of AM Techniques, Applications of different AM Systems. Noise in amplitude modulated systems.	**10**
Unit – 3	
Angle Modulation: Basic concepts, Frequency	**10**

Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Phase locked loop, Pre-emphasis & De-emphasis, Comparison of FM & AM. Noise in frequency modulated systems threshold effect in angle modulation.	
Unit – 4	
Pulse Modulation : Time Division Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, TDM vs FDM. **Pulse Digital Modulation:** Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Commanding in PCM systems. Differential PCM systems(DPCM).Delta modulation, its drawbacks, adaptive delta modulation, comparison of PCM and DM systems, noise in PCM and DM systems	**10**
Unit – 5	
Digital Modulation Techniques: Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-array PSK, ASK, FSK. Calculation of error probability of ASK, BPSK, BFSK, QPSK.	**10**
Course outcomes: After going through this course the student will be able to 1. Understand the concept of modulation and amplitude modulation. 2. Differentiate various schemes of amplitude modulation and demodulation techniques. 3. Understand the fundamentals of angle modulation and demodulation techniques. 4. Extend the various analog modulation schemes for pulse carrier 5. Establish various pulse modulation schemes in digital	

domain
6. Interpret probability error for digital modulation techniques.

Question paper pattern:

Section A:
1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:
1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:
1. Simon Haykin, **"Principles of Communication Systems"**, 2nd Ed, John Wiley.
2. Simon Haykin, **"Digital communications"**, John Wiley, 2005
3. H. Taub and D. Schilling, **"Principles of Communication**

References Books:
1. B.P. Lathi, **"Communication Systems"**, BS Publication, 2006.
2. Proakis J. G. and Salehi M., **"Communication Systems Engineering"**, Pearson Education, 2002.

Web References:
1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-02-introduction-to-eecs-ii-digital-communication-systems-fall-2012/lecture-videos/
2. https://nptel.ac.in/courses/117102059/
3. https://nptel.ac.in/courses/117101051/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-

S.No.	Unit Name	Text Book / Reference	Chapter No.
1	Amplitude Modulation	T1	3
		R1	3
		R2	3
2	DSB & SSB Modulation	T1	3
		R1	3
		R2	3
3	Angle Modulation	T1	4
		R1	4
4	Pulse Modulation	T1	7
	Pulse Digital Modulation	T3	7
		T4	5
		R1	5
5	Digital Modulation Techniques	T3	5
		T4	6
		R1	9

DIGITAL SYSTEM DESIGN LAB SEMESTER IV			
Subject Code	18ECECL4060	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:
This course will enable students to

- Introduce the concepts and techniques associated with the number systems and Boolean algebra.
- Design various combinational circuits, sequential circuits and memories using logic gates and PLDs
- Know various logic families
- Understand the use of VHDL in Digital systems design

The students are required to design combinational and sequential logic circuits, simulate using Modelsim, synthesis using Xilinx ISE and implement on FPGA board.	**Hours**
1. Realization of Logic Gates 2. Design of Full Adder using 3 modeling systems 3. 3 to 8 Decoder -74138 4. 8 to 3 Encoder (with and without parity) 5. 8 x 1 Multiplexer-74151 and 2x 4 De-multiplexer-74155 6. 4- Bit comparator-7485 7. D Flip-Flop-7474 8. Decade counter -7490 9. Shift registers-7495 10. 8-bit serial in-parallel out and parallel in-serial out 11. Fast In & Fast Out (FIFO) 12. MAC (Multiplier & Accumulator) 13. ALU Design.	**36**

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

1. Design digital systems using combinational circuits using VHDL.
2. Design digital systems using sequential circuits using VHDL.
3. Design Memories using VHDL

Question paper pattern:

Ten questions will be given and student should choose one question (blind option) carries 50 marks in total.

a. 15 marks are allotted for procedure including circuit diagrams and model graphs.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

Hardware/Software Requirements:

Modelsim and Xilinx ISE Software, Xilinx FPGA Devices

ANALOG CIRCUITS LAB SEMESTER - IV			
Subject Code	18ECECL4070	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course objectives:

The objective of the course is to make students to understand the concepts of Amplifiers, Oscillators, OP-Amps and 555 timer.

For the following amplifier circuits, Frequency response and frequency of oscillations needs to be executed both in hardware and multisim software	**Hours**
1. 1.Two Stage RC Coupled Amplifier 2. 2.Voltage-Series Feedback Amplifier 3. 3.Current-Shunt Feedback Amplifier 4. RC Phase Shift and Wien Bridge Oscillator 5. Hartley and Colpitts Oscillator 6. Class A Series-fed Power Amplifier 7. Complementary Symmetry Class B Push-Pull Power Amplifier 8. OP AMP Applications – Adder, Subtractor, Comparator Circuits. 9. Integrator and Differentiator Circuits using IC 741. 10. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators. 11. IC 555 Timer – Monostable/ Astable Operation Circuit. 12. R-2R D/A Converter – using IC 741	**36**

Course outcomes:

After completing this course, students will be able to:

1. Design two stage amplifier and analyse frequency response at low, mid and high frequencies.

2. Design feedback amplifier and analyse its frequency response
3. Design different oscillator circuits and evaluate its frequency of oscillation
4. Design different Power amplifiers and evaluate the efficiency.
5. Design linear and non-linear applications of operational amplifiers.
6. Design 555 timer applications and different Data Converters

Question paper pattern:

Ten questions will be given and student should choose one question (blind option) which carries 50 marks in total.

a. 15 marks are allotted for procedure including circuit diagrams and model graphs.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

ANALOG & DIGITAL COMMUNICATIONS LAB SEMESTER - IV			
Subject Code	18ECECL4080	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course objectives:

The objective of the lab is to

- Perform the continuous wave & Pulse modulation & demodulation techniques.
- Perform the Digital Modulation techniques.

List of Experiments: Note: Each Experiment is verified using a) Hardware b) MATLAB program c) Simulink	**Hours**
1. Amplitude Modulation and demodulation 2. DSB-SC Modulation and demodulation and also verify using Spectrum Analyzer 3. Frequency Modulation and demodulation 4. Pre-emphasis and de-emphasis 5. Sampling Theorem 6. PWM, PPM Modulation and demodulation 7. Pulse Code Modulation 8. Delta Modulation 9. Amplitude Shift Keying 10. Frequency Shift Keying 11. Phase Shift Keying 12. Differential Phase Shift Keying	**36**

Course outcomes:

After studying this course, students will be able to:

1. Infer the modulation and demodulation techniques for continuous wave.
2. Apply the sampling theorem.
3. Analyse the modulation and demodulation techniques for

Question paper pattern:

Ten questions are given and student should choose one question (blind option), which carries 50 marks in total.

a. 15 marks are allotted for procedure including circuit diagrams and model graphs.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

Course Structure for

B.Tech (Electronics & Communication Engineering)

Semester V (Third year)

S.No	Course Code	Course Title	L	T	P	C
1	18ECECT5010	Control Systems	3	0	0	3
2	18CMEGT5020	Personality Development & Professional Communication	2	0	0	2
3	18CMMST5030	Management Science	3	0	0	3
4	18ECECT5040	Micro Processors & Micro Controllers	3	0	0	3
5	18ECECT5050	Digital Signal Processing	3	0	0	3
6	18ECECL5060	Micro Processors & Micro Controllers Lab	0	0	3	1.5
7	18ECECL5070	Digital Signal Processing Lab	0	0	3	1.5
8	18ECECR5080	Term Paper with Seminar	2	0	0	2
		Total Credits				19

Semester VI (Third year)

S.No	Course Code	Course Title	L	T	P	C
1	18CMBIT6010	Biology for Engineers	3	0	0	3
2	18ECECT6020	Computer Architectures & Organization	3	0	0	3
3	18ECECP603X	Program Elective-1	3	0	0	3
4	18ECECP604X	Program Elective-2	3	0	0	3
5	18CMMST6050	Engineering Economics and Financial Management	3	0	0	3
6	18ECECT6060	Computer Networks	3	0	0	3
7	18ECECL6070	Computer Networks Lab	0	0	3	1.5
8	18ECECL6080	Electronic Design Workshop	0	0	4	2
		Total Credits				21.5

CONTROL SYSTEMS SEMESTER V			
Subject Code	18ECECT5010	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	EM-II, SS	Credits – 03	

Course Objectives:

This course will enable the students to:

- Understand concepts of the mathematical modeling, feedback control and stability analysis in Time and Frequency domains.
- Analyze the system with state variable analysis techniques.

Unit -1	**Hours**
Introduction: System, Control System, Open Loop Control System, Closed loop Control System, Different Examples, Effects of Feedback, Feedback Characteristics and its advantages. **Mathematical models of Physical Systems:** Differential equations of physical systems, Transfer functions of Electrical, mechanical translational and rotational systems. Block diagram Algebra, Signal flow graph	**12**
Unit -2	
Controller Components: DC Servomotor (Armature Controlled and Field Controlled) with necessary derivation for transfer function, AC Servomotor and its transfer function, AC Tachometer, Potentiometer, Synchros. **Time Response Analysis:** Standard test Signals, Time response of first and second order systems, steady state errors and error constants, Design specifications of second order systems, controllers and Compensators	**10**
Unit – 3	
Concepts of Stability and Algebraic Criteria: The concept of Stability, Necessary Conditions for Stability, Routh Hurwitz Stability Criterion, Relative stability analysis **The Root Locus Technique:** Introduction, The Root Locus concepts, Construction of Root Loci, Effect of adding poles and zeros to a system	**10**
Unit – 4	
Frequency response analysis: Introduction, Correlation between time and frequency response, Polar Plots, Bode Plots, Nyquist Stability Criterion, Performance specifications in frequency-domain.	**10**
Unit – 5	
State Variable Analysis and Design: Introduction, Concepts of State, State Variables and State models, State models for linear continuous-time systems, Solution of state equations and Concepts of Controllability and Observability	**8**

Course outcomes:

On completion of the course student will be able to:

1. Characterise a control system and effects of feedback
2. Develop mathematical model of the physical systems.
3. Apply time response analysis on first and second order systems
4. Analyse the system stability using Routh Hurwitz and Root locus techniques
5. Analyse the system stability using frequency response analysis
6. Apply state variable analysis to continuous time systems and obtain the relationship between state variable representation and transfer functions.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. I.J.Nagarath and M.Gopal, **"Control Systems"**, New Age International Publishers, 5th Edition, 2014
2. Katsuhiko Ogata, **"Modern Control Engineering"**, Pearson, 4th Edition, 2012

Reference Books:

1. Ambikapathy, **"Control Systems"**, Khanna Book Publishing Co. (P) Ltd., Delhi
2. Anand Kumar, **"Control Systems",** 2nd Edition, PHI learning PVT. Ltd,2014

Web References:

1. https://nptel.ac.in/courses/108101037/
2. http://www.ee.surrey.ac.uk/Projects/CAL/control/index.htm

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	2	-
3	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
5	3	2	2	-	-	-	-	-	-	-	-	-	-	2	-
6	3	2	2	-	-	-	-	-	-	-	-	-	-	2	-
Course	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	**2**	-

S.No.	Unit Name	Text Book /Reference	Chapter No.
1	Introduction and Mathematical models of Physical Systems	T1	1,2 & 3
		T2	1 & 3
		R1	1
		R2	1,2 & 3
2	Controller Components and Time Response Analysis	T1	4 & 5
		T2	5 & 7
		R1	2
		R2	4
3	Concepts of Stability and Algebraic Criteria and The Root Locus Technique	T1	6 & 7
		T2	6
		R1	3
4	Frequency response analysis	T1	8 & 9
		T2	8
		R2	7 & 8
5	State Variable Analysis and Design	T1	12

		T2	11
		R2	10

PERSONALITY DEVELOPMENT & PROFESSIONAL COMMUNICATION SEMESTER V			
Subject Code	18CMEGT5020	Internal Marks	30
Number of Lecture Hours/Week	02	External Marks	70
Total Number of Lecture Hours	32	Exam Hours	03
Pre-requisite	---	Credits – 02	

Aim of the Course:

Personality Development and Professional Communication skills course aims at equipping students with required skills such as personality development, interpersonal communication skills, career and employability skills, problem solving, and professional communication skills to succeed in their personal and professional life as well as to build a bright career with a clear understanding of their career values through experiential learning and performing several professional tasks.

Objectives: This course will enable students to:

- Understand the process of Personality Development and learn effective methods of developing personality
- Emotional Intelligence, and Intrapersonal skills
- Career skills, Interview skills and Employability Skills
- Problem Solving skills
- Professional Communication skills

Training Methodology: The training methodology is designed to bring about changes in attitudes through experience-based learning. Activities in simulated environments such as role plays, group discussions, micro presentations, audio-video clippings, case studies, psychometric tests etc., will provide students insights into their strengths and areas for development. There will be a project work with problem analysis and presentation of the same.	**Teaching Hours 32**
Course Contents	
Unit –I	
Personality Development a) Personal Effectiveness- being proactive- principles of personal vision b) Intrapersonal communication- emotional intelligence- beginning with the end in mind- c) Time management: understanding priorities- first things first- time – personal effectiveness	**5**
Unit –2	
Emotional Intelligence and Intrapersonal Communication a) Principles of Emotional Intelligence b) Intrapersonal Communication c) Principles of creative cooperation-organization skills-Think win-win d) Principles of balanced self-renewal- Lifelong learning	**5**
Unit – 3	
Career and Employability Skills a) Understanding Career values- values grid-career thinking- what is a career?	**6**

b) Skills vs strengths- spotting skills- reflecting on skills- setting goals for developing skills c) Meeting the expectations of the employer-understanding job description, Skills Grid exercises- matching the skills with requirements d) Preparing Resume and Preparing for interviews- Structuring interview questions- CAR- Context, Action and Results	
Unit – 4	
Problem Solving Skills a) Understanding the complexity at workplace b) defining the problem- identifying the reasons c) finding possible solutions- planning actions- analysing results-feedback d) redefining the problem- the problem solving cycle	**6**
Unit – 5	
Professional Communication a) Active listening skills- note taking- b) Professional presentation skills- understanding the context- expectations of the people- putting across the message effectively- answering questions c) Technical writing skills- practical steps for writing- report writing and writing a report free from plagiarism.	**10**

Course outcomes:

On completion of the course student will be able to:

1. Understand Personality development process and learn to implement effective techniques.
2. Understand how people behave and regulate self behaviours and learn to work in a team.
3. Know their career values, indentify their skills, set goals for enhancing their career skills.
4. Understand and learn how to deal with problems and practice problem solving skills.
5. Learn the principles of professional communication & application of the same
6. Face job interviews confidently and work a team effectively

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Dr. S.P. Dhanvel, English and Soft Skills, Orient Blackswan, 2011

Reference Books:

1. Seven Habits of Highly Effective People by Stephen R Covey
2. Professional Communication by Aruna Koneru, Mc Graw Hill
3. Personality Development and Soft Skills by Barun K Mitra OUP
4. Enhance Your Employability Skills-by David Winter and Laura Brammar, published by University of London -Open Courseware

https://www.mooc-list.com/course/enhance-your-career-and-employability-skills-coursera
5. R.S.Agarwal, Verbal & Non-verbal Reasoning, S. Chand& Co. Latest ed.,2003
6. Stay Hungry and Stay Foolish speech by Steve Jobs You Tube video
7. https://www.mindtools.com/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-
2	-	-	-	-	-	-	-	-	3	2	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	2	2	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
6	-	-	-	-	-	-	-	-	2	2	-	-	-	-	-
Course	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**1**	**-**	**-**	**-**

S.No.	Unit Name	Text books/Reference Books	Chapter Number
1	Personality Development	T1	1,2,3
		R1	Part 2
2	Interpersonal Communication Skills	T1	2,4 and 8
		R1	Part 3
		R2	2 and 3
3	Career and Employability Skills	T1	7
		R4	4
4	Problem Solving Skills	T1	6
		R5	7
5	Professional Communication	T1	8 and 10
		R2	3and 4

MANAGEMENT SCIENCE
(Common to ECE,CSE,IT& EEE)
SEMESTER V

Subject Code	18CMMST5030	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course objectives:
This course will enable the students to
- Understand the concepts of Management its nature & importance, Management theories and organization principles.
- Analyse the Work study, SQC, inventory management and its techniques.
- Learn various concepts like PERT, CPM and Project crashing and recent trends in management.

Unit -I	**Hours**
Introduction to Management: Concept –nature and importance of Management – Functions of Management – Evaluation of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization - Types of organization structure.	**10**
Unit –II	
Operations Management: Principles and Types of Layouts – Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C chart). Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis).	**10**
Unit-III	
Functional Management & **Strategic Management**: **Functional Management**: Concept of HRM, HRD and PMIR- Functions of HRM - Marketing Management- Functions of Marketing, Marketing strategies based on product Life Cycle, Channels of distributions. **Strategic Management**: Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy alternatives	**12**
Unit –IV	
Project Management: **(PERT/CPM):** Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).	**10**
Unit-V	
Contemporary Management Practices: Basic concepts of MIS, MRP, Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma , Supply Chain Management, Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card.	**08**

Course outcomes:
On completion of the course student will be able to:
1. Execute the functions of Management, Principles of Management&Leadership styles.
2. Examine Statistical Quality Control Techniques, Methods of inspection, the concept of Inventory Management and Control

3. Predict the Customer Behaviour and Employees Contribution towards success of Organisation.
4. Identify different Strategies for the Development of the Organisation.
5. Analyse Project Management Techniques like CPM, PERT and Crashing.
6. Apply various contemporary issues in Management Practices like TQM, Business Process Reengineering and BPO etc.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Dr. A. R. Aryasri – Management Science, TMH 2011.
2. Dr. P.G.Ramanujam,Dr. B.V.R.Naidu and Prof.P.V.Rama Sastry: Management Science, Himalaya Publishing House 2013.

Reference Books:

1. Koontz & Weihrich: 'Essentials of Management' TMH 2011.
2. Seth & Rastogi: Global Management Systems, Cengage Learning, Delhi, 2011.
3. Robbins: Organizational Behaviors, Pearson Publications, 2011

Web References:

1. https://www.managementstudyguide.com/management_principles.htm
2. https://businessjargons.com/strategic-management.html

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-
2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
4	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
6	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Course	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**-**

	S.No.	Unit Name	Text Book Reference	Chapter No.
	1	Introduction to Management	T1	1 & 3
			T2	1
	2	Operations Management	T1	7,8,10&15
			T2	2
	3	Functional Management & Strategic Management	T1	11,12 &14
			T2	3 & 5
	4	Project Management: (PERT/CPM)	T1	16 & 17
			T2	4

	5	Contemporary Management Practices	T1	20
			T2	8

MICROPROCESSORS & MICRO CONTROLLERS

SEMESTER V

Subject Code	18ECECT5040	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	DSD	Credits – 03	

Course Objectives:

This course will enable students to

- Understand architectures and programming concepts of Micro processors and Microcontrollers.
- Apply interfacing of Micro processors and Microcontrollers with memory and other peripherals.
- Discuss the operational aspects of advanced Processors.

Unit -1	**Hours**
8086 Architecture: Introduction to 8-bit Processors, Features, Pin Description, 8086 Microprocessor Family, 8086 Internal Architecture, Interrupts, Minimum Mode and Maximum Mode Configuration of 8086.8087 Coprocessor. **8086 Programming:** Instruction set, Addressing Modes, Assembler Directives, Writing Simple Programs with an Assembler, Assembly Language Program Development Tools.	**10**
Unit -2	
8086 Interfacing: Semiconductor memories interfacing (RAM,ROM), Intel 8259 programmable interrupt controller, software and hardware interrupt applications, Intel 8255 programmable peripheral interface, keyboard interfacing, alphanumeric displays(LED,7-segment display), Intel 8279 programmable keyboard/display controller, stepper motor, A/D and D/A converters.	**10**
Unit – 3	
Intel 8051 Microcontroller: Architecture, Hardware concepts, input/output ports and circuits, external memory, counters/timers, serial data input/output, Interrupts. Assembly language programming**:** Instructions, addressing modes, simple programs, Introduction to Embedded C.	**7**
Unit – 4	
8051 I/O Interfacing & Embedded C Programming: LEDs & switches interfacing, keypad interfacing, Seven Segment Display interfacing, ADC & DAC interfacing, 2X16 LCD interfacing, stepper motor interfacing, serial port interfacing, high power devices. Introduction to Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: structuring the 'Hello Embedded World' example and goat-counting example using MAIN.H and PORT.H.	**10**
Unit – 5	
Advanced Processors: Introduction to RISC & CISC Processors, features of to 16/32 Bit processors, Advanced processor Architectures- 286, 386,486, Pentium. **ARM :** Introduction to ARM Processor Families, ARM Pipelining operation, ARM 7 (LPC2148) architecture and organization, ARM / Thumb instruction set & programming model. ARM 7 GPIO programming using Embedded C.	**13**

Course outcomes:

On completion of the course student will be able to

1. Understand the architectural and operation concepts of 8086 microprocessor.
2. Analyze programming concepts of 8086 microprocessor.
3. Apply interfacing concepts to implement microprocessor based system.
4. Interpret the architectural and operation concept of 8051 microcontroller.
5. Apply the programming model of 8051 Microcontroller using embedded C.
6. Discuss the operational aspects of advanced Processors.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. A. K. Ray, K. M. Bhurchandi, **"Advanced Microprocessors and Peripherals"**, 2nd Edition, Tata McGraw Hill Education Private Limited.
2. Muhammad Ali Mazidi, Rolin mckinlay Janice Gillispie Mazidi, **"The 8051 Microcontroller and Embedded Systems Using Assembly and C"**, 2nd Edition Pearson.
3. A.Sloss, D.Symes, C.Wright, **"ARM system Developers Guide: Designing and Optimizing System Software"**, Morgan Kaufmann publishers, 2003.

Reference Books:

1. Douglas V Hall, SSSP Rao, **"Microprocessors and Interfacing – Programming and Hard ware"**, 3rd Edition, Tata McGraw Hill Education Private Limited.
2. Kenneth J. Ayala, **"The 8051 Microcontroller"**, Penram International Publishing, 1996.
3. R. S. Gaonkar, **"Microprocessor Architecture: Programming and Applications with the 8085/8080A"**, Penram International Publishing, 1996

Web References:

1. http://www.zseries.in/embedded%20lab/8085%20microprocessor/#.Uutnt2c2F1c
2. http://www.slideshare.net/harinder0884/evolution
3. http://nptel.ac.in/courses/106108100/
4. http://www.slideshare.net/yayavaram/8086-class-notesynm#
5. https://en.wikipedia.org/wiki/PIC_microcontrollers

Course Outcomes Mapping with Program Outcomes:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
2	3	3	1	1	-	-	-	-	-	-	-	-	3	-	-
3	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
4	3	-	1	1	-	-	-	-	-	-	-	-	3	-	-
5	3	3	3	2	-	-	-	-	-	-	-	-	3	-	-
6	3	2	-	-	-	-	-	-	-	-	-	-	3		
Cours	**3**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**

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S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	8086 Architecture & 8086 Programming	T1	1,2
		R3	4,5,6
2	8086 Interfacing	T1	3, 4 & 5
3	Intel 8051 Microcontroller	T2	1,2,3& 4
		R2	3
4	8051 I/O Interfacing & Embedded C Programming	T2	7,12&13
		R2	4,9
5	Advanced Processors	T1	9,10,12
		T3	2,3,4,5
		R1	15,16

DIGITAL SIGNAL PROCESSING SEMESTER V			
Subject Code	18ECECT5050	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Signals & Systems	Credits – 03	

Course Objectives:

This course will enable students to

- Analyze the Discrete Time Signals and compute different FFT algorithms
- Learn the FIR and IIR filter design procedures and need of Multirate signal Processing
- Understand the basics of DSP Processors

Unit -1	**Hours**
Introduction: Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Invertability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.	**8**
Unit -2	
Discrete Fourier Series & Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.	**12**
Unit – 3	
Design of IIR Digital Filters& Realizations: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.	**12**
Unit – 4	
Design of FIR Digital Filters & Realizations: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters, Basic structures of FIR systems, Lattice structures, Lattice-ladder structures	**10**
Unit – 5	
Multirate Digital Signal Processing: Introduction, Decimation, Interpolation Sampling rate conversion, Implementation of sampling rate converters. Applications – Sub-band Coding of Speech Signals. **DSP Processors:** Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. **Architecture of TMS320C5X:** Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.	**8**

Course outcomes:

On completion of the course student will be able to

1. Apply the difference equations concept for analyzing the Discrete Time Systems
2. Use the FFT algorithm for solving the DFT of a given signal
3. Design a Digital IIR filter for the given specifications
4. Design a Digital FIR filter for the given specifications
5. Use Multirate signal Processing concepts in various applications.
6. Apply the signal processing concepts on DSP Processor.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, **"Digital Signal Processing, Principles, Algorithms, and Applications",**Pearson Education / PHI, 2007.
2. A.V.Oppenheim and R.W. Schaffer, **"Discrete Time Signal Processing",** PHI
3. B.Venkataramani, M.Bhaskar, " **Digital Signal Processors, Architecture, Programming and Applications"**, TATA McGraw Hill, 2002

Reference Books:

1. Andreas Antoniou, **"Digital Signal Processing",** TATA McGraw Hill , 2006
2. Robert J. Schilling, Sandra L. Harris, **"Fundamentals of Digital Signal Processing using Matlab",**Thomson, 2007.

Web References:

1. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring 2011/video-lectures/
2. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/study-materials/
3. https://nptel.ac.in/courses/117102060/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
3	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
4	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	**3**	-

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Introduction	T1	1 & 2
		T2	1 & 2
2	Discrete Fourier Series & Fourier Transforms	T1	7 & 8
		T2	3 & 6
		R1	7
		R2	3
3	Design of IIR Digital Filters& Realizations	T1	10
		T2	5
		R1	11
		R2	8
4	Design of FIR Digital Filters & Realizations	T1	10
		T2	5
		R1	9
		R2	6
5	Multirate Digital Signal Processing & Digital Signal Processors	T1	11
		T3	2 & 3
		R1	18

MICRO PROCESSORS & MICRO CONTROLLERS LAB SEMESTER - V			
Subject Code	18ECECL5060	Internal Marks	50
Number of Practical Hours/Week	03	External Marks	50
Total Number of Practical Hours	36	Exam Hours	03
Credits – 1.5			

Course objectives:

The objective of this course is to

- Understand architectures and programming concepts of Micro processors and Microcontrollers to implement algorithms and to write assemble language programs.
- Apply interfacing concepts to design Micro processors and Microcontrollers based systems.

In this lab different types of microprocessor and microcontroller development boards, I/O interfacing modules and communication modules along with software simulation Tools	**Hours**
PART- A: (Minimum of 3 Experiments has to be performed) **8086 Assembly Language Programming using MASAM/TASM** 1. Signed and unsigned Arithmetic operation -(Multi byte Addition and Subtraction, Multiplication and Division) 2. Logical Operations- (Shift and rotate- Converting packed BCD to unpacked BCD, BCD to ASCII conversion) 3. Factorial of given n-numbers 4. String Operations - (Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison). 5. DOS/BIOS programming : Reading keyboard (Buffered with and without echo) - Display characters, Strings. **PART- B: (Minimum of 3 Experiments has to be performed)** **8086 Interfacing** 1. Hardware/Software Interrupt Application 2. A/D Interface through Intel 8255 3. Keyboard and Display Interface through Intel 8279 4. Generation of waveforms using Intel 8255 5. Stepper Motor interfacing **PART- C: (Minimum of 3 Experiments has to be performed)** **8051 Embedded C Programming and Interfacing** 1. Different timer mode operations for LEDs Interfacing with 8051 2. Simple Calculator using 4 digit seven segment display and Hex Keyboard interface to 8051 3. Alphanumeric LCD panel to 8051 for real time clock operation 4. External ADC and Temperature control interface to 8051 5. Serial Communication Implementation between to 8051 boards **PART- D: (Minimum of 3 Experiments has to be performed)** **LPC2148 with Embedded C Programming and Interfacing** 1. Switches and LEDs interfacing with the ARM- LPC 2148 controller board 2. Interfacing of 2*16 LCD display with the ARM- LPC 2148 controller board	**36**

3. Implement the developer board as a modem for data communication using serial port communication between two PC's. 4. Implement two digit 7-segment display with the ARM- LPC 2148 controller board.	
Hardware/Software Requirements: 1. MASM/TASM software 2. 8086 Microprocessor Kits 3. 8051 Micro Controller kits 4. LPC2148 Microcontroller kits 5. Interfaces/peripheral subsystems i) 8259 PIC ii) 8279-KB/Display iii) 8255 PPI iv) Stepper motor control board and motor 6. A/D and D/AC Interface 7. RTC module 8. 7 Segment modules 9. Microcontroller compact software tools	
Course outcomes: After studying this course, students will be able to: 1. Understand the architectural and operation concepts of 8086 microprocessor to implement algorithms to solve problems. 2. Analyze programming concepts of 8086 microprocessor to develop assemble language programs. 3. Apply interfacing concepts to implement microprocessor based system 4. Interpret the architectural and operation concept of 8051 microcontroller to implement algorithms to solve problems. 5. Apply the programming model of 8051 Microcontroller using embedded C to design Microcontroller based systems. 6. Use different tools to implement microprocessor and microcontroller based systems.	
Question paper pattern: Ten questions are given and student should choose one question (blind option), which carries 50 marks in total. a. 15 marks are allotted for procedure including program b. 15 marks for conduction of the experiment. c. 10 marks for results and conclusions. d. 10 marks for viva voce.	

DIGITAL SIGNAL PROCESSING LAB SEMESTER - V			
Subject Code	18ECECL5070	Internal Marks	50
Number of Practical Hours/Week	03	External Marks	50
Total Number of Practical Hours	36	Exam Hours	03
Credits – 1.5			

Course objectives:

The objective of this course is to

- Generate the fundamental discrete time signals and perform convolution and DFT operations
- Design FIR and IIR filters.
- Perform basic operations in image processing

The programs shall be implemented in software (Using MATLAB/CCStudio) and Student has to perform at least FOUR Experiments in each part	**Hours**
PART-1(Signals) 1) Generation of discrete time signals for discrete signals 2) To verify the Linear Convolution a) Using MATLAB b) Using Code Composer Studio(CCS) 3) To verify the Circular Convolution for discrete signals a) Using MATLAB b) Using Code Composer Studio(CCS) 4) To verify Discrete Fourier Transform(DFT) and Inverse Discrete Fourier Transform(IDFT) a) Using MATLAB b) Using Code Composer Studio(CCS) **5)** Audio application such as to plot a time and frequency display of microphone plus a cosine using DSP. Read a .wav file and match with their respective spectrograms. **6)** Noise removal: Add noise above 3 KHz and then remove, interference suppression using 400 Hz tone **PART-2 (Filters)** 7) Frequency Response of IIR low pass Butterworth Filter 8) Frequency Response of IIR high pass Butterworth Filter 9) Frequency Response of IIR low pass Chebyshev Filter 10) Frequency Response of IIR high pass Chebyshev Filter 11) Frequency Response of FIR low pass Filter using Rectangle Window 12) Frequency Response of FIR low pass Filter using Triangle Window **PART – 3 (Image Processing)** 13) An image processing in a false contouring system 14) To generate the histogram equalization to the image 15) To verify the Normalized Cross Correlation to the addition of noise and removal of noise using filters to an image. 16) Compute the edge of an image using spatial filters. 17) Perform the image motion blur and calculate PSNR to the noise image and also noise free image.	**36**

18) To verify the PSNR to the Second order Decomposition of Discrete Wavelet transforms and to the reconstructed image using inverse Discrete Wavelet transform	

Course outcomes:

After studying this course, students will be able to

1. Generate the fundamental discrete time signals and perform addition operation between sinusoidal signals
2. Perform linear and circular convolution operations
3. Perform DFT and IDFT operations
4. Design a Digital IIR filter for the given specifications
5. Design a Digital FIR filter for the given specifications
6. Perform basic operations in image processing and its applications.

Question paper pattern:

Ten questions are given and student should choose one question (blind option), which carries 50 marks in total.

a. 15 marks are allotted for procedure including program.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

BIOLOGY FOR ENGINEERS SEMESTER - VI			
Subject Code	18CMBIT6010	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- convey that Biology is as important as scientific discipline as Mathematics, Physics and Chemistry
- convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
- convey that "Genetics is to biology what Newton's laws are to Physical Sciences"
- convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
- convey that without catalysis life would not have existed on earth
- molecular basis of coding and decoding genetic information is universal
- analyses biological processes at the reductionist level
- fundamental principles of energy transactions are the same in physical and biological world.

Unit -1 Introduction	**Hours**
Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology. How biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.	**8**
Unit -2 Classification	
Hierarchy of life forms at phenomenological level- classification based on (a) cellularity- Unicellular or multicellular (b) ultra structure- prokaryotes or eucaryotes. (c) energy and Carbon utilization - Autotrophs, heterotrophy, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureoteli (e) Habitata - acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus	**8**
Unit – 3 Genetics & Biomolecules	
Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. **Molecules of life:**Monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	**12**
Unit – 4 Enzymes & Proteins	

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions - Enzyme classification. Mechanism of enzyme action. -examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. **Proteins**- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. **Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosides. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination	**12**
Unit – 5 Microbiology & Metabolism	
Thermodynamics as applied to biological systems - Exothermic and endothermic versus undergone and exergoinc reactions. Concept of K_{eq} and its relation to standard free energy - Spontaneity - ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge **Concept of single celled organisms**. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics	**10**

Course outcomes:

On completion of this course, students are able to

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

References:

1. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
2. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	3	2	-	-	-	-	-	-	-	-
2	-	-	-	-	-	2	3	-	-	-	-	-	-	-	-
3	1	-	-	-	-	3	-	-	-	-	-	-	-	-	-
4	3	-	-	-	-	-	2	-	-	-	-	-	-	-	-
5	2	-	-	-	-	3	-	-	-	-	-	-	-	-	-
6	3	-	-	-	-	3	3	-	-	-	-	-	-	-	-
Course	**1**	**-**	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

COMPUTER ARCHITECTURES & ORGANIZATION SEMESTER VI			
Subject Code	18ECECT6020	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	---	Credits – 03	

Course Objectives:

This course will enable students to

- Understand the concepts of basic structure of Computers, machine instructions and programs.
- Understand memory and I/O devices.
- Understand the concepts of parallel processing and pipelining.

Unit -1	**Hours**
Basic Structure of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development. Processor organization, Information representation, number formats. Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats	**12**
Unit -2	
Machine Instruction and Programs: Instruction and Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, Basic Instruction Types, Addressing Modes, Basic Input/output Operations, The role of Stacks and Queues in computer programming equation. Component of Instructions: Arithmetic Instructions, Logic Instructions, shift and Rotate Instructions, Branch Instructions.	**12**
Unit – 3	
Input/ Output Organization: Accessing I/O Devices, Interrupts: Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access, Buses: Synchronous Bus, Asynchronous Bus, Interface Circuits, Standard I/O Interface: Peripheral Component Interconnect (PCI) Bus, Universal Serial Bus (USB)	**10**
Unit – 4	
The Memory Systems: Basic memory circuits, Memory System Consideration, Read-Only Memory: ROM, PROM, EPROM, EEPROM, Flash Memory. **Cache Memories:** Mapping Functions, INTERLEAVING **Secondary Storage:** Magnetic Hard Disks, Optical Disks.	**08**
Unit – 5	
Processing Unit: Fundamental Concepts: Register Transfers, Performing An Arithmetic Or Logic Operation, Fetching A Word From Memory, Execution of Complete Instruction, Hardwired Control, **Micro programmed Control:** Microinstructions, Micro program Sequencing, Wide Branch Addressing Microinstructions with next –Address Field. Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network	**08**

Course outcomes:

On completion of the course student will be able to

1. Understand the basic structure of Computers and their functional units.
2. Analyze the machine instruction and programming concepts.

3. Analyze the interface between the peripheral devices.
4. Analyze different types of memories.
5. Understand the operation of processing unit.
6. Interpret parallel processing, Pipelining and parallel processing concepts.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. Carl Hamacher, Zvonks Vranesic, Safea Zaky, **"Computer Organization"**, 5th Edition, McGraw Hill.
2. John P. Hayes, **"Computer Architecture and Organization"**, 3rd Edition, McGraw Hill.

Reference Books:

1. William Stallings, **"Computer Organization and Architecture"**, 6th Edition, Pearson/PHI
2. Andrew S. Tanenbaum, **"Structured Computer Organization"**, 4th Edition PHI/Pearson
3. Sivaraama Dandamudi, **"Fundamentals or Computer Organization and Design"**, Springer Int. Edition.

Web References:

1. https://nptel.ac.in/courses/106106092/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-823-computer-system-architecture-fall-2005/lecture-notes/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
2	3	2	3	-	-	-	-	-	-	-	-	-	3	-	-
3	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
4	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
5	3	1	3	-	-	-	-	-	-	-	-	-	3	-	-
6	3	1	3	-	-	-	-	-	-	-	-	-	3	-	-
Course	**3**	**1**	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Basic Structure of Computers	T1	1,6
2	Machine Instruction and Programs	T1	2
		R2	5
3	Input/ Output Organization	T1	4
		R1	7
4	The Memory Systems	T1	5

		R1	4,5,6
5	Processing Unit	T1	7,8,12

ANTENNAS AND WAVE PROPAGATION
(Program Elective-I)
SEMESTER VI

Subject Code	18ECECP6031	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	EMTL	Credits – 03	

Course Objectives:
This course will enable students to

- Understand the concepts of radiation mechanism and antenna parameters
- Apply the knowledge of electromagnetic radiation for wire antennas and loop antennas
- Analyze and compare the characteristics of various antenna arrays
- Analyze non-resonant and broadband antennas and differentiate wave propagation modes and their propagation characteristics

Unit -1	**Hours**
Fundamental Concepts: Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Polarization, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.	**08**
Unit -2	
Radiation from Wires and Loops: Fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of λ/2 antenna, Fields of thin linear antenna with uniform travelling wave, Loop antenna general case and Radiation resistance of loop antenna.	**10**
Unit – 3	
Antenna Arrays : Array of two isotropic point sources, non isotropic point sources and principle of multiplication of patterns, Linear array of n point sources (Broad side array, End-fire array) , Linear array with non-uniform amplitude distribution, array of two driven λ/2 elements broad side case, array of two driven λ/2 elements end fire case. Horizontal and vertical antennas above a plane ground. Binomial Array	**12**
Unit – 4	
Micro Strip Antennas: Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. **VHF and UHF Antennas:** Broadband Antennas-Helical antenna, Practical design considerations, Principle of operation. Reflector antennas, parabolic reflector, corner reflector, Feed methods for parabolic reflectors, Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning, Applications. Smart Antennas-Basic concepts and benefits.	**12**
Unit – 5	
Radio Wave Propagation: Ground Wave Propagation, Space Wave Propagation: Field Strength Relation, Effect of Earth, Super Refraction, Tropospheric	**08**

Propagation. Sky Wave Propagation: Structural details of the Ionosphere, Wave propagation Mechanism, Refraction and Reflection of Sky waves by Ionosphere, Ray Path, Critical frequency, MUF,LUF,OF, virtual Height and Skip distance, Relation between MUF and the Skip Distance, Multi-Hop propagation.	

Course outcomes:

On completion of the course student will be able to

1. Understand the concepts of radiation mechanism and antenna parameters
2. Apply electromagnetic radiation for wire antennas and loop antennas
3. Analyze and compare the characteristics of various antenna arrays
4. Analyze non-resonant and broadband antennas
5. Design VHF, UHF and Microwave antennas
6. Differentiate wave propagation modes and their propagation characteristics

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit..

Text Books:

1. C.A. Balanis, **"Antenna Theory"**, 2nd Edition, John Wiley and Sons, 2001.
2. K.D. Prasad, Satya Prakashan, **"Antennas and Wave Propagation"**, Tech India Publications, New Delhi, 2001.

Reference Books:

1. John D. Kraus and Ronald J. Marhefka, **"Antennas for All Applications"**, 3rd Edition, TMH, 2003.
2. E.C. Jordan and K.G. Balmain, **"Electromagnetic Waves and Radiating Systems"**, 2nd Edition, PHI, 2000.

Web References:

1. https://nptel.ac.in/courses/108101092/
2. https://nptel.ac.in/courses/117107035/

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
3	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
4	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
5	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
6	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**2**	**1**	-	-	-	-	-	-	-	-	**1**	-	**3**	-

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Fundamental Concepts	T1	1 & 2
		T2	6
		R1	2
2	Radiation From Wires And Loops	T1	4 & 5
		T2	5
		R1	5 & 6
3	Antenna Arrays	T1	6
		T2	7
		R1	4
4	Micro Strip, VHF & UHF Antennas	T1	9, 14 & 15
		T2	9 & 10
		R1	7
5	Radio Wave Propagation	T2	15
		R2	17

CMOS VLSI DESIGN
(Program Elective – I)
SEMESTER VI

Subject Code	18ECECP6032	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	ED & DSD	Credits – 03	

Course Objectives:
This course will enable students to
- Learn all aspects of fundamental concepts of IC fabrication and designs steps.
- Design various combinational circuits and sequential design concepts under CMOS digital design methodologies.
- Understand the concepts of CMOS analog design for amplifiers and op-amps.

Unit -1	**Hours**
Introduction: Introduction to IC Technology, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes, BiCMOS Technology, Comparison between CMOS and Bipolar technologies. **Basic Electrical Properties of CMOS Circuits:** I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit, Pass transistor, Alternative forms of pull-up, CMOS Inverter, MOS transistor circuit model, Latch-up in CMOS circuits, Bi-CMOS Inverter.	**12**
Unit -2	
Combinational Circuits using CMOS digital logic: Static CMOS Design, Complementary CMOS, Ratioed Logic, Pass-Transistor Logic, Dynamic CMOS Design, Dynamic Logic: Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates.	**8**
Unit – 3	
Sequential Circuits using CMOS digital logic: Static Latches and Registers, Dynamic Latches and Registers, Timing Issues, Pipelines, Pulse and sense amplifier based Registers, Nonbistable Sequential Circuits.	**8**
Unit – 4	
Analog CMOS Sub-Circuits: MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference. CMOS Amplifiers: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.	**12**
Unit – 5	
CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.	**10**

Course outcomes:
Upon completion of the course, students will be able to
1. Identify the industry standard fabrication techniques for IC manufacturing.
2. Formulate the current and voltage relations in CMOS logic based transistor design.
3. Design combinational logic circuits based on CMOS digital logic.
4. Design sequential logic circuits based on CMOS digital logic.
5. Analyze amplifier designs using CMOS analog logic.

6. Analyze op-amps designs using CMOS analog logic.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

TEXT BOOKS:

1. Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, **"Essentials of VLSI Circuits and Systems"**, Prentice-Hall of India Private Limited, 2005 Edition.
2. Jan Rabaey, Anantha Chandrakasan, B Nikolic, **"Digital Integrated Circuits: A Design Perspective"**, Second Edition, Feb 2003, Prentice Hall of India.
3. Behzad Razavi, **"Design of Analog CMOS Integrated Circuits"**, TMH Edition.

Reference Books:

1. Jacob Baker, "**CMOS: Circuit Design, Layout, and Simulation"**, Third Edition, Wiley IEEE Press 2010 3rd Edition.
2. M J Smith, **"Application Specific Integrated Circuits"**, Addison Wesley 1997.
3. N.Weste, K. Eshraghian, **"Principles of CMOS VLSI Design"**, Second Edition, Addison Wesley 1993.

Web References:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-374 analysis-and-design-of-digital-integrated-circuits-fall-2003/lecture-notes/
2. www.ee.iitm.ac.in/~ani/2013/ee5390/lectures.html
3. bwrcs.eecs.berkeley.edu/Classes/icdesign/ee241_s00/LECTURES/index.html
4. www.rnbs.hiroshima-u.ac.jp/RCNS/lecture/pdf/HJM.../OHP_CMOS_1(H20-4-11).pdf
5. https://www.ece.ucdavis.edu/~ramirtha/EEC116/F11/F11.html

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	-	3	3	-	-	-	-	-	-	-	-	-	-	3
2	3	-	3	3	-	-	-	-	-	-	-	-	-	-	3
3	3	-	2	2	-	-	-	-	-	-	-	-	-	-	2
4	3	-	3	3	-	-	-	-	-	-	-	-	-	-	3
5	3	-	3	3	-	-	-	-	-	-	-	-	-	-	3
6	3	-	3	3	-	-	-	-	-	-	-	-	-	-	3
Course	**3**	-	**3**	3	-	-	-	-	-	-	-	-	-	-	**3**

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Introduction and Basic Electrical Properties of CMOS Circuits	T1	1 & 2
2	Combinational Circuits using CMOS digital logic	T2,R2	6
3	Sequential Circuits using CMOS digital logic	T2	7

4	Analog CMOS Sub-Circuits	T3,R1	4 & 5
5	CMOS Operational Amplifiers	T3	9

ADVANCED DIGITAL SIGNAL PROCESSING **(Program Elective-I)** SEMESTER VI			
Subject Code	18ECECP6033	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Digital Signal Processing	Credits – 03	

Course Objectives:

This course will enable students to:

- Understand the algorithms for signal processing applications
- Study Finite word length effects in Fixed point DSP Systems.

Unit -1	**Hours**
Discrete and Fast Fourier Transforms: Properties of DFT, Linear Filtering methods based on the DFT, Overlap save, Overlap -Add methods, frequency analysis of signals, Radix-2 FFT and Split- Radix FFT algorithms, The Goertzel and Chirp Z transform algorithms.	**12**
Unit -2	
Multi Rate Signal Processing: Review of Decimation and Interpolation, Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Sub-band Coding of Speech Signals, Quadrature Mirror Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion.	**8**
Unit – 3	
Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman Tukey methods, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation.	**12**
Unit – 4	
Implementation of Digital Filters: Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.	**10**
Unit – 5	
Analysis of Finite Word Length Effects in Fixed-Point DSP Systems: Fixed, Floating Point Arithmetic – ADC quantization noise & signal quality – Finite word length effect in IIR digital Filters – Finite word length effects in FFT algorithms.	**8**

Course outcomes:

On completion of the course student will be able to

1. Comprehend the DFTs and FFTs.
2. Acquire the basics of multi rate digital signal processing
3. Demonstrate the applications of multi rate digital signal processing

4. Analyze the power spectrum estimation.
5. Implement the digital filters.
6. Comprehend the Finite word length effects in Fixed point DSP Systems.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. J.G.Proakis & D.G.Manolokis, **"Digital Signal Processing – Principles, Algorithms Applications"**, PHI.
2. Alan V Oppenheim & Ronald W Schaffer, **"Discrete Time signal processing"**, PHI.

Reference Books:

1. S. M .Kay, **"Modern Spectral Estimation Techniques"**, PHI, 1997.
2. Emmanuel C. Ifeacher Barrie. W. Jervis, **"DSP – A Practical Approach"**, Pearson Education.

Web References:

1. https://nptel.ac.in/courses/117101001/
2. https://dss.tf.uni-kiel.de/index.php/teaching/lectures/lecture-advanced-digital-signal-processing

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
3	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
4	3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**3**	**1**	-	-	-	-	-	-	-	-	-	-	**3**	-

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Discrete and Fast Fourier Transforms	T1	8
		T2	3 & 6
2	Multi Rate Signal Processing	T1	11
		R2	8
3	Power Spectral Estimation	T1	14
		T2	11
		R1	4 & 5
		R2	10

4	Implementation of Digital Filters	T1	10
		T2	5
5	Analysis of Finite Word Length Effects in Fixed-Point DSP Systems	T2	9
		R2	7

MICROWAVE THEORY AND TECHNIQUES (Program Elective-II) SEMESTER VI			
Subject Code	18ECECP6041	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	EMTL	Credits – 03	

Course Objectives:

This course will enable the students to :

- Understand the generation & amplification of the microwave signals and obtain the characteristics of O & M Type Tubes.
- Analyze the passive components for microwave systems and obtain the characteristics of these components.
- Analyze the reciprocal and nonreciprocal devices at microwave frequencies
- Analyze the Microwave design principles and Microwave Antennas and Measure various Microwave parameters (VSWR, Impedance, etc.).

Unit -1	**Hours**
Introduction to Microwaves- History, Microwave Spectrum and Bands, Applications of Microwaves. Effects of microwaves on human body. **Microwave Tubes (O-type & M Type):** Limitations of Conventional Tubes at Microwave Frequencies, Klystron: Velocity Modulation Process. Bunching Process, Output Power and Beam Loading, Reflex Klystron: Velocity Modulation, Power Output and Efficiency, Electronic Admittance. Helix Traveling Wave Tube Amplifiers, Amplification Process, Wave Modes and Gain Considerations (Qualitative analysis only). Cylindrical Magnetron, Forward Wave Crossed Field Amplifier, Backward Wave Oscillator	**10**
Unit -2	
Microwave Passive Components: Waveguide Adapters, Matched Termination, Rectangular to Circular Waveguide Transitions, Waveguide Corners, Bends and Twists, Attenuators and Phase Shifters, Waveguide Tees - E-plane Tee, H-plane Tee, Magic Tee and their applications, Tee Junction Parameters, Introduction to S parameters ,Properties of S parameters, S Matrix derivation for all components, Directional Couplers, Coupler Parameters, Applications of Directional Couplers, Propagation in ferrites, Ferrite Devices, Faraday Rotation Isolator, Gyrator, Circulator	**10**
Unit – 3	
Microwave Active and Solid State Devices: Microwave active components: Diodes, Transistors, Oscillators, Mixers. Solid State Devices-Gunn-Effect Diodes - GaAs Diode, Gunn Effect, Ridely-Watkins-Hilsun (RWH) Theory, Differential Negative Resistance, Two-Valley Model Theory, Modes of Operation, Avalanche Transit-Time Devices: IMPATT, TRAPATT and BARITT diodes, Schottky Barrier diodes, PIN diodes	**10**
Unit – 4	
Microwave Design Principles: Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas- Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne	**12**

systems, Planar Antennas.	
Unit – 5	
Microwave Measurements: Description of Microwave Bench Features, Precautions, Measurement of Power, Attenuation, Frequency, Q of cavity, Phase shift, VSWR, Impedance, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure.	**08**

Course outcomes:

On completion of the course student will be Able to

1. Understand the generation & amplification of the microwave signals and obtain the characteristics of O & M Type Tubes.
2. Analyze the passive components for microwave systems and obtain the characteristics of these components.
3. Analyze the reciprocal and nonreciprocal devices at microwave frequencies
4. Analyze the Microwave design principles
5. Analyze the Microwave antennas
6. Measure various Microwave parameters (VSWR, Impedance, etc.).

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. Samuel Y. Liao, **"Microwave Devices and Circuits"**, 3rd Edition, PHI,1994.
2. M.Kulkarni, **"Microwave and Radar Engineering",** 3rd Edition, Umesh Publications,
3. R.E. Collin, **"Foundations for Microwave Engineering",** 2nd Edition, IEEE Press, John Wiley, 2002.

Reference Books:

1. I.J. Bahl and P. Bhartia, **"Microwave Solid State Circuit Design",** 2nd Edition, John Wiley, 2003
2. Annapurna Das and Sisir K.Das, **"Microwave Engineering",** 3rd Edition, Tata McGraw Hill Education.
3. G S N Raju , **"Microwave Engineering",** I K International

Web References:

1. https://nptel.ac.in/courses/108101112/
2. https://onlinecourses.nptel.ac.in/noc18_ee23/preview

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
2	3	3	2	-	-	-	-	-	-	-	-	2	-	3	-
3	3	3	-	-	-	-	-	-	-	-	-	2	-	3	-
4	3	3	3	-	-	-	-	-	-	-	-	2	-	3	-
5	2	3	3	-	-	-	-	-	-	-	-	2	-	3	-
6	2	2	-	3	-	-	-	-	-	-	-	2	-	3	-
Cours e	**3**	**3**	**1**	-	-	-	-	-	-	-	-	**2**	-	**3**	-

S.No.	Unit Name	Text Book/Reference	Chapter No.
1	Microwave Tubes (O-Type & M Type)	T1	9 & 10
		T2	8
		R2	9 & 11
2	Microwave Passive Components	T1	4
		T2	6
3	Microwave Active And Solid State Devices	T1	7 & 8
		T2	9
		R2	10
4	Microwave Design Principles	T3	5, 8 & 12
		R1	4 & 10
5	Microwave Measurements	T2	7
		R2	13

DIGITAL DESIGN THROUGH VERILOG HDL
(Program Elective – II)
SEMESTER VI

Subject Code	18ECECP6042	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	--	Credits – 03	

Course Objectives:
Students able to,

- Understand the basic concepts of Verilog HDL and learn different modeling techniques.
- Construct digital circuits and corresponding RTL modeling using different styles along with related test bench based verification.
- Learn FPGA based design concepts depending on available architectures.

Unit -1	**Hours**
Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.	**10**
Unit -2	
Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit. **Modeling at Dataflow Level:** Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.	**10**
Unit – 3	
Behavioural Modeling: Introduction, Operations and Assignments, Functional Bifuracation, 'Initial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, Parallel Blocks, Force-Release, Construct, Event. **Switch Level Modeling:** Basic Transistor Switches, CMOS Switches, Bi-Directional Gates, Time Delays with Switch Primitives, **System Tasks, Functions and Compiler Directives:** Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.	**12**
Unit – 4	
Sequential Circuit Description: Sequential Models - Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis. Components Test and Verification: Test Bench - Combinational Circuits Testing, Sequential Circuit Testing, Test Bench Techniques, Design Verification, Assertion Verification.	**10**

Unit – 5	
FPGA Fundamentals: Basic FPGA architecture, FPGA configuration, configuration modes, FPGA design process- FPGA design flow, FPGA families, FPGA design examples-stack, queue and shift register implementation using VHDL, step-by-step approach of FPGA design process on Xilinx environment.	**8**

Course outcomes:

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

1. Understand the basics of Verilog hardware description languages.
2. Apply the gate level and dataflow modeling styles to all digital circuits.
3. Construct digital circuits using behavioral modeling.
4. Understand switch level modeling along with system tasks and functions.
5. Implement sequential logic design and analyze the models by learning test bench programming.
6. Understand various architectures of commercial FPGAs.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

TEXT BOOKS:

1. T.R. Padmanabhan, B Bala Tripura Sundari, **"Design Through Verilog HDL"**, Wiley 2009.
2. J. Bhasker, **"Verilog HDL Primer"**, 2nd Edition, BS Publications,2001.
3. Michael D.Ciletti, **"Advanced Digital Design with the Verilog HDL"**, Xilinx Design Series, Pearson Education.

Reference Books:

1. Stephen Brown, Zvonkoc Vranesic, **"Fundamentals of Digital Logic with Verilog Design"**, TMH, 2nd Edition.
2. Sunggu Lee, **"Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA"**, Cengage Learning, 2012.
3. Samir Palnitkar, **"Verilog HDL"**, 2nd Edition, Pearson Education, 2009.
4. Michel D. Ciletti, **"Advanced Digital Design with Verilog HDL"**, PHI,2009.

Web References:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer.../lecture-notes/
2. https://nptel.ac.in/courses/106105165/8
3. 3.

https://www.ece.umd.edu/courses/enee359a/verilog_tutorial.pdf

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	-	-	1	-	-	-	-	-	-	-	-	-	3
2	3	2	3	-	2	-	-	-	-	-	-	-	-	-	3
3	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
4	3	2	2	-	2	-	-	-	-	-	-	-	-	-	3
5	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
6	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
Cours e	**3**	**2**	**2**	-	2	-	-	-	-	-	-	-	-	-	**3**

Unit No	Unit Description	Text book/ Reference	Chapter No
1	Introduction to Verilog HDL	T1	2,3
		R1	3
2	Gate level Modeling	T1	4,5
		R1	4,5
3	Behavioral Modeling, Switch level Modeling and System Task & Functions.	T1	7,8,10,11
		R2	5
4	Sequential Circuit Description	T2	8,9
		R3	7,8
5	FPGA Fundamentals	T3	8
		R4	8

DIGITAL IMAGE PROCESSING (Program Elective-II) SEMESTER VI			
Subject Code	18ECECP6043	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Digital Signal Processing	Credits – 03	

Course Objectives:

This course will enable students to:

- Familiarize with fundamentals of digital image processing and different transforms
- Understand image processing concepts of enhancement, restoration, color image processing , compression, segmentation and wavelets

Unit -1	**Hours**
Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. **Image Transforms:** Need for image transforms,2-d Discrete Fourier transform (DFT) and its properties, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD , Comparison of different image transforms	**12**
Unit -2	
Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods **Filtering in the Frequency Domain:** Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering Implementation	**10**
Unit – 3	
Image Restoration: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter **Color image processing:** Color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.	**7**
Unit – 4	
Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding **Image segmentation:** Fundamentals, point, line, edge detection, thresholding, region – based segmentation.	**12**

Unit – 5	
Wavelets: Image pyramids, sub band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimensions. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets. **Case Studies:** Feature Detection, Face Recognition, Image Cryptography	**9**

Course outcomes:

On completion of the course student will be able to

1. Understand the fundamentals and transforms of digital image processing
2. Apply image enhancement and filtering concepts in spatial and frequency domains.
3. Apply image restoration and understand color image processing techniques.
4. Apply different segmentation algorithms on digital images
5. Analyze digital images using compression algorithms
6. Analyze digital images using wavelets

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. R. C. Gonzalez and R. E. Woods, **"Digital Image Processing"**, 3rd edition, Prentice Hall, 2008.
2. Anil K.Jain, **"Fundamentals of Digital Image Processing"**, Prentice Hall of India, 7th Edition, Indian Reprint, 1989

Reference Books:

1. R. C. Gonzalez, R. E. Woods and Steven L. Eddins , **"Digital Image Processing Using MATLAB"** , 2nd edition, Prentice Hall, 2009.
2. S.Sridhar, **"Digital Image Processing"**, oxford publishers, 2011
3. M.C. Trivedi, **"Digital Image Processing"**, Khanna Book Publishing House

Web References:

1. https://nptel.ac.in/courses/117105079/
2. http://www.cs.rug.nl/~roe/courses/ip.html

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	2	-	-	2	-	-	-	-	-	-	-	-	3	-
2	3	2	-	-	3	-	-	-	-	-	-	-	-	3	-
3	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
4	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
5	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
6	3	3	-	-	3	-	-	-	-	-	-	-	-	3	-
Course	**3**	**3**	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-

S.No.	Unit Name	Text Book /Reference	Chapter No.
1	Introduction and Image Transforms	T1	1 & 2
		T2	4 & 5
		R2	1, 2 ,3 & 4
		R3	1
2	Intensity Transformations and Spatial Filtering and Filtering in the Frequency Domain	T1	3 & 4
		T2	7
		R3	2 & 3
3	Image Restoration and Color Image Processing	T1	5 & 6
		R2	5
		R3	4 & 5
4	Image compression and Image segmentation	T1	8 & 10
		T2	11
		R2	6 & 7
		R3	8
5	Wavelets and Multi-resolution Processing	T1	7

ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT SEMESTER VI			
Subject Code	18CMMST6050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course objectives:

This course will enable the students to

- Understand the concept and nature of Managerial Economics and Concept of Demand and Demand forecasting.
- Analyse the Cost Concepts, Cost-Volume-Profit Analysis and Market structures.
- Learn different Accounting Systems, preparation of Financial Statements and Capital Budgeting proposals by using different methods.

Unit -I	**Hours**
Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concept of Demand-Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types and Measurement- Demand forecasting and its Methods.	**10**
Unit –II	
Production and Cost Analysis: Production function-Isoquants and Isocost-Law of Variable proportions- Cobb-Douglas Production function-Economics of Sale-Cost Concepts- Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs- Cost Volume Profit analysis- Determination of Break-Even Point (Simple Problems).	**10**
Unit-III	
Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles: Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features – Price Output Determination – Methods of Pricing: Market Skimming Pricing, And Internet Pricing: Flat Rate Pricing. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle	**12**
Unit –IV	
Introduction to Accounting & Financing Analysis: Introduction to Double Entry Systems – Preparation of Financial Statements- Analysis and Interpretation of Financial Statements-Ratio Analysis (Simple Problems)	**10**
Unit-V	
Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.	**08**

Course outcomes:

On completion of the course student will be able to:

1. Equipped with the knowledge of managerial economics and estimating demand for a product.
2. Examine the Production Concept and familiar with the concepts of iso-quants, iso-cost lines and MRTS
3. Predict the cost of production and its relevance to managerial decision making
4. Differentiate various the Markets and Pricing methods along with Business Cycles.

5. Prepare Financial Statements along with Analysis
6. Analyse and interpret various investment project proposals with the help of Capital Budgeting techniques.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011.
2. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House 2011.

Reference Books:

1. Dr. P. Vijaya Kumar & Dr. N. Apparao Management Science Cengage, Delhi, 2012.
2. S. A. Siddiqui & A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
3. Vanitha Agarwal : Managerial Economics, Pearson Publications 2011.

Web References:

1. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_MEFA_LECTURE_NOTES_1.pdf
2. https://www.edx.org/course/introduction-to-managerial-economics

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Course	-	-	-	-	-	1	1	-	-	-	3	-	-	-	-

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Introduction to Managerial Economics and demand Analysis	T1	1,2,3 & 4
		T2	1,2,3 & 4
2	Production and Cost Analysis	T1	4,5,6 & 7
		T2	5,6,7,8 & 9
3	Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles	T1	8 & 9
		T2	10,11,12,13 & 14
4	Introduction to Accounting & Financing Analysis	T1	13 & 14
		T2	16 &17
5	Capital and Capital Budgeting	T1	11&12
		T2	18

COMPUTER NETWORKS SEMESTER VI			
Subject Code	18ECECT6060	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	---	Credits – 03	

Course Objective This course will enable students to:

- Understand key concepts and principles of computer networks.
- Demonstrate different layer architecture and their functions.
- Analyze various layer protocols and services.

Unit -1	**Hours**
Introduction to Computer Networks and the Internet: Network Topologies, Reference models- The OSI Reference Model- the TCP/IP Reference Model, Examples of Networks. **Switching in networks:** Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch, Packet switching, Buffering, Multicasting, and Multiplexing.	**12**
Unit -2	
Data Link Layer: Elementary Data Link Protocols- A Utopian Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-N- A Protocol Using Selective Repeat Link Layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, and Switches.	**10**
Unit – 3	
Network Layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing.	**8**
Unit – 4	
Transport Layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.	**10**
Unit – 5	
Application Layer: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming.	**10**

Course outcomes:

On completion of the course student will be able to

1. Recognize different type reference models, topologies and networks.
2. Describe the functions of physical layer.
3. Analyze various data link layer protocols.
4. Demonstrate about different Routing Algorithms in Computer Networks.
5. Demonstrate transport layer services and protocols.
6. Interpret network security and computer network applications.

Question paper pattern:

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition
2. Andrew Tanenbaum, " Computer networks", Prentice Hall

Reference Books:

1. B. A. Forouzan, " **Data Communications and Networking**", Tata McGraw Hill, 4th Edition
2. L. Peterson and B. Davie, "**Computer Networks – A Systems Approach**" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. S. Keshav, " **An Engineering Approach to Computer Networking**" , Pearson Education
4. William Stallings, " **Data and computer communications**" , Prentice Hall

Web References:

1. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
2. http://www.nptelvideos.in/2012/11/computer-networks.html
3. https://en.wikipedia.org/wiki/MAC_address

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
3	3	1	3	-	-	-	-	-	-	-	-	-	3	-	-
4	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
5	3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
6	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
Course	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-	**2**	-	-

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Introduction to Computer Networks and the Internet	T1	1
		T2	1,2
		R1	6,7
2	Data Link Layer	T2	3, 4
		R4	7
3	Network Layer	T1	4
		R3	11
4	Transport Layer	T1	3
		R4	20
5	Application Layer	T1	2
		R2	8

COMPUTER NETWORKS LAB SEMESTER VI			
Subject Code	18ECECL6070	Internal Marks	50
Number of Practical Hours/Week	03	External Marks	50
Total Number of Practical Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable students to

- Understand different linear data structures.
- Apply the concepts of Elementary data link protocols and routing algorithms.
- Implement Transport layer applications.

The students are required to design different Computer Network protocols and application using C programming.	**Hours**
1. Study of linear data structures like stack, queue and linked list. 2. Implement stack (its operations) using arrays. 3. Use stack operations to convert infix expression into postfix expression. 4. Implement queue (its operations) using arrays. 5. Write functions to perform different operations i.e., insertion, deletion on a singly linked list. 6. Implement stack (its operations) using linked list. 7. Implement queue (its operations) using linked list. 8. Implement the data link layer framing methods such as character stuffing, bit stuffing. 9. Implement on a data set of characters the CRC polynomials – CRC 12, CRC 16 and CRC CCIP. 10. Implement Dijkstra's algorithm to compute the shortest path through a graph. 11. Take an example of subnet of hosts and obtain broadcast tree for it. 12. Take an example of subnet graph with weights indicating delay between nodes and obtain routing table at each node using distance vector routing algorithm.	**36**

Course outcomes:

Upon completion of the course, students will be able to

1. Interpret the different linear data structures.
2. Demonstrate Elementary data link protocols and routing algorithms.
3. Construct Transport layer applications.

Question paper pattern:

Ten questions are given and student should choose one question (blind option), which carries 50 marks in total.

a. 15 marks are allotted for procedure including program.
b. 15 marks for conduction of the experiment.
c. 10 marks for results and conclusions.
d. 10 marks for viva voce.

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Department of Electronics & Communication Engineering

Course Structure for B.Tech. ECE

B.Tech (Electronics & Communication Engineering)
Semester VII (Fourth year)

S.No	Course Code	Course Title	L	T	P	C
1	18ECECT7010	Electronic Measurements & Instrumentation	3	0	0	3
2	18ECECP702X	Program Elective-3	3	0	0	3
3	18ECECP703X	Program Elective-4	3	0	0	3
4	18ECXXO704X	Open Elective-1	3	0	0	3
5	18ECXXO705X	Open Elective-2	3	0	0	3
6	18ECECL706X	Elective Related Lab	0	0	4	2
7	18ECECR7070	Project Work Phase-I	0	0	8	4
8	18ECECR7080	Internship	0	0	0	2
		Total Credits				23

Semester VIII (Fourth year)

S.No	Course Code	Course Title	L	T	P	C
1	18ECECP801X	Program Elective-5	3	0	0	3
2	18ECECP802X	Program Elective-6	3	0	0	3
3	18ECXXO803X	Open Elective-3	3	0	0	3
4	18ECXXO804X	Open Elective-4	3	0	0	3
5	18ECECR8050	Project Work Phase-II	0	0	14	7
6	18ECECC8060	Co Curricular and Extra Curricular Activity (MC)	0	0	0	0
		Total Credits				19

Program Elective Courses:

Program Elective-1	18ECECP6031	Antennas & Wave Propagation
	18ECECP6032	CMOS VLSI Design
	18ECECP6033	Advanced Digital Signal Processing
Program Elective-2	18ECECP6041	Microwave Theory and Techniques
	18ECECP6042	Digital Design through Verilog HDL
	18ECECP6043	Digital Image Processing
Program Elective-3	18ECECP7021	Optical Communications
	18ECECP7022	Low Power VLSI
	18ECECP7023	Information Theory & Coding
Program Elective-4	18ECECP7031	Wireless Sensor Networks
	18ECECP7032	Bio-Medical Electronics
	18ECECP7033	Embedded System Design
Program Elective-5	18ECECP8011	Cellular Mobile Communication
	18ECECP8012	VLSI Physical Design Automation
	18ECECP8013	Internet of Things and its Applications
Program Elective-6	18ECECP8021	Radar Systems
	18ECECP8022	Nano Electronics
	18ECECP8023	Embedded & Real Time Concepts

Open Elective Courses offered by ECE Department

Open Electives	Microcontroller Programming
	Internet of Things and its Applications
	Digital Signal Processing
	Digital Image Processing
	Antennas & Wave Propagation
	Cellular Mobile Communication
	VLSI Design
	VLSI Physical Design Automation

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION SEMESTER VII			
Subject Code	18ECECT7010	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable the students to:

- Understand the performance characteristics and working of various meters in Electronic Measuring Instruments
- Familiarize with different signal generators & wave analyzers.
- Analyze the functioning of various types of oscilloscopes.
- Design AC bridges which can measure Inductance, Capacitance, Resistance
- Recognize and describe significance and working of different types of transducers.

Unit -1	**Hours**
Measurement and Error: Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics, speed of response, Fidelity, Lag and Dynamic error. **Voltmeters, Ammeters:** DC Voltmeters, Multi-range voltmeters, AC voltmeters, True RMS responding voltmeter. Ammeter, Ohmmeters, series type, shunt type.	**11**
Unit -2	
Signal Generator- Fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers.	**9**
Unit – 3	
Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement.	**10**
Unit – 4	
AC Bridges Measurement of inductance- Maxwell's bridge, Hay's bridge Anderson bridge, Owen's bridge. Measurement of capacitance -Schering Bridge, De Sauty bridge. Wheat stone bridge. Wien Bridge, Sources of errors in bridge circuits, Precautions and techniques used for reducing errors in bridges.	**10**
Unit – 5	
Transducers: Active & passive transducers, Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Thermocouples, Thermistors.	**10**

Course outcomes:

On completion of the course student will be able to

1. Interpret the performance characteristics and principle of various meters in Electronic Measuring Instruments.
2. Use different types of Electronic equipment for generating and analysing various signals.

3. Discriminate a signal / waveform with various types of oscilloscopes.
4. Construct AC bridges which can measure Inductance, Capacitance, Resistance
5. Summarize the working of active & passive transducers
6. Distinguish various transducers for measurement of different parameters.

Question paper pattern:
Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Electronic instrumentation, second edition - H.S.Kalsi, Tata McGraw Hill, 2004.
2. A. K. Sawhney, Electronics and Electrical Measurements, Dhanpat Rai &Sons. ISBN -81-7700-016-0

Reference Books:

1. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.
2. Electronic Test Instruments, Analog and Digital Measurements - Robert A.Witte, Pearson Education, 2nd Ed., 2004.
3. Electronic Instrumentation & Measurements - David A. Bell, PHI, 2nd Edition, 2003.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	-	-	-	-	-	-	-	-	-	3	-	1	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	1	-
3	3	-	-	-	-	-	-	-	-	-	-	-	-	1	-
4	3	3	2	2	-	-	-	-	-	-	-	3	-	1	-
5	3	-	-	-	-	-	-	-	-	-	-	3	-	1	-
6	3	3	-	-	-	-	-	-	-	-	-	-	-	1	-
Course	**3**	**2**	**1**	1	-	-	-	-	-	-	-	2	-	1	-

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Measurement and Error Voltmeters, Ammeters	T1	1 & 4
2	Signal Generator	T1	8 & 9
3	Oscilloscopes	T1	7
		T2	21
4	AC Bridges	T1	11
		T2	16
5	Transducers	T2	13

OPTICAL COMMUNICATIONS **(Program Elective-3)** SEMESTER VII			
Subject Code	18ECECP7021	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Understand the properties of optical fiber and types of fiber materials with their properties and the losses occur in fibers.
- Analyze the operation of LEDs, laser diodes, and PIN photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems.
- Design optical communication and fiber optic sensor systems.
- Learn the models of analog and digital receivers

Unit -1	**Hours**
Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.	**11**
Unit -2	
Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.	**10**
Unit – 3	
Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies, Reliability of LED&ILD, Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors, Related problems. **Optical fiber Connectors**-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing- Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints.	**12**
Unit – 4	
Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital	**9**

receiver performance, Probability of Error, Quantum limit, Analog receivers.	
Unit – 5	
Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.	**8**

Course outcomes:

On completion of the course student will be able to

1 Understand basic concepts of optical fibers
2 Analyze different losses occurs in optical fibers and
3 Understand the operation of LEDs, laser diodes, and PIN photo detectors
4 Illustrate different types of optical connectors
5 Understand the models of analog and digital receivers
6 Analyze optical system design.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

Reference Books:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
3	-	3	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
5	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-

LOW POWER VLSI DESIGN (Program Elective-3) SEMESTER VII			
Subject Code	18ECECP7022	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Digital System Design, CMOS VLSI Design	**Credits – 03**	

Course Objectives:

This course will enable students to

- The student will be able to understand the Fundamentals of MOSFET and Low Power VLSI Design.
- In this course, students can study low-Power Design Approaches, Power estimation and analysis.
- Another main object of this course is to motivate the graduate students to study and to analyze the Low-Voltage Low-Power Adders, Multipliers.
- The concepts of Low-Voltage Low-Power Memories and Future Trend and Development of DRAM.

Unit -1	**Hours**
MOSFET Electrical Parameters: Introduction to IC technology, I_{DS} versus V_{DS} relationship, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit, CMOS Inverter, nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. **Fundamentals of Low Power VLSI Design:** Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.	**12**
Unit -2	
Low-Power Design Approaches: Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. **Switched Capacitance Minimization Approaches:** System Level Measures, Circuit Level Measures, Mask level Measures.	**10**
Unit – 3	
Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.	**10**
Unit – 4	
Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier,	**8**

Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.	
Unit – 5	
Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.	**10**

Course outcomes:

Upon completion of the course, students will be able to

1. Understand the concepts of Low-Power Design Approaches.
2. Apply the Low-Power design approaches for designing Low-Power Circuits.
3. Analyze the Low-Voltage Low-Power Circuits.
4. Design different adders to satisfy low power requirements
5. Construct the Low Power Designs to Different Applications.
6. Understand of Low-Voltage Low-Power Memories and Basics of DRAM.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

TEXT BOOKS:

1. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.
2. Practical Low Power Digital VLSI Design – Gary K. Yeap, Kluwer Academic Press, 2002.

Reference Books:

1. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons, 2000.
2. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
2	2	-	3	-	-	-	-	-	-	-	-	-	-	-	3
3	-	-	3	-	-	-	-	-	-	-	-	2	-	-	3
4	-	-	3	-	-	-	-	-	-	-	-	2	-	-	3
5	-	-	3	-	-	-	-	-	-	-	-	-	-	-	3
6	2	-	3	-	-	-	-	-	-	-	-	2	-	-	3
Course	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Fundamentals of Low Power VLSI Design	R1	1 & 2
2	Low-Power Design Approaches, Switched Capacitance Minimization Approaches	T1	3
3	Low-Voltage Low-Power Adders	T1	4
4	Low-Voltage Low-Power Multipliers	T1	5
5	Low-Voltage Low-Power Memories	T1	6 & 7

INFORMATION THEORY AND CODING **(Program Elective-3)** SEMESTER VII			
Subject Code	18ECECP7023	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students :

- Understand digital modulation techniques.
- Understand the methods for the generation of codes and their decoding techniques.
- Understand concept of multimedia communication

Unit -1	**Hours**
Information Theory: Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties.	**8**
Unit -2	
Source Coding: Introductions, Advantages, Shannon's theorem, Shanon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth –S/N trade off.	**10**
Unit – 3	
Error Control Coding **Linear Block codes** – Syndrome Decoding – Minimum distance consideration – cyclic codes – Generator Polynomial – Parity check polynomial – Encoder for cyclic codes – calculation of syndrome – **Convolutional codes** – time domain approach – transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm	**9**
Unit – 4	
Compression Techniques Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.	**11**
Unit – 5	
Audio and Video Coding Linear Predictive coding – code excited LPC – Perceptual coding, MPEG audio coders – Dolby audio coders – Video compression – Principles – Introduction to H.261 & MPEG Video standards.	**12**

Course outcomes:

On completion of the course student will be able to

1. Explain basic concept of information theory
2. Make use of different source coding techniques.
3. Identify different error control coding techniques.
4. Construct Convolutional codes
5. Summarize different compression standards.
6. Explain different audio and video coding techniques.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley and Sons, 2001.
2. Fred Halsall, "Multimedia Communications, Applications Networks Protocols and Standards", Pearson Education, Asia 2002.

Reference Books:

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

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	-	3	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
3	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-
5	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	1	2	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

WIRELESS SENSOR NETWORKS (Program Elective-4) SEMESTER VII			
Subject Code	18ECECP7031	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students

- To understand the concepts of MAC protocols.
- To understand Routing and design issues in Wireless Sensor Networks.
- To understand Network Architectures and the concepts of communication.
- To understand the concept of operating system.

Unit -1	**Hours**
Overview of Wireless Sensor Networks: Introduction to sensor networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.	**10**
Unit -2	
Networking Technologies: Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.	**10**
Unit – 3	
Routing and Data Gathering Protocols: Routing Challenges and Design Issues in Wireless Sensor Networks, Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. Design Principles for WSNs.	**10**
Unit – 4	
Architectures : Network Architecture, Sensor Network Scenarios, Single Node Architecture, Hardware Components & design constraints, Energy Consumption of Sensor Nodes, Gateway Concepts, Need for gateway, WSN to Internet Communication, and Internet to WSN Communication, Optimization Goals and Figures of Merit.	**10**
Unit – 5	
Sensor Network Platforms and Tools: Introduction, Sensor Node Hardware, Sensor Network Programming Challenges, Node level Software Platforms, Node level Simulators, Operating Systems for Wireless Sensor Networks, Operating System Design Issues, Examples of Operating Systems, introduction to TinyOS and nesC.	**10**

Course outcomes:

Upon completion of the course, students will be able to

1. Study basic concepts of wireless sensor networks
2. Design wireless sensor networks for a given application
3. Understand MAC protocols used for different communication standards

4. Understand emerging research areas in the field of sensor networks
5. Study the node and network architecture of sensor nodes.
6. Study the sensor node hardware and software platforms.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

TEXT BOOKS:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.

Reference Books:

1. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
2. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
3. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009.
4. Philip Levis, And David Gay "TinyOS Programming" by Cambridge University Press 2009
5. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications ,2011.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	-	3	-
2	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
3	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
4	3	1	-	-	-	-	-	-	-	-	-	-	-	3	-
5	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
6	3	1	2	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Overview of Wireless Sensor Networks	T1	1,2
2	Networking Technologies	T1	5
3	Routing and Data Gathering Protocols	T1	6
		T2	3,4,6,11&12
4	Architectures	T2	2&3
5	Sensor Network Platforms and Tools	T1	7,10

BIO MEDICAL ELECTRONICS (Program Elective-4) SEMESTER-VII			
Subject Code	18ECECP7032	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:
This course will enable students to:

- Understand the origin of bioelectric potential and bio medical Engineering.
- Familiarize with different types of electrodes, transducers and their principles.
- Analyze the functionality of various body organs and their measurements.
- Examine the patient care monitoring systems and therapeutic- prosthetic devices.
- Identify diagnostic techniques and need for recorders and safety measures.

Unit -1	**Hours**
Introduction to Biomedical Instrumentation: Man Instrumentation System, Components of the Man-Instrument System, Physiological System of the Body, Problems Encountered in Measuring a Living System, Sources of Bioelectric Potentials - Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG.	**10**
Unit -2	
Electrodes and Transducers: Introduction, Electrode Theory, Biopotential Electrodes, Examples of Electrodes, Basic Transducer Principles, Biochemical Transducers, The Transducer and Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications, Pulse Sensors, Respiration Sensor.	**9**
Unit – 3	
Cardiovascular System and Measurements: The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart Sound, Plethysmography. **Measurements in the Respiratory System:** The Physiology of The Respiratory System, Tests and Instrumentation for The Mechanics of Breathing, Respiratory Therapy Equipment.	**10**
Unit – 4	
Patient Care and Monitoring: Elements of Intensive-Care Monitoring, Instrumentation for Monitoring Patients, Pacemakers, Defibrillators, Telemedicine-Essential parameters for telemedicine, Using mobile communications, Applications. **Therapeutic and Prosthetic Devices:** Audiometers and Hearing Aids. Myoelectric Arm, Laparoscope, Ophthalmology Instruments, Anatomy of Vision, Ophthalmoscope, Tonometer for Eye Pressure Measurement. Diathermy.	**12**
Unit – 5	
Diagnostic Techniques: Principles of Ultrasonic Measurement, Ultrasonic	**9**

Imaging, Ultrasonic Applications of Therapeutic Uses, Ultrasonic Diagnosis, X-Ray and Radio-Isotope Instrumentations, CAT Scan, Emission Computerized Tomography, MRI. **Monitors, Recorders and Shock Hazards:** Bio potential Amplifiers, Monitors, Recorders, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Isolated Power Distribution System.	

Course outcomes:

On completion of the course student will be able to

1. Identify the origin of bioelectric potential and bio medical Engineering.
2. Distinguish different types of electrodes, transducers and their principles.
3. Analyze the functionality of cardiovascular system and their measurements.
4. Distinguish various aspects of measurements in the Respiratory System
5. Demonstrate the patient care monitoring systems and therapeutic- prosthetic devices.
6. Use of diagnostic techniques and need for recorders and safety measures.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Biomedical Instrumentation and Measurement, Leslie Cromwell, Fred J. Weibell and Erich A. Pfeifer., 2nd Edition, Pearson Education. 2006.
2. Bio-Medical Electronics and Instrumentation", Onkar N. Pandey, Rakesh Kumar, Katson Books.

Reference Books:

1. Handbook of Biomedical Instrumentation, R.S. Khandpur Tata McGraw Hill, 2nd Edition, 2006.
2. Introduction to Bio-Medical Equipment Technology", 4th Edition, Joseph J. Carr, John M. Brown, Pearson Publications.
3. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	-	-	-	-	-	-	-	1	-	-
2	3	-	3	-	-	-	-	-	-	-	-	-	2	-	-
3	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
4	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
5	3	2	3	-	-	-	-	-	-	-	-	-	2	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	3	2	-
Course	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**-**

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Introduction To Biomedical Instrumentation.	T1	1,3
2	Electrodes and Transducers	T1	2,4
3	Cardiovascular System and Measurements. Measurements in the Respiratory System.	T1	5,8
4	Patient Care and Monitoring. Therapeutic and Prosthetic Devices.	T1	7
		T2	10
		R1	9
5	Diagnostic Techniques. Monitors, Recorders and Shock Hazards.	T1	14
		T2	8,14

EMBEDDED SYSTEM DESIGN (Program Elective-4) SEMESTER VII			
Subject Code	18ECECP7033	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Understand the fundamentals of the embedded systems.
- Know the hardware details of the embedded systems.
- Learn concept of firmware design approaches, Interrupt concept.
- Learn about the various embedded software development tools.
- Understand the embedded system design life cycle and co-design issues with case studies.
- Learn the concepts of operational accepts of small scale embedded systems

Unit -1	**Hours**
Introduction: Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, Embedded Systems Vs General Computing Systems, Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system.	**10**
Unit -2	
Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces, Wireless communication devices, Watchdog timer, Real time clock.	**11**
Unit – 3	
Embedded Firmware Design: Embedded Firmware design approaches, Embedded Firmware development languages, Programming in Embedded C, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.	**9**
Unit – 4	
Embedded System Development: The integrated development environment, Types of files generated on cross-compilation, Dissembler/Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools. Embedded System Implementation And Testing tools.	**11**
Unit – 5	
Hardware Software Co-Design: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware, **Case studies**: digital camera, Automatic Coffee Vending Machine.	**9**

Course outcomes:

On completion of the course student will be able to

1 Understand the fundamentals of the embedded systems.
2 Know the hardware details of the embedded systems.
3 Learn concept of firmware design approaches, Interrupt concept.
4 Learn about the various embedded software development tools.
5 Understand the embedded system design life cycle and co-design issues with case studies.
6 Understand the working principals of simple embedded system applications

Question paper pattern:

Section A:

1. This section contains 10 one-mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill
2. Embedded Systems, Raj Kamal-Tata McGraw Hill Education Private Limited, Second Edition, 2008

Reference Books:

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications. 2005
2. David Simon, " An Embedded Software Primer" Addison Wesley, 2000
3. Embedded Systems – Lyla, Pearson, 2013

Web References:

1. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/ microcontrollers/ micro/ui/ Course _home2_5.htm
2. http://www.keil.com/books/8051books.asp
3. http://www.8051projects.info/
4. http://arm-designcon.com/

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	-	1	-	-	-	-	-	-	-	-	-	2	-	-
3	3	-	2	-	-	-	-	-	-	-	-	-	2	-	-
4	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
5	2	-	3	-	-	-	-	-	-	-	-	-	3	-	-
6	3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
Course	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**

S.No.	Unit Description	Text Book No	Chapter No.
1	Introduction Embedded Systems	T1	1,3,4
2	Typical Embedded System	T1	2
3	Embedded Firmware Design	T1	9
		T3	4
4	Embedded System Development	T1	13
		T3	13,14
5	Hardware Software Co-Design	T1	7,12
		T3	11

MICROWAVE & OPTICAL COMMUNICATIONS LAB

(Elective Related Lab)

SEMESTER - VII

Subject Code	18ECECL7061	Internal Marks	50
Number of Practical Hours/Week	03	External Marks	50
Total Number of Practical Hours	36	Exam Hours	03

Credits – 2

Course objectives:

- To study and analyze microwave components by measuring various parameters.
- To verify the characteristics of optical sources.
- To measure attenuation and distortions in optical fiber link.

List of Experiments	Teaching Hours
1. Reflex Klystron Characteristics. 2. Gunn Diode Characteristics. 3. Attenuation Measurement. 4. Directional Coupler Characteristics. 5. VSWR Measurement. 6. Waveguide parameters measurement. 7. Scattering parameters of Magic Tee. 8. Characterization of LED. 9. Measurement of Data rate for Digital Optical link. 10. Measurement of NA 11. Measurement of losses for Analog Optical link. 12. Measurement of antenna radiation pattern	**36 Hours**

Course outcomes:

After studying this course, students will be able to:

1. Identify and demonstrate the working of various microwave and optical components.
2. Analyze Microwave Passive and active Devices by conducting experiments and measuring various parameters. .
3. Analyze the characteristics of Optical Sources by conducting experiments and measuring various parameters.
4. Analyze the characteristics of optical fiber by conducting experiments and measuring various parameters.
5. Analyze antenna performance by conducting experiments and measuring various parameters.

Question paper pattern:

1. Ten questions will be given and student should choose one question (blind option) carries 50 marks in total.
   a. 40 marks will be allotted for write-up, execution and result.

b. 10 marks will be allotted for viva voce.

Equipment required for Laboratories:

1. Regulated Klystron Power Supply
2. VSWR Meter -
3. Micro Ammeter - 0 – 500 μA
4. Multi meter
5. CRO
6. GUNN Power Supply, Pin Modulator
7. Reflex Klystron
8. Crystal Diodes
9. Micro wave components (Attenuation)
10. Frequency Meter
11. Slotted line carriage
12. Probe detector
13. wave guide shorts
14. Pyramidal Horn Antennas
15. Directional Coupler
16. E, H, Magic Tees
17. Circulators, Isolator
18. Matched Loads
19. Fiber Optic Analog Trainer based LED
20. Fiber Optic Analog Trainer based laser
21. Fiber Optic Digital Trainer
22. Fiber cables - (Plastic, Glass)

VLSI DESIGN LAB

(Elective Related Lab)

SEMESTER VII

Subject Code	18ECECL7062	Internal Marks	50
Number of Practical Hours/Week	03	External Marks	50
Total Number of Practical Hours	36	Exam Hours	03

Credits – 2

Course objectives:

This course will enable students to

- Able to design the CMOS logic circuits.
- Design various combinational circuits, sequential circuits and memories using logic gates and PLDs.
- Able to draw layout diagrams

Improve the minimization logic for each design

The students are required to design combinational and sequential logic circuits using CMOS 130 nm technology with Mentor graphics/Tanner upto layout level.	**Hours**
1. Design and implementation of Inverter 2. Design and implementation of universal logic gates 3. Design and implementation of 1-bit full adder 4. Design and implementation of full subtractor 5. Design and implementation of RS latch 6. Design and implementation of D latch 7. Design and implementation of Asynchronous counter 8. Design and implementation of static RAM Cell 9. Design and Implementation of Differential amplifier 10. Design and Implementation of Common source amplifier 11. Design and implementation of Ring Oscillator	**36 Hours**
For the above circuits, Circuit simulation, Layout generation, parasitic extraction and power consumption need to be executed.	

Course outcomes:

After studying this course, students will be able to:

1. Design digital systems using combinational and sequential circuits using Mentor Graphics.
2. Draw the layout and schematic diagrams for digital circuits
3. Improve the logic minimization skills

Question paper pattern:

1. Ten questions will be given and student should choose one question (blind option) carries 50 marks in total.
   a. 40 marks will be allotted for write-up, execution and result.
   b. 10 marks will be allotted for viva voce.

Hardware/Software Requirements:
Mentor Graphics Software / Tanner software

EMBEDDED SYSTEMS LAB
(Elective Related Lab)
SEMESTER - VII

Subject Code	18ECECL7063	Internal Marks	50
Number of Practical Hours/Week	03	External Marks	50
Total Number of Practical Hours	36	Exam Hours	03

Credits – 2

Course objectives:
The course objective is to make students understanding the fundamental operations and interfacing concepts of different microprocessors and microcontrollers with various I/O peripheral, display and communication modules along with their design aspects

In this lab different types of microprocessor and microcontroller development boars, I/O interfacing modules and communication modules are used along with software simulation Tools	**Hours**
PART- A: (At least 6 Experiments are to be performed) **LPC1768 Trainer Kit with Embedded C Programming and its interfacing.** 1. Switches, buzzer and LEDs interfacing with the ARM Cortex M3 controller board. 2. 4*4 matrix key pad and 2*16 LCD Display Interfacing with the ARM Cortex M3 controller board. 3. Stepper Motor and switch Interfacing with the ARM Cortex M3 controller board. 4. Implementing RTC display with the ARM Cortex M3 controller board. 5. LM 35 Temperature sensor and 2*16 LCD Interfacing with the ARM Cortex M3 controller board. 6. Different wave form Generating using ARM Cortex M3 controller board. 7. Bluetooth Module Interfacing with the ARM Cortex M3 controller board with a simple mobile app. 8. Implementing Zigbee protocol with ARM Cortex M3 controller board **PART- B: (At least 6 Experiments are to be performed)** **Raspberry pi Board programming and interfacing with associated OS** Study Experiments a. To demonstrate the OS(RASPBIAN) for RPi in a SD card preparation, configuration of Raspberry Pi during first booting and updating. b. To demonstrate the basic Linux commands on raspberry pi Experiments: 1. Interface GPIOs using python programming to Raspberry Pi. 2. Interface Servo Motor Direction Control Using PWM using Raspberry Pi.	**36**

3. Stream Video over HTTP using MJPEG-STREAMER with USB CAMERA. 4. Control home appliances using MQTT in Raspberry Pi with TFT screen. 5. To Interface DS18b20 temperature and DHT22 humidity sensor with TFT screen and Raspberry Pi board. 6. Implement Raspberry Pi based oscilloscope. 7. Digital notice Board using Raspberry Pi 8. AWS – Cloud infrastructure in Raspberry Pi	
Hardware/Software Requirements: **a) Hardware requirements.** 1. LPC1768 Microcontroller kits 2. Interfaces/peripheral subsystems a. Switches, Buzzer and LEDs. b. 4*4 Key pad c. 2*16 LCD module, RTC module. d. Stepper motor control board and motor. e. LM 35temperature sensor. f. HC 05 blue-tooth module. g. Zigbee module. 3. Raspberry Pi computer board with power adapter. 4. Interfaces/peripheral subsystems for Raspberry Pi board a. HDMI cable, USB to micro USB cable, micro SD card. b. USB mouse and keyboard. c. 5/3 inch TFT screen or LCD monitor. d. Relay unit, servo motor and driver unit e. DS18b20 temperature sensor and DHT22 humidity sensor. f. USB camera module. g. VGA to HDMI convertor. **b) software requirements.** 1. Keil u vision 4 or higher IDE for ARM, Flash magic software. 2. Open source Linux (Raspbian or any) and Phyton software.	
Course outcomes: After studying this course, students will be able to: 1. Understood the operation of ARM Cortex M3 boards and Raspberry Pi boards 2. Learn the various interfacing analog and digital interfacing concepts with ARM Cortex M3. 3. Design and implementing real time clock communication protocols with modern microcontroller boards. 4. Learn the Raspberry Pi (RPi) single-board computer, and how to use its text-based commands to explore the environment of the RPi. 5. Compile, design and test various interfacing and displaying modules with RPi board using Python language.	

Question paper pattern:

1. Ten questions will be given and student should choose one question (blind option) carries 50 marks in total.
    a. 40 marks will be allotted for write-up, execution and result.
    b. 10 marks will be allotted for viva voce.

CELLULAR AND MOBILE COMMUNICATIONS (Program Elective-5) SEMESTER VIII			
Subject Code	18ECECP8011	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Design and analyze Basic Cellular System
- Know of frequency reuse and Co-channel Interference, Non co-channel Interference
- Know the concepts Cell coverage for signal and Antennas
- Apply the different methods of Channel Assignment and Handoff mechanisms
- Explore the implementing of these wireless technologies in cellular and mobile communications

Unit -1	**Hours**
Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, Why Cellular Mobile Telephone Systems, History Of 800mhz Spectrum Allocation, Trunking Efficiency, A Basic Cellular System, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Marketing Image of Hexagonal Shaped Cells, Planning a Cellular system, Analog cellular Systems. **Elements of Cellular Radio System Design :** General Description of The Problem, Concept of Frequency Channels, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni-directional Antenna System, Handoff Mechanism, Cell Splitting, Consideration of The Components of Cellular System.	**12**
Unit -2	
Interference: Co-Channel Interference, Exploring Co-Channel Interference areas in a system, Real Time Co-Channel Interference Measurement at mobile radio transceivers, Design of an Omni Directional Antenna System in the worst case, Design of a Directional Antenna System, Lowering the Antenna height, Reduction of Co-channel Interference by means of a notch in the tilted antenna pattern, Umbrella-pattern effect, use of parasitic elements, power control, Diversity Receiver. **Non Co-Channel Interference:** Subjective test Vs objective test, Adjacent-channel interference, near-end-far-end interference, effect on near-end mobile units, cross talk-A unique characteristics of voice channels, effects on coverage and interference by applying power decrease, antenna height decrease, beam tilting, effects of cell-site components, interference between systems, UHF TV interference, long-distance interference.	**10**
Unit – 3	
Cell Coverage for Signal and Traffic: General Introduction, Obtaining the Mobile Point-to-Point Model (Lee Model), Propagation over Water or Flat Open Area, Foliage Loss, Propagation in Near-in Distance, Long –Distance Propagation, Obtain Path Loss from a Point-to-Point Prediction Model-A General Approach, Form of a Point-to-Point Model.	**9**

Cell Site and Mobile Antennas: Sum and Difference Patterns and their Synthesis, Antennas at Cell Site, Omni-directional Antennas, Directional Antennas for Interference Reduction, Unique Situations of Cell-Site Antennas, Mobile Antennas.	
Unit – 4	
Frequency Management and Channel Assignment: Frequency Management, Frequency –Spectrum Utilization, Set-up Channels , Channel Assignments to Cell Sites and Mobile Units, Fixed Channel Assignment, Adjacent Channel Assignment, Channel Sharing and Borrowing, Sectorization, Underlay-Overlay arrangement, Non fixed Channel Assignment Algorithms. **Handoff:** Value of Implementing Handoffs, Why handoffs, Types of Handoff, Initiation of a Handoff, Delaying a Handoff, Forced Handoffs, Queuing of Handoffs, Power-Difference Handoffs, Mobile Assisted Handoff(MAHO) and Soft Handoff, Cell-Site Handoff, Intersystem Handoff, Introduction to Dropped Call Rate, Formula of Dropped Call Rate.	**11**
Unit – 5	
Digital Cellular Networks: GSM- Architecture, Channels, Multiple-access scheme, Radio resource management, Mobility management, Communication management, Network management, North American TDMA-History, Architecture, CDMA.	**8**
Course outcomes: On completion of the course student will be able to 1. Learn Basic concepts of Cellular System 2. Identify Co-channel and Non co-channel Interference 3. Know the concepts Cell coverage for signal 4. Choose proper cell site antenna 5. Apply different methods of Channel Assignment and Handoff mechanisms **6.** Apply wireless technologies in cellular and mobile communications	
Question paper pattern: **Section A:** 1. This section contains 10 one mark questions. 2. Two questions are given from each unit. **Section B:** 3. This Section contains 10 questions, 02 from each unit. 4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit. 5. The student has to answer 05 questions, one from each unit with internal choice.	
Text Books: 1. William C. Y. Lee (2006), Mobile Cellular Telecommunications, 2nd edition, Tata McGraw Hill, India. 2. Theodore S. Rappaport (2002), Wireless Communications, 2nd edition, Pearson education, India.	
Reference Books: 1. Gordon L. Stuber (2007), Principles of Mobile Communication, 2nd edition, Springer International, India. 2. William C. Y. Lee (2006), Wireless and Cellular Telecommunications, 3rd edition,	

3. McGraw Hill, New Delhi.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
2	3	-	3	-	-	-	-	-	-	-	-	-	-	3	-
3	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
4	3	2	3	-	-	-	-	-	-	-	-	-	-	3	-
5	3	2	1	-	-	-	-	-	-	-	-	-	-	3	-
6	3	2	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

VLSI PHYSICAL DESIGN AUTOMATION (Program Elective-5) SEMESTER VIII			
Subject Code	18ECECP8012	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:
Students able to,

- Understand the concepts of EDA methodologies for IC design.
- Understand the process of transforming structural representation of VLSI system into its layout representation.
- Carry out the transformation efficiently using computers to optimize topological, geometric, timing and power-consumption constraints of the design
- Understand the concepts of design automation for FPGAs and MCMs.

Unit -1	**Hours**
VLSI Design Methodologies: New Trends in Physical Design Cycle, Issues related to the Fabrication Process, Review of Data structures and algorithms, Complexity Issues and NP-hardness, Graph Algorithms for Physical design, Review of VLSI Design automation tools.	**9**
Unit -2	
Partitioning, Floorplanning and Pin Assignment: Introduction to Partitioning, Problem Formulation, Kernighan-Lin Algorithm, Fiduccia-Mattheyses Algorithm, Introduction to Floorplanning, Problem Formulation, Integer Programming Based Floorplanning, Rectangular Dualization, General Pin Assignment and Channel Pin Assignment.	**10**
Unit – 3	
Placement and Routing: Problem Formulation, Simulated Annealing Algorithm, Breuer's Algorithm, Force Directed Algorithm, Terminal Propagation Algorithm, Routing problem formulation, Maze Routing Algorithms: Lee's Algorithm, Soukup's Algorithm, Hadlock's Algorithm, Line-Probe Algorithms, Shortest Path Based Algorithms, Steiner Min-Max Tree based Algorithm, Detailed Routing Problem Formulation, Greedy Channel Routing Algorithm, Greedy Routing Algorithm for Switch Box.	**11**
Unit – 4	
Clock and Power Routing: Clocking Schemes, Design Considerations for the Clocking System, Delay Calculation for Clock Trees, Clock Routing Algorithms: H-tree Based Algorithm, The MMM Algorithm, Geometric Matching based Algorithm, Weighted Center Algorithm, Exact Zero Skew Algorithm, Multiple Clock Routing, Power and Ground Routing, Compaction and Review of Compaction Algorithms.	**11**
Unit – 5	
Physical Design Automation of FPGAs: FPGA Technologies, Physical Design Cycle for FPGAs, Partitioning, Routing Algorithm for the Non-Segmented Model, Routing Algorithms for the Segmented Model.	**9**

Physical Design Automation of MCMs: MCM Technologies, MCM Physical Design Cycle, Partitioning, Placement, Routing, Maze Routing, Multiple Stage Routing, Topological Routing.	

Course outcomes:

By the end of this course, students should be able to:

1 Understand the basics of design cycle stages.
2 Retrieve the graph theory concepts and relate to VLSI physical design.
3 Learn partitioning and floor planning algorithms.
4 Learn different placement and routing algorithms.
5 Differentiate routing algorithms for clock and power sources.
6 Understand design automation for FPGAs and MCMs.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

TEXT BOOKS:

1. N.A. Sherwani, Algorithms for VLSI Physical Design Automation, Kluwer Academic Publishers, 2002.
2. S.H. Gerez, Algorithms for VLSI Design Automation, John Wiley & Sons, 2002.

Reference Books:

1. Sadiq M. Sait, Habib Youssef, VLSI Physical Design automation: Theory and Practice, World scientific 1999.
2. Steven M.Rubin, Computer Aids for VLSI Design, Addison Wesley Publishing 1987.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	1	-	-	-	-	-	-	-	-	-	3
2	3	2	3	-	2	-	-	-	-	-	-	-	-	-	3
3	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
4	3	2	2	-	2	-	-	-	-	-	-	-	-	-	3
5	3	3	3	-	3	-	-	-	-	-	-	-	-	-	3
6	3	3	2	-	2	-	-	-	-	-	-	-	-	-	3
Course	**3**	**3**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

Unit No	Unit Description	Text book	Chapter No
1	VLSI Design Methodologies	T1	4
2	Partitioning, Floor planning and Pin Assignment	T1	5 & 6

3	Placement and Routing	T1	7, 8 & 9
4	Clock and Power Routing	T1	11 & 12
5	Physical Design Automation of FPGAs and MCMs	T1	13 & 14

INTERNET OF THINGS AND ITS APPLICATIONS (Program Elective-5) SEMESTER VIII			
Subject Code	18ECECP8013	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to

- Understand the Architectural Overview of IoT.
- Understand the IoT Reference Architecture and Real World Design Constraints.
- Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service).

Unit -1	**Hours**
Overview: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.	**12**
Unit -2	
Reference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture. Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.	**12**
Unit – 3	
IoT Data Link Layer & Network Layer Protocols: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN. Case Studies: Remote monitoring and controlling applications like Structural health Monitoring, Agriculture, etc	**8**
Unit – 4	
Transport, Session Layer and Service Layer Protocols Transport Layer (TCP, MPTCP, UDP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, MQTT. Service Layer -oneM2M, ETSI M2M, OMA. Case study: Home Automation, Examples on Smart cities.	**8**
Unit – 5	
Protocols & Security: Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer; Data Analytics: Apache Storm for Real Time Data Analysis. Hardware platforms for IoT applications: Features and applications of IoT supported hardware platforms such as: raspberry pi, ARM Cortex processors, Arduino and Intel Galileo Board. Case Studies on Industrial IoT 4.0 applications.	**10**

Course outcomes:

On completion of the course student will be able to

1. Understand fundamentals of IoT systems.
2. Describe the functions of IoT architectures.
3. Apply real world design constraints on IoT architectures.
4. Analyze IoT data link and Network layer protocols.
5. Demonstrate transport and Session layer services and protocols of Iot.
6. Interpret Service layer and network security protocols.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

Reference Books:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2015.
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
2	3	1	3	-	-	-	-	-	-	-	-	-	3	-	-
3	3	1	3	-	-	-	-	-	-	-	-	-	3	-	-
4	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
5	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
6	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
Course	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-

RADAR SYSTEMS (Program Elective-6) SEMESTER VIII			
Subject Code	18ECECP8021	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:
This course will enable students to:
- Gain knowledge about RADAR theory and equations.
- Understand different types of RADAR and their working principles.
- Gain knowledge on RADAR signal detection methods.
- Understand about radio navigation techniques.
- Acquire information about RADAR transmitters and receivers

Unit -1	**Hours**
Basics of Radar : Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems. **Radar Equation :** Modified Radar Range Equation, SNR, probability of detection, probability of False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Creeping Wave, Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.	**11**
Unit -2	
CW and Frequency Modulated Radar : Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems **FM-CW Radar:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar.	**11**
Unit – 3	
MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, Nth Cancellation Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.	**9**
Unit – 4	
Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two- coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers. Active Electronically Scanned Array (AESA) Radar.	**9**
Unit – 5	
Detection of Radar Signals in Noise : Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection and Cross-correlation Receiver, Efficiency of Non-matched Filters,	**10**

Matched Filter with Non-white Noise, Noise Figure and Noise Temperature. **Radar Receivers** –Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Series versus parallel feeds, Applications, Advantages and Limitations. Radomes.	

Course outcomes:

On completion of the course student will be able to

1. Learn basic concepts of RADAR Systems.
2. Familiarize the RADAR equation.
3. Understand different types of RADAR and their working principles.
4. Gain knowledge on RADAR signal detection methods.
5. Understand about radio navigation techniques.
6. Acquire information about RADAR transmitters and receivers

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.

Reference Books:

1. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.
2. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.
3. Principles of Modern Radar: Basic Principles – Mark A. Richards, James A. Scheer, William A. Holm, Yesdee,
4. Radar Engineering – GSN Raju, IK International.
5. https://en.wikipedia.org/wiki/Active_electronically_scanned_array

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
2	2	2	-	-	-	-	-	-	-	-	-	-	-	3	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
4	-	3	-	-	-	-	-	-	-	-	-	-	-	3	-
5	3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
Course	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**

NANOELECTRONICS (Program Elective-6) SEMESTER-VIII			
Subject Code	18ECECP8022	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre-requisite	Engineering Physics	**Credits – 03**	

Course Objectives:

This course will enable students to

- Understand the basic principles of Nano electronics
- Familiarize with different Nano materials.
- Understand the basic fabrication principles of nanostructures and nanodevices.
- Study the characteristics of various Nano electronic Devices.
- Understand applications of Tunnelling in Nano electronics devices.

Unit -1	**Hours**
Introduction to Nanoelectronics: History of Nanoscience, definition of nano meter, The Top-Down Approach, The Bottom-Up Approach, Nanotechnology Potential, Origins of Quantum Mechanics, The Schrodinger equation, Electrons as Quantum Particles, Further development of quantum mechanics.	09
Unit -2	
Materials for Nano Electronics : Introduction, Semiconductors, Crystal lattices: bonding in crystals, Electron energy bands ,Semiconductor hetero structures , Lattice-matched and pseudomorphic hetero structures, Organic semiconductors, Carbon nanomaterials: nanotubes and fullerenes.	09
Unit -3	
Fundamentals of Nanofabrication: Introduction, Bulk crystal and heterostructure growth, Nanolithography, etching, fabrication of nanostructures and nano devices , characterization of nanostructures , Spontaneous formation and ordering of nanostructures, Clusters and nanocrystals, Methods of nanotube growth, Chemical and biological methods for nanoscale fabrication, Fabrication of nanoelectro mechanical systems.	11
Unit – 4	
Nano electronic Devices: Introduction , Resonant-tunneling diodes, Field-effect transistors, Single-electron-transfer devices, Potential-effect transistors, short channel Nano Transistor –MOSFETs - Advanced MOSFETs - Trigate FETs, FinFETs-CMOS,Nano electromechanical system devices , Quantum-dot cellular automata.	10
Unit – 5	
Tunnel Junctions and Applications of Tunneling: Tunneling Through a Potential Barrier Potential, Energy Profiles for Material Interfaces , Metal—Insulator, Metal-Semiconductor, and Metal—Insulator—Metal Junctions, Applications of Tunneling Field Emission Gate—Oxide Tunneling and Hot Electron Effects in MOSFETs, Scanning Tunneling Microscope, Double Barrier Tunneling and the Resonant Tunneling Diode.	11

Course outcomes:

On completion of the course student will be able to

1. Understand the basic concepts of Nano electronics
2. Know about various Nano materials.
3. Apply the knowledge of device fabrication in nanoscale engineering.
4. Familiarize with the characteristics of different Nano electronic Devices.
5. Uunderstand the concept of Tunnelling in Nano electronics.
6. Uunderstand the concept of electron transport across Nano electronics.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. G.W. Hanson, **"Fundamentals of Nanoelectronics"**, Pearson, 2009.
2. V. Mitin, V. Kochelap, M. Stroscio, **"Introduction to Nanoelectronics"**, Cambridge University Press, 2008

Reference Books:

1. W. Ranier, "Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices)", Wiley-VCH, 2003.
2. C.P. Poole, F. J. Owens, "Introduction to Nanotechnology", Wiley, 2003.
3. Edward L. Wolf, "Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience",Wiley-VCH (2006)

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	-	-	-	-	-	-	-	1	-	1	3
2	3	-	-	-	-	-	-	-	-	-	-	1	-	1	3
3	3	2	-	-	-	-	-	-	-	-	-	1	-	3	3
4	3	2	-	-	-	-	-	-	-	-	-	1	-	1	3
5	2	3	-	-	-	-	-	-	-	-	-	-	-	1	3
6	2	3	-	-	-	-	-	-	-	-	-	-	-	1	3
Course	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**	**3**

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Introduction to Nano Electronics	T1	1 & 2
		T2	3
2	Materials for Nano Electronics	T1	4 & 5
		T2	4
3	Fundamentals of Nanofabrication	T2	5
4	Nano electronic Devices	T2	8
5	Tunnel Junctions & Applications of Tunnelling.	T1	6

EMBEDDED & REAL TIME CONCEPTS **(Program Elective-6)** SEMESTER VIII			
Subject Code	18ECECP8023	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Understand the fundamentals of the Real Time Embedded Systems.
- Know the various state machine models of the embedded systems.
- Learn the components of Real Time Operating Systems.
- Learn about the operation of various embedded operating systems
- Understand the mechanism for loading RTOS into Embedded Hardware.

Unit -1	**Hours**
Introduction: Introduction to Embedded Systems, Classification of Embedded Systems, An Embedded Real Time System- Definition, Examples, Applications, Embedded System Design Flow, Processors in Embedded Systems and other hardware units, Software Development Flow & Tools. **Embedded Communication Units:** Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Blue tooth.	**10**
Unit -2	
State Machine and Concurrent Process Models Introduction, models Vs Languages, finite state machines with data path model(FSMD),using state machines, program state machine model(PSM, concurrent process model, concurrent processes, communication among processes, synchronization among processes, Implementation, data flow model.	**10**
Unit – 3	
Embedded/RTOS Concepts-I: Introduction to Embedded/RTOS, Types of Embedded/RTOS, Architecture of the Kernel, Tasks and task scheduler, interrupt service routines, Semaphores, Mutex, Mailboxes, Message Queues, Event Registers, Pipes-Signals.Timers-Memory Management-Priority inversion problem, real time operating system,Basic design using an RTOS, OS security issues.	**10**
Unit – 4	
Embedded/RTOS Concepts-II: Why Embedded Linux?, Embedded Linux Versus Desktop, Embedded Linux Distributions, Architecture of Embedded Linux, Linux Kernel Architecture, User Space, Linux Start-Up Sequence, GNU Cross-Platform Toolchain, -Embedded Linux Vs Real-time operating systems	**10**

Unit – 5	
Embedded/RTOS Concepts-III: Off-the shelf OS, RTOS, Handheld OS, OS software, Target image creation for windows XP embedded, Porting RTOS on a micro-controller based development board, Overview of Linux, Shell programming, System programming, Overview of RT Linux, Core RT Linux, API. RT Linux Vs Windows CE	**10**

Course outcomes:

On completion of the course student will be able to

1. Review basic operation of the Real Time Embedded Systems.
2. Describe the various communication models used in Embedded application
3. Understand various Embedded System design computing models
4. Describe the concepts of Real Time Operating Systems.
5. Demonstrate the fundamentals of Embedded Linux concepts
6. Apply RTOS in Embedded & Real Time System Hardware.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Embedded/Real Time Systems- KVKK prasad, Dreamtech press-2005.
2. Embedded System Design-A Unified Hardware/Software Introduction- Frank Vahid, Tony D.Givargis, John Wiley & Sons, Inc.2002.

Reference Books:

1. Embedded Microcomputer Systems-Jonathan W.Valvano, Books/Cole, Thomson Leaarning.
2. An Embedded Software Primer- David E.Simon, pearson Ed.2005
3. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.

Web References:

1. https://nptel.ac.in/courses/106105086/
2. http://studentsfocus.com/ec6703-erts-notes-embedded-real-time-systems-lecture-handwritten-notes-ece-7th-sem-anna-university/

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	2	-	-	-	-	-	-	3	2	-	-
2	3	-	-	-	2	-	-	-	-	-	-	3	2	-	-
3	3	-	1	-	2	-	-	-	-	-	-	3	2	-	-
4	3	-	2	2	3	-	-	-	-	-	-	3	2	-	-
5	3	-	3	2	2	-	-	-	-	-	-	3	3	-	-
6	3	-	3	3	3	-	-	-	-	-	-	3	3	-	-
Course	**3**	-	**2**	1	2	-	-	-	-	-	-	3	**2**	-	-

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Introduction & Embedded Communication Units	T1	1,2 &6
		T2	6
2	State Machine and Concurrent Process Models	T2	8
3	Embedded/RTOS Concepts-I	T1	7
4	Embedded/RTOS Concepts-II	T1	8
5	Embedded/RTOS Concepts-III	T1	8 ,9, 11& 12

Open Elective Courses offered by ECE Department

MICROCONTROLLERS PROGRAMMING (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objective: This course will enable students to:

- Understand internal architecture and functional description of 8051 microcontroller.
- Learn the programming models of 8051 Microcontroller using embedded C.
- Interpret the concept of 8051 microcontroller internal architecture like Timer/Counter, I/O ports interfacing.
- Discuss the operational aspects of advanced Processors.

Unit -1	**Hours**
Intel 8051 Microcontroller: Architecture, Hardware concepts, input/output ports and circuits, external memory, counters/timers, serial data input/output, Interrupts. Assembly language programming**:** Instructions, addressing modes, simple programs.	9
Unit -2	
Embedded C Programming for 8051: Introduction to Embedded C Programming, Example Programs with switch and LED interfacing. Introduction to Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: structuring the 'Hello Embedded World' example and goat-counting example using MAIN.H and PORT.H.	**11**
Unit – 3	
8051I/O Interfacing& Embedded C Programming module 1: Keypad interfacing, Seven Segment Display interfacing, ADC & DAC interfacing. Case Studies: Two digit up down counter, LM 35 Temperature sensor interfacing and programming	**9**
Unit – 4	
8051I/O Interfacing& Embedded C Programming module 2: 2X16 LCD interfacing, stepper motor interfacing, serial port interfacing, high power devices. Case Studies: Password based door locking system, Controlling Stepper motor through serial port communication.	**9**
Unit – 5	
ARM: Advanced Processors: Introduction to RISC & CISC Processors, features of32-Bit processors. Advanced processor Architectures: Introduction to ARM Processor Families, ARM Pipelining operation, ARM 7 (LPC2148) architecture and organization, ARM / Thumb instruction set & programming model.	**12**

Course outcomes:

On completion of the course student will be able to

1. Understand the internal operations of 8051microcontroller
2. Apply the programming model of 8051 Microcontroller using embedded C.
3. Apply the interfacing concepts of 8051 with I/O ports and other peripherals.
4. Demonstrate the data communication issues of 8051 microcontroller.

5. Discuss the operational aspects of advanced Processors.
6. Interpret the architectural concept of ARM 7 (LPC2148)

Question paper pattern:

Section A:

1. This section contains 10 one-mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. The 8051 Microcontroller and Embedded Systems Using Assembly and C by Muhammad Ali Mazidi, Rolin mckinlay Janice Gillispie Mazidi, Pearson, Second Edition
2. A.Sloss, D.Symes, C.Wright, (2003), "ARM system Developers Guide: Designing and Optimizing System Software", Morgan Kaufmann publishers.

Reference Books:

1. Michael J Pont-Embedded C-Addison-Wesley Professional (2002)
2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
3. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996

S.No.	Unit Name	Text Book Reference	Chapter No.
1	8086 Architecture&8086 Programming	T1	1,2
2	8086 Interfacing	T1	3, 4 &5
3	Intel 8051 Microcontroller	T2	1,2,3& 4
4	8051 I/O Interfacing & Embedded C Programming	T2	7,12&13
5	Advanced Processors	T1	9,10,12
		T3	2,3,4,5

INTERNET OF THINGS AND ITS APPLICATIONS (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to

- Understand the Architectural Overview of IoT.
- Understand the IoT Reference Architecture and Real World Design Constraints.
- Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service).

Unit -1	**Hours**
Overview: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.	**12**
Unit -2	
Reference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture. Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.	**12**
Unit – 3	
IoT Data Link Layer & Network Layer Protocols: PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN. Case Studies: Remote monitoring and controlling applications like Structural health Monitoring, Agriculture, etc	**8**
Unit – 4	
Transport, Session Layer and Service Layer Protocols: Transport Layer (TCP, MPTCP, UDP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, MQTT. Service Layer -oneM2M, ETSI M2M, OMA. Case study: Home Automation, Examples on Smart cities.	**8**
Unit – 5	
Protocols & Security: Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer; Data Analytics: Apache Storm for Real Time Data Analysis. Hardware platforms for IoT applications: Features and applications of IoT supported hardware platforms such as: raspberry pi, ARM Cortex processors, Arduino and Intel Galileo Board. Case Studies on Industrial IoT 4.0 applications.	**10**

Course outcomes:

On completion of the course student will be able to

1. Understand fundamentals of IoT systems.
2. Describe the functions of IoT architectures.
3. Apply real world design constraints on IoT architectures.
4. Analyze IoT data link and Network layer protocols.
5. Demonstrate transport and Session layer services and protocols of Iot.
6. Interpret Service layer and network security protocols.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

Reference Books:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2015.
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

DIGITAL SIGNAL PROCESSING (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Pre requisite: Signals and Systems			**Credits – 03**

Course Objectives:

This course will enable students to

- Analyze the Discrete Time Signals and compute different FFT algorithms
- Learn the FIR and IIR filter design procedures
- Understand the basics of DSP Processors and architectures

Unit -1	**Hours**
Introduction: Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Invertability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.	**8**
Unit -2	
Discrete Fourier Series & Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.	**12**
Unit – 3	
Design of IIR Digital Filters& Realizations: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems.	**12**
Unit – 4	
Design of FIR Digital Filters & Realizations: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters, Basic structures of FIR systems.	**10**
Unit – 5	
DSP Processors: Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. **Architecture of TMS320C5X:** Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.	**8**

Course outcomes:

On completion of the course student will be able to

1. Apply the difference equations concept for analyzing the Discrete Time Systems
2. Understand the DFT of a discrete time signal
3. Use the FFT algorithm for solving the DFT of a given signal
4. Design a Digital IIR filter for the given specifications
5. Design a Digital FIR filter for the given specifications
6. Understand the programmable DSPs and their architectures.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications",Pearson Education / PHI, 2007.
2. A.V.Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", PHI
3. B.Venkataramani, M.Bhaskar, " Digital Signal Processors, Architecture, Programming and Applications", TATA McGraw Hill, 2002

Reference Books:

1. A Anand Kumar, "Digital Signal Processing", PHI.
2. Robert J. Schilling, Sandra L. Harris, "Fundamentals of Digital Signal Processing using MATLab",Thomson, 2007.

Web References:

1. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring 2011/video-lectures/
2. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/study-materials/
3. https://nptel.ac.in/courses/117102060/

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Introduction	T1	1 & 2
		T2	1 & 2
2	Discrete Fourier Series & Fourier Transforms	T1	7 & 8
		T2	3 & 6
3	Design of IIR Digital Filters& Realizations	T1	10
		T2	5
4	Design of FIR Digital Filters & Realizations	T1	10
		T2	5
5	Digital Signal Processors	T3	2 & 3

DIGITAL IMAGE PROCESSING (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Familiarize with fundamentals of digital image processing and different transforms
- Understand image processing concepts of enhancement, restoration, color image processing , compression, segmentation and wavelets

Unit -1	**Hours**
Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. **Image Transforms:** Need for image transforms,2-d Discrete Fourier transform (DFT) and its properties, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD , Comparison of different image transforms	**12**
Unit -2	
Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods **Filtering in the Frequency Domain:** Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering Implementation	**10**
Unit – 3	
Image Restoration: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter **Color image processing:** Color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.	**7**
Unit – 4	
Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding **Image segmentation:** Fundamentals, point, line, edge detection, thresholding, region – based segmentation.	**12**

Unit – 5	
Wavelets: Image pyramids, sub band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimensions. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets. **Case Studies:** Feature Detection, Face Recognition, Image Cryptography	**9**

Course outcomes:

On completion of the course student will be able to

1. Understand the fundamentals and transforms of digital image processing
2. Apply image enhancement and filtering concepts in spatial and frequency domains.
3. Apply image restoration and understand color image processing techniques.
4. Apply different segmentation algorithms on digital images
5. Analyze digital images using compression algorithms
6. Analyze digital images using wavelets

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. R. C. Gonzalez and R. E. Woods, **"Digital Image Processing"**, 3rd edition, Prentice Hall, 2008.
2. Anil K.Jain, **"Fundamentals of Digital Image Processing"**, Prentice Hall of India, 7th Edition, Indian Reprint, 1989

Reference Books:

1. R. C. Gonzalez, R. E. Woods and Steven L. Eddins , **"Digital Image Processing Using MATLAB"** , 2nd edition, Prentice Hall, 2009.
2. S.Sridhar, **"Digital Image Processing"**, oxford publishers, 2011
3. M.C. Trivedi, **"Digital Image Processing"**, Khanna Book Publishing House

Web References:

1. https://nptel.ac.in/courses/117105079/
2. http://www.cs.rug.nl/~roe/courses/ip.html

S.No.	Unit Name	Text Book /Reference	Chapter No.
1	Introduction and Image Transforms	T1	1 & 2
		T2	4 & 5
2	Intensity Transformations and Spatial Filtering and Filtering in the Frequency Domain	T1	3 & 4
		T2	7
3	Image Restoration and Color Image Processing	T1	5 & 6
		R2	5
4	Image compression and Image segmentation	T1	8 & 10
		T2	11
5	Wavelets and Multi-resolution Processing	T1	7

ANTENNAS AND WAVE PROPAGATION (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to

- Understand the concepts of radiation mechanism and antenna parameters
- Apply the knowledge of electromagnetic radiation for wire antennas and loop antennas
- Analyze and compare the characteristics of various antenna arrays
- Analyze non-resonant and broadband antennas and differentiate wave propagation modes and their propagation characteristics

Unit -1	**Hours**
Fundamental Concepts: Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Polarization, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.	**08**
Unit -2	
Radiation from Wires and Loops: Fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of λ/2 antenna, Fields of thin linear antenna with uniform travelling wave, Loop antenna general case and Radiation resistance of loop antenna.	**10**
Unit – 3	
Antenna Arrays : Array of two isotropic point sources, non isotropic point sources and principle of multiplication of patterns, Linear array of n point sources (Broad side array, End-fire array) , Linear array with non-uniform amplitude distribution, array of two driven λ/2 elements broad side case, array of two driven λ/2 elements end fire case. Horizontal and vertical antennas above a plane ground. Binomial Array	**12**
Unit – 4	
Micro Strip Antennas: Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. **VHF and UHF Antennas:** Broadband Antennas-Helical antenna, Practical design considerations, Principle of operation. Reflector antennas, parabolic reflector, corner reflector, Feed methods for parabolic reflectors, Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning, Applications. Smart Antennas-Basic concepts and benefits.	**12**
Unit – 5	
Radio Wave Propagation: Ground Wave Propagation, Space Wave Propagation: Field Strength Relation, Effect of Earth, Super Refraction, Tropospheric Propagation. Sky Wave Propagation: Structural details of the Ionosphere, Wave propagation Mechanism, Refraction and Reflection of Sky waves by Ionosphere, Ray Path, Critical frequency, MUF,LUF,OF, virtual Height	**08**

and Skip distance, Relation between MUF and the Skip Distance, Multi-Hop propagation.	

Course outcomes:

On completion of the course student will be able to

1. Understand the concepts of radiation mechanism and antenna parameters
2. Apply electromagnetic radiation for wire antennas and loop antennas
3. Analyze and compare the characteristics of various antenna arrays
4. Analyze non-resonant and broadband antennas
5. Design VHF, UHF and Microwave antennas
6. Differentiate wave propagation modes and their propagation characteristics

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. C.A. Balanis, **"Antenna Theory"**, 2nd Edition, John Wiley and Sons, 2001.
2. K.D. Prasad, Satya Prakashan, **"Antennas and Wave Propagation"**, Tech India Publications, New Delhi, 2001.

Reference Books:

1. John D. Kraus and Ronald J. Marhefka, **"Antennas for All Applications"**, 3rd Edition, TMH, 2003.
2. E.C. Jordan and K.G. Balmain, **"Electromagnetic Waves and Radiating Systems"**, 2nd Edition, PHI, 2000.

Web References:

1. https://nptel.ac.in/courses/108101092/
2. https://nptel.ac.in/courses/117107035/

CELLULAR AND MOBILE COMMUNICATIONS (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Design and analyze Basic Cellular System
- Know of frequency reuse and Co-channel Interference, Non co-channel Interference
- Know the concepts Cell coverage for signal and Antennas
- Apply the different methods of Channel Assignment and Handoff mechanisms
- Explore the implementing of these wireless technologies in cellular and mobile communications

Unit -1	**Hours**
Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, Why Cellular Mobile Telephone Systems, History Of 800mhz Spectrum Allocation, Trunking Efficiency, A Basic Cellular System, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Marketing Image of Hexagonal Shaped Cells, Planning a Cellular system, Analog cellular Systems. **Elements of Cellular Radio System Design :** General Description of The Problem, Concept of Frequency Channels, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni-directional Antenna System, Handoff Mechanism, Cell Splitting, Consideration of The Components of Cellular System.	**12**
Unit -2	
Interference: Co-Channel Interference, Exploring Co-Channel Interference areas in a system, Real Time Co-Channel Interference Measurement at mobile radio transceivers, Design of an Omni Directional Antenna System in the worst case, Design of a Directional Antenna System, Lowering the Antenna height, Reduction of Co-channel Interference by means of a notch in the tilted antenna pattern, Umbrella-pattern effect, use of parasitic elements, power control, Diversity Receiver. **Non Co-Channel Interference:** Subjective test Vs objective test, Adjacent-channel interference, near-end-far-end interference, effect on near-end mobile units, cross talk-A unique characteristics of voice channels, effects on coverage and interference by applying power decrease, antenna height decrease, beam tilting, effects of cell-site components, interference between systems, UHF TV interference, long-distance interference.	**10**
Unit – 3	
Cell Coverage for Signal and Traffic: General Introduction, Obtaining the Mobile Point-to-Point Model (Lee Model), Propagation over Water or Flat Open Area, Foliage Loss, Propagation in Near-in Distance, Long –Distance Propagation, Obtain Path Loss from a Point-to-Point Prediction Model-A General Approach, Form of a Point-to-Point Model. **Cell Site and Mobile Antennas:** Sum and Difference Patterns and their Synthesis, Antennas at Cell Site, Omni-directional Antennas, Directional	**9**

Antennas for Interference Reduction, Unique Situations of Cell-Site Antennas, Mobile Antennas.	
Unit – 4	
Frequency Management and Channel Assignment: Frequency Management, Frequency –Spectrum Utilization, Set-up Channels , Channel Assignments to Cell Sites and Mobile Units, Fixed Channel Assignment, Adjacent Channel Assignment, Channel Sharing and Borrowing, Sectorization, Underlay-Overlay arrangement, Non fixed Channel Assignment Algorithms. **Handoff:** Value of Implementing Handoffs, Why handoffs, Types of Handoff, Initiation of a Handoff, Delaying a Handoff, Forced Handoffs, Queuing of Handoffs, Power-Difference Handoffs, Mobile Assisted Handoff(MAHO) and Soft Handoff, Cell-Site Handoff, Intersystem Handoff, Introduction to Dropped Call Rate, Formula of Dropped Call Rate.	**11**
Unit – 5	
Digital Cellular Networks: GSM- Architecture, Channels, Multiple-access scheme, Radio resource management, Mobility management, Communication management, Network management, North American TDMA-History, Architecture, CDMA.	**8**

Course outcomes:

On completion of the course student will be able to

1. Learn Basic concepts of Cellular System
2. Identify Co-channel and Non co-channel Interference
3. Know the concepts Cell coverage for signal
4. Choose proper cell site antenna
5. Apply the different methods of Channel Assignment and Handoff mechanisms
6. Plan wireless technologies in cellular and mobile communications

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. William C. Y. Lee (2006), Mobile Cellular Telecommunications, 2nd edition, Tata McGraw Hill, India.
2. Theodore S. Rappaport (2002), Wireless Communications, 2nd edition, Pearson education, India.

Reference Books:

1. Gordon L. Stuber (2007), Principles of Mobile Communication, 2nd edition, Springer International, India.
2. William C. Y. Lee (2006), Wireless and Cellular Telecommunications, 3rd edition, McGraw Hill, New Delhi.

VLSI DESIGN (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives: The students are able to

- learn about the various fabrication steps of IC and electrical properties of MOSFET.
- learn about the Specific rules to draw the stick diagrams and Layouts.
- analyze the circuit concepts and to apply Scaling factors for Device parameters.
- learn about VLSI design trends and testing methods.
- know about FPGA architecture and Low power VLSI design.

Unit -1	**Hours**
Introduction: Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production and MOS fabrication process. **Basic Electrical Properties of MOS and Bi-CMOS Circuits:** Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit, Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, Alternative forms of pull-up, CMOS Inverter.	**10**
Unit -2	
MOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2μm Double Metal, Double Poly CMOS rules, 1.2μm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter.	**10**
Unit – 3	
Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Transistor switches, Realization of gates using NMOS, PMOS and CMOS technologies, Scaling models, Scaling factors for device parameters.	**11**
Unit – 4	
Chip Input and Output circuits: ESD Protection, Input Circuits, Output Circuits and L(di/dt) Noise, On-Chip clock Generation and Distribution. **Design for Testability**: Fault types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based Techniques and Built-In Self Test techniques.	**10**
Unit – 5	
FPGA Design: Basic FPGA architecture, FPGA configuration, configuration modes, FPGA design process- FPGA design flow, FPGA families.	**9**

Introduction to Low Power VLSI Design: Introduction to Deep submicron digital IC design **and** Low Power CMOS, Overview of low power design through voltage scaling, switching activity, and switching capacitance. Interconnect Design and Clock Design.	

Course outcomes:

By the end of this course, students should be able to:

1. Understand the fabrication steps of IC and electrical properties of MOSFET.
2. Apply the concepts of design rules during the layout of a circuit.
3. Apply circuit concepts for Device parameters.
4. Apply Scaling factors for Device parameters
5. Identify the VLSI design trends and testing methods.
6. Understanding FPGA and Low power techniques.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

TEXT BOOKS:

1. Kamran Eshraghian, Douglas and A. Pucknell and SholehEshraghian, "Essentials of VLSI Circuits and Systems", Prentice-Hall of India Private Limited, 2005 Edition.
2. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, Yusuf Leblebici, Tata McGraw-Hill Education, 2003.

Reference Books:

1. Advanced Digital Design with Verilog HDL, Michael D.Ciletti, Xilinx Design Series, Pearson Education.
2. Analysis and Design of Digital Integrated Circuits in Deep submicron Technology, 3'rd edition, David Hodges.

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Introduction, Basic Electrical Properties of MOS and Bi-CMOS Circuits	T1	1 & 2
2	MOS and Bi-CMOS Circuit Design Processes	T1	3
3	Basic Circuit Concepts, Scaling of MOS Circuits	T1	4 & 5
4	VLSI Design Issues	T2	1
5	FPGA Design	R1	2 & 3

VLSI PHYSICAL DESIGN AUTOMATION (Open Elective)			
Subject Code		Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives: Students are able to

- Understand the concepts of EDA methodologies for IC design.
- Understand the process of transforming structural representation of VLSI system into its layout representation.
- Carry out the transformation efficiently using computers to optimize topological, geometric, timing and power-consumption constraints of the design
- Understand the concepts of design automation for FPGAs and MCMs.

Unit -1	**Hours**
VLSI Design Methodologies: New Trends in Physical Design Cycle, Issues related to the Fabrication Process, Review of Data structures and algorithms, Complexity Issues and NP-hardness, Graph Algorithms for Physical design, Review of VLSI Design automation tools.	**9**
Unit -2	
Partitioning, Floorplanning and Pin Assignment: Introduction to Partitioning, Problem Formulation, Kernighan-Lin Algorithm, Fiduccia-Mattheyses Algorithm, Introduction to Floorplanning, Problem Formulation, Integer Programming Based Floorplanning, Rectangular Dualization, General Pin Assignment and Channel Pin Assignment.	**10**
Unit – 3	
Placement and Routing: Problem Formulation, Simulated Annealing Algorithm, Breuer's Algorithm, Force Directed Algorithm, Terminal Propagation Algorithm, Routing problem formulation, Maze Routing Algorithms: Lee's Algorithm, Soukup's Algorithm, Hadlock's Algorithm, Line-Probe Algorithms, Shortest Path Based Algorithms, Steiner Min-Max Tree based Algorithm, Detailed Routing Problem Formulation, Greedy Channel Routing Algorithm, Greedy Routing Algorithm for Switch Box.	**11**
Unit – 4	
Clock and Power Routing: Clocking Schemes, Design Considerations for the Clocking System, Delay Calculation for Clock Trees, Clock Routing Algorithms: H-tree Based Algorithm, The MMM Algorithm, Geometric Matching based Algorithm, Weighted Center Algorithm, Exact Zero Skew Algorithm, Multiple Clock Routing, Power and Ground Routing, Compaction and Review of Compaction Algorithms.	**11**
Unit – 5	
Physical Design Automation of FPGAs: FPGA Technologies, Physical Design Cycle for FPGAs, Partitioning, Routing Algorithm for the Non-Segmented Model, Routing Algorithms for the Segmented Model. **Physical Design Automation of MCMs:** MCM Technologies, MCM Physical Design Cycle, Partitioning, Placement, Routing, Maze Routing, Multiple Stage Routing, Topological Routing.	**9**

Course outcomes:

By the end of this course, students should be able to:

1 Understand the basics of design cycle stages.
2 Retrieve the graph theory concepts and relate to VLSI physical design.
3 Learn partitioning and floor planning algorithms.
4 Learn different placement and routing algorithms.
5 Differentiate routing algorithms for clock and power sources.
6 Understand design automation for FPGAs and MCMs.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

TEXT BOOKS:

1. N.A. Sherwani, Algorithms for VLSI Physical Design Automation, Kluwer Academic Publishers, 2002.
2. S.H. Gerez, Algorithms for VLSI Design Automation, John Wiley & Sons, 2002.

Reference Books:

1. Sadiq M. Sait, Habib Youssef, VLSI Physical Design automation: Theory and Practice, World scientific 1999.
2. Steven M.Rubin, Computer Aids for VLSI Design, Addison Wesley Publishing 1987.

Unit No	Unit Description	Text book	Chapter No
1	VLSI Design Methodologies	T1	4
2	Partitioning, Floor planning and Pin Assignment	T1	5 & 6
3	Placement and Routing	T1	7, 8 & 9
4	Clock and Power Routing	T1	11 & 12
5	Physical Design Automation of FPGAs and MCMs	T1	13 & 14