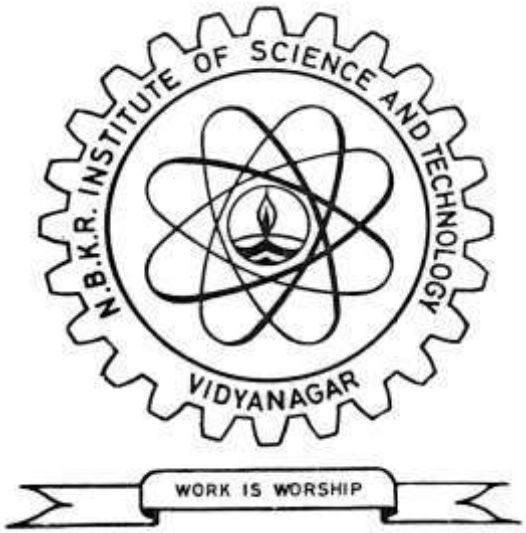
N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

(AUTONOMOUS)

COLLEGE WITH POTENTIAL FOR EXCELLENCE (CPE)
Affiliated to JNTUA, Anantapuramu
Re-Accredited by NAAC with 'A' Grade
B.Tech. Courses Accredited by NBA under TIER-I



SYLLABUS

B.TECH. DEGREE COURSE

I B.TECH

I & II Semesters

ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from the batch admitted in the academic year 2020-2021)

VIDYANAGAR - 524413
SPSR Nellore-Dist. Andhra Pradesh
www.nbkrist.org

INSTITUTE:

Vision:

To emerge as a comprehensive Institute that provides quality technical education and research thereby building up a precious human resource for the industry and society.

Mission:

1. To provide a learner-centered environment that challenges individuals to actively participate in the education process.

2. To empower the faculty to excel in teaching while engaging in research, creativity and public service.

3. To develop effective learning skills enabling students pick up critical thinking thus crafting them professionally fit and ethically strong.

4. To reach out industries, schools and public agencies to partner and share human and academic resources.

VISION AND MISSION OF THE DEPARTMENT

Vision:

To develop high quality engineers with sound technical knowledge, skills, ethics and morals in order to meet the global technological and industrial requirements in the area of Electronics and Communication Engineering.

Mission:

1. To produce high quality graduates and post-graduates of Electronics and Communication Engineering with modern technical knowledge, professional skills and good attitudes in order to meet industry and society demands.
2. To develop graduates with an ability to work productively in a team with professional ethics and social responsibility.
3. To develop highly employable graduates and post graduates who can meet industrial requirements and bring innovations.
4. Moulding the students with foundation knowledge and skills to enable them to take up postgraduate programmes and research programmes at the premier institutes.

Programme Educational Objectives (PEOs):

1. To provide the students with strong fundamental and advanced knowledge in mathematics, Science and Engineering with respect to Electronics and Communication Engineering discipline with an emphasis to solve Engineering problems.

2. To prepare the students through well - designed curriculum to excel in bachelor degree programme in Electronics and Communication Engineering in order to engage in teaching or industrial or any technical profession and to pursue higher studies.

3. To train students with intensive and extensive engineering knowledge and skill so as to understand, analyze, design and create novel products and solutions in the field of Electronics and Communication Engineering.

4. To inculcate in students the professional and ethical attitude, effective communication skills, team spirit, multidisciplinary approach and ability to relate engineering issues to broader social context.

5. To provide students with an excellent academic environment to promote leadership qualities, character molding and lifelong learning as required for a successful professional career.

Program Outcomes (POs):

PO1: Ability to acquire and apply knowledge of science and engineering fundamentals in problem solving.

PO2: Acquire in-depth technical competence in a specific information technology discipline.

PO3: Ability to undertake problem identification, formulation and providing optimum solution.

PO4: Ability to utilize systems approach to design and evaluate operational performance.

PO5: Understanding of the principles of inter-disciplinary domains for sustainable development.

PO6: Understanding of professional & ethical responsibilities and commitment to them.

PO7: Ability to communicate effectively, not only with engineers but also with the community at large.

PO8: Ability to Communicate effectively on complex engineering activities with the engineering community and with society at large.

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

PO10: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO11: Understanding of the social, cultural, global and environmental responsibilities as a professional engineer.

PO12: Recognizing the need to undertake life-long learning, and possess/acquire the capacity to do so.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR

(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

I YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional-I Marks			Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks		Duration In Hours	Max. Marks	100
1	20SH1101	Communicative English*	3	0	-	3	34	6	40	34	6	40	0.8*Best of two+0.2* least of two	3	60	100
2	20SH1102	Engineering Chemistry**	2	2	-	3	34	6	40	34	6	40		3	60	100
3	20SH1104	Engineering Mathematics-I*	3	0	-	3	34	6	40	34	6	40		3	60	100
4	20CS1101	Programming For Problem Solving*	2	2	-	3	34	6	40	34	6	40		3	60	100
5	20ME11P2	Computer Aided Engineering Drawing**	1	0	4	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	20SH11P1	English Language Lab**	-	-	3	1.5	-	-	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	20SH11P2	Engineering Chemistry Lab**	-	-	3	1.5	-	-	-	-	-	40		3	60	100
8	20CS11P1	PPS Lab*	-	-	3	1.5	-	-	-	-	-	40		3	60	100
9	20MC1101	Induction Program**	3	-	0	0	-	-	-	-	-	40	-	3	60	100
		TOTAL	14	4	12	19.5	-	-	-	-	-	360	-	-	540	900

***** Common to all Braches.

**Common to ECE, CE & ME.

A for Assignment (continuous evaluation)

$ Test (Descriptive & Objective) duration = 2 Hours

20SH1101-COMMUNICATIVE ENGLISH

(Common to All Branches)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic Level of LSRW Skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To develop basic writing skills in English. 2. To achieve specific linguistic and communicative competence. 3. To acquire relevant skills and make useof them effectively in practical working context. 4. To inculcate the habit of reading and make aware of appropriate reading strategies. 5. To learn writing paragraphs effectively with unity and coherence. 6. To learn writing of simple and analytical essays.	
Course Outcomes	On successful completion of this course, the students will be able to:	
	CO1	Identify activity-based learning methods to ensure that they would be engaged in use of language.
	CO2	Demonstrate effective listening skills for better comprehension of academic lectures and English spoken by the native speakers.
	CO3	Apply knowledge of grammatical structures and vocabulary and encourage their appropriate usage in speaking and writing.
	CO4	Contrast graphic elements used in academic texts and produce a coherent paragraph construing a figure/graph/chart/table
	CO5	Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.
	CO6	Develop appropriate reading strategies of comprehension in various academic texts and authentic materials and comprehend, discuss and respond to academic texts orally and in writing.

UNIT-I

Lesson: On the Conduct of Life: William Hazlitt

Writing: Paragraph Writing: Sentence Structures- use of phrases and clauses in sentences - importance of proper punctuation- creating coherence- beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph

Grammar: Content words and Function words: Word Forms: Verbs, Nouns, Adjectives and Adverbs; Nouns: Countable and Uncountable; singular and plural; Basic Sentence Structures; Simple Question form - Wh-questions; Word Order in Sentences

Vocabulary : Word Formation - Suffixes

Course Content	**UNIT-II** **Lesson: The Brook: Alfred Tennyson** **Writing:** Descriptions: Nature and style of sensible writing - Describing - Defining -Classifying- Providing examples and evidence - Writing introduction and conclusion **Grammar:** Cohesive devices - Linkers, Sign posts and transition signals; Use of Articles and Zero Article, Prepositions, **Vocabulary:**Word Formation- Prefixes **UNIT-III** **Lesson: The Death Trap: Saki** **Writing:** Drafting of Public Speech**:** Introduction - Structure - Content- Informing facts- Conclusion **Grammar:** Pronoun-Agreement, Subject-Verb Agreement **Vocabulary:** Synonyms **UNIT-IV** **Lesson: Innovation: Muhammad Yunus** **Writing:** Information Transfer: describe, compare, contrast, and identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar:** Quantifying expressions - Adjectives and Adverbs; Comparing and Contrasting; Degrees of Comparison **Vocabulary:** Antonyms **UNIT-V** **Lesson: Politics and the English Language: George Orwell** **Writing:** Letter Writing: Official Letters and E-mail letters **Grammar:** Verbs - Tenses - Active Voice and Passive Voice, Question Tags, Reported Speech **Vocabulary:** One - Word Substitutes **UNIT –VI** **Reading:** Comprehension: Different Reading Strategies - Skimming - Scanning - Inferring, Predicting and responding to content - Guessing from context and vocabulary extension. **Writing:** Essay writing: Writing structured essays on specific topics - introducing the issue - analyzing and arguing - creating coherence usage of proper punctuation - importance of conclusion **Grammar :** Editing short texts - identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement) **Vocabulary:** Common Abbreviations
Text Book	**Text Book:** Language and Life: A Skills Approach- I Edition 2018, Orient Black Swa
Reference Books:	**REFERENCE BOOKS:** 1. Bailey, Stephen. Academic writing: A hand book for international students.Routledge, 2014. 2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking, HeinleyELT; 2nd Edition, 2018. 3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational. 4.Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book 5.Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.
e-resources:	www.englishclub.com www.easyworldofenglish.com www.languageguide.org/english www.bbc.co.uk/learningenglish www.eslpod.com/index.html www.myenglishpages.com

20SH1102-APPLIED CHEMISTRY

(Common to ECE, ME & CE)

Course Category:	Basic science	**Credits**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre-requisite:	Fundamental concepts of Chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about	
	1.To familiarize engineering chemistry and its applications 2.To train the students on the principles and applications of electrochemistry and polymers 3.To introduce modern engineering materials, semiconductors and nanomaterials	
Course Outcomes	On successful completion of this course student will be able to:	
	CO1	Explain the calculation of bond order of O_2 and CO molecules
	CO2	Illustrate the band theory of solids for conductors, semiconductors and insulators
	CO3	Apply Nernst equation for calculating electrode and cell potentials
	CO4	Demonstrate the factors affecting corrosion and corrosion prevention methods
	CO5	Discuss the different types of polymers and their applications
	CO6	Understand the types of calorific value
Course content	**UNIT I: STRUCTURE AND BONDING MODELS:** Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, applications to hydrogen, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of N_2, O_2, CO and NO, π-molecular orbitals of butadiene and benzene, calculation of bond order. **UNIT II: MODERN ENGINEERING MATERIALS** i). Understanding of materials: Crystal field theory – salient features – splitting in octahedral, tetrahedral and square planar geometry. Properties of coordination compounds-oxidation state, coordination number, magnetic properties and colour. ii). Semiconductor materials, superconductors- basic concept, band diagrams for conductors, semiconductors and insulators, effect of doping on band structures. iii). Nanochemistry: Introduction, classification of nanometerials, properties and applications of fullerenes, carbon nanotubes and graphene nanoparticles. **UNIT III: ELECTRO CHEMISTRY AND APPLICATIONS** Introduction to Electro chemistry, Electrode potential, Nernst equation, reference electrodes (Calomel electrode and glass electrode), electrochemical cell, cell potential calculations and numerical problems .Batteries- Primary cells – Zinc-air battery. Secondary cells – lead acid and lithium ion batteries-working of the batteries including cell reactions. Fuel cells- hydrogen-oxygen fuel cell– working of the cell. Potentiometry – potentiometric titration (redox reaction). Conductometry – concept of conductivity- Specific, equivalent & molar conductance and cell constant, conductivity cell, conductometric titrations (acid-base titrations). P^Hmetry-Basic concepts and applications.	

	UNIT IV: SCIENCE OF CORROSION Introduction to corrosion, definition, types of corrosion, Mechanism of corrosion- metal oxide formation by dry corrosion, Pilling Bedworth ratios and uses and electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, Factors affecting the corrosion, prevention methods of corrosion- Cathodic protection (Sacrificial anodic protection and Impressed current cathodic protection) and Metallic coatings -electroplating and electro less plating. **UNIT V: POLYMER SCIENCE AND TECHNOLOGY** Introduction to polymers, Polymerisation and Types of polymerisation (addition, condensation and co-polymerisation), Poly dispersibity index-Measurement of average molecular weight of polymer. Plastomers -Thermoplastics and Thermo setting plastics, Preparation, properties and applications of PVC, Bakelite, Urea-Formaldehyde and Nylons. Elastomers – Preparation, properties and applications of Buna S, Buna N and Thiokol **UNIT VI:FUEL TECHONOLOGY** Chemical fuels – Introduction, classification, characteristics of a good fuel, calorific value, determination of calorific value (Bomb and Boy's gas calorimeters), numerical problems based on calorific value. **Solid Fuels–** Types, ranking of coal andAnalysis of coal (Proximate and Ultimate analysis). **Liquid Fuels** -Refining of petroleum, knocking and anti-knock agents, Octane and Cetane numbers. **Gaseous Fuels**-L.P.G, Water gas, producer gas and Flue gas analysis by Orsat's apparatus.
Text Books & References	**TEXT BOOKS:** 1. Jain and Jain, Engineering Chemistry, 16 Ed., DhanpatRai Publishers, 2013. 2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10 Ed., Oxford University Press, 2010. **REFERENCE BOOKS:** 1. K N Jayaveera, G V Subba Reddy and C Rama Chandraiah, Engineering Chemistry 1 Ed. Mc Graw Hill Education (India) Pvt Ltd, New Delhi 2016 2. J. D. Lee, Concise Inorganic Chemistry, 5 Ed., Oxford University Press, 2008. 3. Dr. S.S. Dara and Dr S.S Umare, A Text book of Engineering Chemistry, 1 Ed., Chand & Company Ltd., 2000. 4. K SeshaMaheswaramma and MridulaChugh, Engineering Chemistry, 1 Ed., Pearson India Education Services Pvt. Ltd, 2016.

20SH1104-ENGINEERING MATHEMATICS –I

(Common to all branches**)**

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre -requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about	
	1. The concepts of Newton's law of cooling, Law of natural growth and decay. 2. Solving higher order differential equations with RHS of different types by using analytical techniques. 3. The concepts of first shifting theorem, Change of scale property, Laplace transformation of multiplied by t and division by t and transformation of derivatives and integrals. 4. The application of Solutions of Ordinary Differential Equations. 5. The basic concepts of Matrices. 6. Taylor's and Maclaurin's series, Maxima and Minima of the functions of two and three variables.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Attains skills in solving first order differential equations and its applications.
	CO2	Acquire knowledge in solving higher order differential equations by using various types.
	CO3	Acquire basic knowledge in Laplace transforms and their applications.
	CO4	Develop analytical skills in solving the Ordinary Differential Equations by using the Laplace transform technique.
	CO5	Understand effectively the analyzation of the Rank of the matrix, Consistency of system of linear equations, Eigen values and Eigen vectors.
	CO6	Attains skills in analyzing the Taylor's and Maclaurin's series and Maxima and Minima of the functions of two and three variables.
Course Content	**UNIT - I** **First order Differential Equations**: Differential Equations of first order and first degree – exact, linear and Bernoulli. Applications to Newton's law of cooling, Law of natural growth and decay. **UNIT - II** **Higher order Differential Equations:** Homogeneous linear differential equations of second and higher order with constant coefficients with R.H.S. of the type e^{ax}, $\sin ax$ or $\cos ax$, x^n, e^{ax} V and $x^n v(x)$. **UNIT - III** **Laplace Transformation:** Laplace Transformations of standard functions, First shifting theorem, Change of scale property, Laplace transformation of multiple by t and division by t, Transformation of derivatives and integrals. **UNIT - IV** **Inverse Laplace Transformation:** Inverse transforms, Method of partial fractions, Shifting property, Inverse Laplace transform of a multiple by s and division by s, Inverse Laplace	

	transform of derivatives and integrals, Convolution theorem. Application to Solutions of Ordinary Differential Equations. **UNIT - V** **Matrices:** Rank of Matrix by Echelon form, System of homogenous and non- homogenous linear equations, Eigen values and Eigen vectors and their properties. UNIT - VI **Differential Calculus:** Taylor's and Maclaurin's series , Maxima and Minima of function of two variables and Lagrangian method of multipliers with three variables only.
Textbooks & Reference Books	**TEXT BOOKS:** 1. Higher Engineering Mathematics - B.S.Grewal, Kanna Publishers, New Delhi. 2. Engineering Mathematics - B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd, New Delhi. **REFERENCE BOOKS:** 1. Higher Engineering Mathematics - H.K. Dass, Er. RajnishVerma, S.Chand Publication, New Delhi. 2. Advanced Engineering Mathematics - N.P. Bali & M. Goyal, Lakshmi Publishers, New Delhi. 3. Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India

20CS1101 - PROGRAMMING FOR PROBLEM SOLVING

(Common to all branches)

<table>
<tr><td>Course category:</td><td>Program Core</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td>Theory</td><td>Lecture – Tutorial – Practical:</td><td>2-2-0</td></tr>
<tr><td rowspan="3">Pre-requisite:</td><td rowspan="3">Knowledge on computer fundamentals and basic mathematics</td><td>Sessional Evaluation:</td><td>40</td></tr>
<tr><td>Univ. Exam Evaluation:</td><td>60</td></tr>
<tr><td>Total Marks:</td><td>100</td></tr>
<tr><td>Course Objectives</td><td colspan="3">Students undergoing this course are expected to:
1. Learn the procedure how to develop algorithms, representations and programming development steps
2. Learn the basic building blocks of C language.
3. Usage of C constructs (arrays, structures, pointers and file management) to develop various programs
4. Create better awareness how effectively utilize the concepts of C for application development</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">Upon successful completion of the course , the students will be able to:
CO1 Learn the fundamentals of programming development, structure of C and basicdata types
CO2 Find the usage of operators in expression evaluation and construction of I/O Statements.
CO3 Acquire knowledge on various control structures to develop simple programs
CO4 Explore the concept of arrays, strings and its effective utilization
CO5 Understand the concepts of Pointers and Functions for exploring the dynamic memory usage
CO6 Explore the basics of Structures, Unions, File operations and supporting implementations</td></tr>
<tr><td>Course Content</td><td colspan="3">UNIT – I
INTRODUCTION: Algorithms, Flow charts, Program development steps.

FUNDAMENTALS OF C: History, Structure of a C program, Programming rules and execution. Character set, Delimiters, C keywords, Identifiers, Constants, Variables, Rules for defining Variables, Data types, Declaration and Initialization of Variables.

UNIT – II
OPERATORS AND EXPRESSIONS: Introduction, Operator Precedence and Associativity, Operator Types

INPUT AND OUTPUT IN C: Formatted and Unformatted functions, Commonly used library functions.
UNIT – III
DECISION STATEMENTS: Introduction, Types of If statements, switch statement, break, continue, goto.
ITERATIVE STATEMENTS: while, do-while and for loops.</td></tr>
</table>

Course Content	**UNIT-IV** **ARRAYS**: Definitions, Initialization, Characteristics of an array, Array Categories. **STRINGS:** Declaration and Initialization of strings, String handling functions. **STORAGE CLASSES**: Automatic, External, Static and Register Variables. **UNIT-V** **POINTERS:** Fundamentals, Declaration and initialization of Pointers, Arithmetic Operations, Pointers and Arrays. **FUNCTIONS:** Definition, Function Prototypes, Types of functions, Call by Value and Call by Reference, Recursion. **UNIT-VI** **STRUCTURES:** Definition, Declaration and Initialization of Structures. **UNIONS:** Definition, Declaration and Initialization of Union. **FILES:** Introduction, File Types, Basic operations on Files, File I/O, Command Line Arguments.
Text Books & Reference Books	**TEXT BOOKS:** 1. Programming with ANSI & TURBO C by Ashok N.Kamthane, Pearson Education 2007 **REFERENCE BOOKS:** 1. A Book on C by Al Kelley/Ira Pohl, Fourth Edition,Addison-Wesley.1999 2. Let Us C by Yashavant Kanetkar, BPB Publications. 3. Programming in ANSI C by Balaguruswamy 6th Edition, TataMcGraw Hill Education, 2012.

20ME11P2-COMPUTER AIDED ENGINEERING DRAWING LABORATORY

(Common to ECE, ME & CE)

Course Category:	Engineering Science	**Credits:**	3
Course type:	Practical	**Lecture- Tutorial-Practical:**	0-0-6
Pre-requisite:	Geometrical Construction	**Sessional Evaluation:**	40
		External Exam Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected:	
	❖ To enable the students with various concepts like dimensioning, construction of conic sections, polygons, cycloids and involutes. ❖ To impart and inculcate proper understanding of AutoCAD fundamentals. ❖ To apply the knowledge of AutoCAD for the projections of points, lines and solids. ❖ To know about sections and developments of solids. ❖ To improve the visualization skills with isometric projections.	
Course Outcomes	At the end of the course, the student will be able to	
	CO1	Understand the conventions and methods of engineering drawings
	CO2	Sketch the solutions to the problems on projection of points, lines, planes and solids
	CO3	Demonstrate orthographic and Isometric principles
	CO4	Understand and apply the knowledge of engineering drawing in modern CAD tools.

Course Content

INTRODUCTION TO CAD SOFTWARE:

Introduction: Importance of Computer Aided Drawing, software tool environment, drawing size and scale, main menu, tool bar and menus, co-ordinate system, drafting settings.

Creation and Editing: Points, Lines, Poly lines, Polygons, Splines, circle, ellipse, text, move, copy, off-set, pan, mirror, rotate, trim, extend, break, chamfer, fillet, curves, block, layers, line representations, dimensioning and hatching.

GEOMETRICAL CONSTRUCTIONS, AND CONIC SECTIONS:

Importance of Drawing, Drawing Instruments, Sheet layout, BIS Conventions, Types of lines, Lettering, and dimensioning methods.

Geometrical Constructions: Regular Polygons.

Conic Sections: Introduction, Construction of Ellipse, Parabola and Hyperbola using Eccentricity method and Rectangular/ Oblong methods, Rectangular hyperbola.

SPECIAL CURVES:

Construction of Cycloidal curves – Cycloid, Epi-cycloid and Hypo- cycloid.

Involutes – Involutes of circle and polygons.

PROJECTIONS OF POINTS AND LINES:

Projections of Points: Principles of projections, Planes of projection, Points in four quadrants.

Projections of Lines: Line inclined to both the principal planes (first angle projection only).

PROJECTIONS OF PLANES:

Projections of Planes: Plane (triangle, square, rectangle, pentagon, hexagon and circular) inclined to both the principal planes.

PROJECTIONS OF SOLIDS:

Projections of Solids: Solids such as Prisms, Pyramids, Cylinders and Cones inclined to both the principal plane.

SECTIONS OF SOLIDS:

Solids such as Prisms, Pyramids, Cylinders and Cones resting on their bases on HP.

	DEVELOPMENT OF SURFACES. Lateral surfaces of solids such as Prisms, Pyramids, Cylinders and Cones (cut by a plane inclined to HP). **ISOMETRIC VIEWS AND PROJECTIONS:** Isometric views of planes and solids. Isometric scale, Isometric Projections of simple objects**.** **ORTHOGRAPHIC PROJECTIONS:** Conversion of Pictorial views into Orthographic Views.
TEXT BOOKS	**Text Books** 1. Engineering Drawing, N.D. Bhat / Charotar Publishing House,. Gujarat, 53rd edition, 2014. 2. AutoCAD 2013 For Engineers and Designers, Sham Tickoo, Dream tech Press, 2013.
REFERENCE BOOKS	**Reference Books** 1. Engineering Drawing And Graphics + Autocad, Venugopal K, New Age International Pvt. Ltd.New Delhi, 2007. 2. Engineering Graphics with Auto CAD, D.M. Kulkarni, A.P. Rastogi and A.K. Sarkar, PHI Learning Private Limited, Revised Edition, August 2010. 3. Engineering Drawing and Graphics Using Autocad, T Jeyapoovan, Vikas Publishing House, 3rd Edition, 2010. 4. A Textbook on Engineering Drawing, P. Kannaiah, K. L. Narayana, K. Venkata Reddy, Radiant Publishing House, 2012.

20SH11P1-ENGLISH LANGUAGE LABORATORY

(Common to ECE, ME & CE)

Course Category:	Basic Sciences	**Credits:**	1
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-2
Pre-requisite:	Basic Level of LSRW skills	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected: The main objective is to prepare the students to improve their communicative ability in English with emphasis on LSRW skills and enable them to communicate effectively in different socio- cultural and professional contexts.
Course Outcomes	After completing the course, the student will be able to These activities practiced in the laboratory are helpful in comprehending the important language aspects which are useful for the real-life situations. These are also helpful in enhancing the language competency and communicative level of students.
Course Content	**LIST OF ACTIVITIES** **1. Listening Skills** • Listening for Identifying key terms, understanding concepts • Listening for specific information • Listening for global comprehension and summarizing • Listening to short audio texts and answering a series of questions. **2. Common Everyday Conversations:** (Asking and answering general questions on familiar topics such as home, family, work, studies and interests) • Expressions in various situations • Making requests and seeking permissions • Interrupting and apologizing ,Role plays / Situational dialogues **3. Communication at Work Place:** • Introducing oneself and others • Ice Breaking Activity and JAM Session, Greetings ,Taking leave **4. Debates &Group Discussions** • Discussion in pairs/ small groups on specific topics • Short structured talks, Reporting/ summarizing **5. Presentations (Oral presentation, PPT & Poster presentation):** • Pre-planning , Non-verbal communication • Formal oral presentations on topics from academic contexts **6. Giving directions** **REFERENCE BOOKS:** 1. A Manual for English Language Laboratories: Dr. D. Sudha Rani, Pearson Publications 2. https://www.talkenglish.com/ 3.www.esl-lab.com 4.www.englishmedialab.com

20SH11P2-APPLIED CHEMISTRY LABORATORY

(Common to ECE, ME & CE)

<table>
<tr><td>Course Category:</td><td>Basic science</td><td>Credits:</td><td>1.5</td></tr>
<tr><td>Course Type:</td><td>Practical</td><td>Lecture-Tutorial-Practical:</td><td>0-0-3</td></tr>
<tr><td>Pre-requisite:</td><td colspan="2">Fundamental concepts of Chemistry</td><td>Sessional Evaluation: 40
External Exam Evaluation: 60
Total Marks: 100</td></tr>
<tr><td rowspan="3">Course Objectives</td><td colspan="3">Students undergoing this course are expected to learn :</td></tr>
<tr><td colspan="3">The main objective is to provide students to learn about experimental techniques in chemistry with knowledge in theoretical aspects so that they can excel in that particular field.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="3">Course Outcomes</td><td colspan="3">At the end of the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">Determine the cell constant and conductance of solutions</td></tr>
<tr><td>CO2</td><td colspan="2">Prepare advanced polymer materials</td></tr>
<tr><td>Course Content</td><td colspan="3">Minimum of 8 experiments to be completed out of the following:

<u>LIST OF EXPERIMENTS</u>

1. Determination of cell constant and conductance of solutions
2. Conductometric titration of strong acid Vs strong base
3. Conductometric titration of weak acid Vs strong base
4. Determination of pH of unknown solution
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a polymer-Bakelite
8. Estimation of ferrous iron by Dichrometry
9. Estimation of Mangneous by Colorimetry
10. Determination of viscosity of oils with Redwood viscometer 1&2
11. Determination of Flash and Fire point
12. Preparation of Nano materials by precipitation method</td></tr>
<tr><td>Text Books</td><td colspan="3">TEXT BOOKS:
1. Mendham J et al, Vogel’s text books of quantitative chemical analysis, 5 Ed., Pearson publications, 2012.
2. KN Jayaveera, Subbareddy& Chandra sekhar , Chemistry lab manual, 1 Ed., SM Enterprises, Hyderabad, 2014
3. Chatwal & Anand , Instrumental methods of chemical analysis, 2 Ed., Himalaya publications, 2006.</td></tr>
</table>

20CS11P1 –PYTHON PROGRAMMING LABORATORY

(Common to all)

<table>
<tr><td>Course Category:</td><td>Professional Core</td><td>Credits:</td><td>1.5</td></tr>
<tr><td>Course Type:</td><td>Practical</td><td>Lecture – Tutorial – Practical:</td><td>0-0-3</td></tr>
<tr><td>Pre-requisite:</td><td>Fundamentals of Computers and basic Mathematics</td><td>Sessional Evaluation:
Univ.Exam Evaluation:
Total Marks:</td><td>40
60
100</td></tr>
<tr><td rowspan="2">Course Objectives:</td><td colspan="3">• Students undergoing this course are expected:</td></tr>
<tr><td colspan="3">• To learn and practice the fundamental blocks of Python Programming</td></tr>
<tr><td rowspan="2">Course Outcomes</td><td colspan="3">• After completing the course, the student will be able to</td></tr>
<tr><td colspan="3">Gain knowledge on Python programming</td></tr>
<tr><td>Course Content</td><td colspan="3">1. Check whether the given year is leap year or not.
2. Compute GCD of two numbers using python.
3. Check whether the given number is palindrome.
4. Find all prime numbers within a given range.
5. Print ‘n’ terms of Fibonacci series using recursion
6. Implement matrix multiplication.
7. Demonstrate use of slicing in string.
8. Build an application using lists & list methods.
9. Demonstrate use Dictionary& related functions.
10. Implement a program to show usage of tuples, sets & their methods.
11. Demonstrate read and write from a file.
12. Write a program to copy a file.
13. Demonstrate working of classes and objects.
14. Write a program to demonstrate constructors.
15. Write a program to demonstrate inheritance.</td></tr>
<tr><td>Text Books & References</td><td colspan="3">Text Book(s):
1. Gowrishankar. S, Veena.A, “Introduction to Python Programming”, CRC Press, Taylor and Francis group, 2019.
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage Learning, ISBN: 978-1111822705
Reference Books:
1. Martin C.Brown, “The Complete Reference: Python”, McGraw-Hill, 2018. 2. Kenneth A. Lambert, B.L. Juneja, “Fundamentals of Python”, CENGAGE, 2015.
2. R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019</td></tr>
<tr><td>E-Resources</td><td colspan="3">1. https://Wiki.python.org/moin/WebProgrammingBooks
2. https://realpython.com/tutorials/web-dev/
3. https://nptel.ac.in/courses</td></tr>
</table>

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR

(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

I YEAR OF FOUR YEAR B.TECH DEGREE COURSE – II SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional-I Marks			Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks		Duration In Hours	Max. Marks	100
1	20SH1201	Applied Physics**	3	0	-	3	34	6	40	34	6	40	0.8*Best of two+0.2* least of two	3	60	100
2	20SH1203	Engineering Mathematics-II*	2	2	-	3	34	6	40	34	6	40		3	60	100
3	20EC1201	Electronic Devices	3	0	-	3	34	6	40	34	6	40		3	60	100
4	20CS1204	Python programming	2	2	-	3	34	6	40	34	6	40		3	60	100
5	20EE1202	Electrical Circuits	3	0	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	20SH12P3	Applied Physics Lab**	-	-	3	1.5	-	-	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	20CS12P2	Python programming Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
8	20ME12P1	Engineering Workshop	-	-	2	1	-	-	-	-	-	40		3	60	100
9	20MC1201	Universal Human Values*	3	-	0											
		TOTAL	14	4	8	19	-	-	-	-	-	320	-	-	480	800

* Common to all Braches.

**Common to ECE, CE & ME.

A for Assignment (continuous evaluation)

$ Test (Descriptive & Objective) duration = 2 Hours

20SH1201-APPLIED PHYSICS

(Common to ECE, ME & CE **)**

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Fundamental concepts of Physics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to	
	1. Learn various phenomena exhibited by light and describe the characteristics, construction & working of lasers along with applications in Science & Technology. 2. Acquire knowledge of crystal systems & their analysis using X-rays and concepts of ultrasonics. 3. Apply principles of quantum mechanics to various atomic phenomena and understand the electrical behaviour of solids. 4. Explain and provide the knowledge about semiconductors and their use in electronic devices. 5. Learn basic properties of dielectric &magnetic materials and their uses in Science & Technology. 6. Learn the behaviour of super conductors, nano materials, quantum phenomena and the limitations of basic physical laws.	
Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the utilization of laser technology in various disciplines.
	CO2	Understand the structure of crystalline solids and their applications in x-ray diffraction.
	CO3	Able to understand the basic concepts of quantum physics applicable to solids.
	CO4	To know the properties of semiconductor materials by projecting the view of energy bands.
	CO5	Understand the concepts of polarization& magnetization and also applications of dielectric& magnetic materials in various disciplines.
	CO6	Basic ideas about superconductors and nano materials with their uses in various fields of Science & Technology
	UNIT-I:Wave optics & Lasers **Wave optics**: Introduction (Interference of light) - Interference of light by wave front splitting (Young's double slit experiment) and amplitude splitting (Newton rings) – Fraunhoffer diffraction from a single slit, double slit - Diffraction grating (qualitative). **Lasers**: Spontaneous & stimulated emission of radiation - Population inversion– Properties of lasers (monochromacity, coherence, directionality, brightness) – Types of lasers: solid state (Nd-YAG), gas (He–Ne) – Applications of lasers in science, engineering & medicine.	

Course Content	**UNIT-II: Crystallography, X-ray diffraction &Ultrasonics** **Crystallography**: Introduction – Space lattice – Unit cell – Lattice parameters – Bravais lattice – Crystal systems – Packing fractions of S.C., B.C.C., F.C.C. – Planes in crystal : Miller indices – Inter planar spacing in cubic crystals– Bragg's law of diffraction – X-ray diffraction techniques: Laue method – Powder method (Debye – Scherrer method). Ultrasonics: Introduction-Properties and detection-Production of ultrasonics using Piezo electric method-Applications of ultrasonics. **UNIT-III: Introduction to quantum mechanics &Electron theory** **Introduction to quantum mechanics** : Wave nature of particles (de-Broglie hypothesis) – Uncertainty principle – Schrodinger time independent wave equation - Significance of wave function (Born interpretation) – Solution of stationary state Schrodinger equation for one dimensional problems (particle in a box). **Free electron theory:** Introduction (classical &quantum:postulates, success& drawbacks) – Fermi–Dirac distribution function and its temperature dependence – Fermi level – Density of states (qualitative) –Kronig–Penny model (non mathematical treatment) - Origin of energy bands– Classification into conductors, semiconductors & insulators. **UNIT-IV: Semiconductor physics & Semiconductor devices** **Semiconductor physics**: Intrinsic Semiconductors – Intrinsic conductivity – P&N type semiconductors - Variation of Fermi level with temperature– Drift & diffusion –Einstein relation – Hall effect and its applications. **Semiconductor devices:** Formation of P-N junction – V-I Characteristics of P-N junction diode (forward & reverse bias)– Direct & indirect bandgap semiconductors – Light emitting diodes, photo detectors & solar cells (construction, working, materials & applications) **UNIT-V:Dielectrics & Magnetic properties** **Dielectric properties**: Basic definitions – Electronic, ionic and orientation polarizations (qualitative) – Internal field in solid dielectrics – Clausius – Mossotti equation – Ferroelectricity – Applications of dielectrics. **Magnetic properties:** Introduction and basic definitions (B, M, H & χ) – Origin of magnetic moment – Classification of magnetic materials into dia, para, ferro ,anti ferro&ferri magnetics – Hysteresis – Soft & hard magnetic materials – Applications of magnetic materials . **UNIT VI: Superconductors and Nanomaterials** **Superconductors:** Introduction – Effect of temperature and magnetic field – Meissner effect – Types of superconductors (type I & II) – BCS theory –DC & AC Josephson effects (qualitative) – Applications of superconductors **Nanomaterials:** Introduction – Significance of nanoscale – Types of nanomaterials – Properties of nanomaterials: physical, mechanical, magnetic and optical – Synthesis of nanomaterials: top down-Ball milling, bottom up – Chemical vapour deposition – Applications of nanomaterials
Text Books & Reference Books	**TEXT BOOKS:** 1.Engineering Physics by P.K.Palanisamy, Scitech Publications (2nd edition). 2. Engineering Physics by S.Maninaidu, Pearson (2009). 3. Applied Physics by K.Thyagarajan, McGraw Hill (2019). **REFERENCE BOOKS:** 1.Solid State Physics, by C.Kittel, Wiley India PVT Limited (2007) 2. Solid State Physics by S.O.Pillai, New Age International Publishers (2018). 3. Engineering Physics by R.K.Gaur and S.L.Gupta, Dhanpatrai Publications(2012)

20SH1203-ENGINEERING MATHEMATICS –II

(Common to all)

Course Category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Pre – requisite:	Intermediate Mathematics	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To make the student learn about	
	1. The concepts of Double integrals, Areas and Volumes 2. The basic concepts of Triple integrals and its volume, Beta and Gamma functions. 3. The Gradient, Divergence and Curl operators, Solenoidal and Irrotational vectors. 4. The basic concepts of Vector Integration. 5. The determination of Fourier coefficients, Fourier series, Even and Odd Functions and Change of intervals. 6. The concepts of Fourier Transforms.	
Course Outcomes	After completing the course the student will be able to	
	CO1	Attains skills in analyzing the Double integrals also its Areas and Volumes.
	CO2	Understand effectively in analyzing the Triple integrals, Beta and Gamma functions
	CO3	Acquire knowledge in analyzing the Curl, Divergence and Gradient operators, Solenoidal and Irrotational vectors with their applications.
	CO4	Attains skills in analyzing the applications ofGreen's, Stoke's and Gauss-divergence theorems.
	CO5	Develop analytical skills in solving the problems involving Fourier Series.
	CO6	Understand effectively Fourier Sine and Cosine integral, Fourier Transforms, Fourier Sine and Cosine transforms.

Course Content

UNIT - I

Double integrals: Double integrals - Change of order of integration - Change to polar coordinates - Area and Volumes by double integration.

UNIT - II

Tripple integrals and Special functions: Evaluation of triple integrals, Volume by triple integral. Beta and Gamma functions and their properties, Relation between Beta and Gamma functions.

UNIT - III

Vector Differentiation: Scalar and vector point function, Vector operator Del, Del applied to scalar point function, Gradient, Divergence, Curl, Solenoidal and Irrotational vectors.

UNIT - IV

Vector Integration: Line integral-circulation-workdone, Surface integrals – flux, Green's theorem in the plain (Without proof), Stoke's theorem (Without proof), Volume integral, Gauss-divergence theorem (without proof).

	UNIT-V **Fourier Series:** Determination of Fourier coefficients - Fourier series - Even and Odd functions - Change of intervals (0,2l). **UNIT-VI** **Fourier Transforms:** Fourier Integral Theorem (Without proof)-Fourier Sine and Cosine integral - Fourier integral in complex form - Fourier Transforms - Fourier Sine and Cosine transforms.
Textbooks & Reference Books	**TEXT BOOKS:** 1. Higher Engineering Mathematics - B.S.Grewal, Khanna Publishers, New Delhi. 2. Engineering Mathematics - B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd, New Delhi.
	REFERENCE BOOKS: 1.Higher Engineering Mathematics - H.K. Dass, Er. RajnishVerma, S.Chand Publication, New Delhi. 2.Advanced Engineering Mathematics - N.P. Bali & M. Goyal, Lakshmi Publishers, New Delhi. 3.Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India

20EC1201 – ELECTRONIC DEVICES

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Engineering Physics.	**Sessional Evaluation :**	40
		Univ.Exam Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The concepts of Solid State Semi-Conductor Theory. 2. The operation of a PN Junction diode and its applications. 3. The Ideal, Practical and Electrical Characteristics of, Varactor, Tunnel diodes, LED. 4. The need for biasing of Transistor. 5. The working of FET and MOSFET. 6. The working of MOSFET and CMOS circuits.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the Semiconductor Physics for Intrinsic and Extrinsic materials and theory of operation of Solid State devices.
	CO2	Apply how the properties of semiconductor materials are used for the formation of PN and Zener diodes.
	CO3	Explain the functioning of various solid-state devices, including several types of diodes including conventional, Varactor, LED.
	CO4	Design the various Bi-polar Junction Transistor biasing circuits and its usage in applications of amplifiers.
	CO5	Distinguish the constructional features and operation of FET and their applications.
	CO6	Understand the operation of MOSFET and CMOS circuits.

Course Content

UNIT-I

SEMICONDUCTORS: Introduction, Classification of Semiconductors, Conductivity of Semiconductor, Energy Distribution of Electrons, Carrier Concentration in Intrinsic Semiconductor, Mass-Action Law, Properties of Intrinsic Semiconductors, Variation in Semiconductor Parameters with Temperature, Drift and Diffusion currents, Carrier Life Time, Continuity Equation.

UNIT – II

PN JUNCTION DIODE: Introduction, Energy Band Structure of Open Circuited Diode, Quantitative Theory of Diode Currents, Diode Current Equation, Transition Capacitance, Diffusion Capacitance, Temperature Dependence of V-I characteristics, break down mechanisms in semiconductor diodes, Diode as a Circuit Element, Piecewise Linear Diode Model, Applications.

UNIT –III

SPECIAL SEMICONDUCTOR DEVICES: Introduction, Varactor Diode, Zener diode,

Course Content	LED, Photo diode, Photovoltaic Cell, Solar Cell, UJT. **UNIT – IV** **BIPOLAR JUNCTION TRANSISTOR:** Introduction, Transistor Biasing, Operation of Transistor, Types of configuration, Characteristics & current gains (α, β, γ), Introduction to h-parameters. **UNIT – V** **JUNCTION FIELD EFFECT TRANSISTOR:** Introduction, Construction, Operation of N-Channel JFET & Characteristics, pinch-off voltage, parameters, Comparison of JFET and BJT. **UNIT – VI** **MOS FIELD EFFECT TRANSISTOR:** Introduction, MOSFET, Threshold effect, Enhancement MOSFET, Depletion MOSFET, Long-Channel V-I Characteristics, Non ideal V-I effects, CMOS inverters.
Text Books and Reference Books	**TEXT BOOKS:** 1. Electronic Devices & Circuits 4th edition by Jacob Millman & Christos C. Halkia McGraw- Hill Co. 2. Electronic Devices and Circuits 4th edition by S Salivahanan and N. Suresh Kumar McGraw Hill Education. **REFERENCES:** 1. Boylestad, Louis Nashelsky "Electronic devices and circuits" 9ed.., 2008 PE. 2. Electronic Devices and Circuits-5th edition, Oxford University Press 3. CMOS VLSI Design : A circuits and systems perspective 4t edition by by Neil H.E. Weste, David Harris
E-Resources	1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iitm

20CS1201-PYTHON PROGRAMMING

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture – Tutorial – Practical:**	2-2-0
Pre-requisite:	Basic mathematical knowledge to solve problems and programming	**Sessional Evaluation:** **Univ.ExamEvaluation:** **TotalMarks:**	40 60 100

Course Objective

Students undergoing this course are expected:

- To learn the fundamentals of Python constructs.
- To develop various simple programs using Python.
- To define Python functions, exceptions and various other features.
- To explore features of object oriented concepts.

Course Outcomes

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

CO1	Learn the basic building blocks of Python
CO2	Understand the flow of execution, exception handling mechanism and functions for application development
CO3	Study Strings, Lists and their applications
CO4	Acquire knowledge in the concepts of Dictionaries, Tuples, and Sets.
CO5	Comprehend the rules to construct regular expressions, and apply them to text to search for patterns and make changes.
CO6	Understand Object-oriented programming paradigm in controlling the access of data and reducing the duplication of code by employing code reusability techniques.

Course Content

UNIT-I

Why Python: Thrust areas of Python, Open Source Software

Python Basics: Identifiers, Keyword, Statements and Expressions, variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input and Writing Output, Type Conversions, type() function and "is"operator, Dynamic and Strongly Typed Language

UNIT-II

Control Flow Statements: if and nested if, for, while Continue and Break statements, Catching Exceptions

Functions: Built-in Functions, Commonly Used Modules, Function Definition and Calling the function, The return statement and void function, scope and lifetime of variables, Default Parameters, Keyword Arguments, Variable number of arguments with *args and **kwargs, command line arguments

	UNIT-III **Strings:** Creating and Storing Strings, Basic String Operations, Access characters by Index, Slicing and Joining of Strings, String Methods and Formatting Strings **Lists:** Creating Lists, List operations, indexing and Slicing, Built-in Functions, List Methods, del() vs pop() **UNIT-IV** **Dictionaries:** Creation, accessing and modifying key-value pairs, built-in functions used on dictionaries, dictionary methods, del statement **Tuples and Sets**: Creation of Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-in functions, Relationship among Tuples, Lists and Dictionaries, Tuple Methods, aggregation with zip(), Sets, Set Methods and Frozen sets **UNIT-V** **Files**: Types, Creating, Reading Text data and methods used for it, Manipulating Binary and CSV files, pickling (serialization of objects), os and os.path modules. **Regular Expression Operations**: Using Special Characters, Regular Expression Methods,Named Groups in Python Regular Expression andRegular Expression with glob Module. **UNIT-VI** **Object-Oriented Programming:** Classes and Objects and Creating them, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, Polymorphism.
Text Books & References:	**Text Book(s):** 1. Gowrishankar. S, Veena.A, "Introduction to Python Programming",CRC Press, Taylor and Francis group,2019. **Reference Books:** 1. Brian Heinold, A Practical Introduction to Python Programming. 2. April Speigh,Bite-Size Python: An Introduction to Python Programming. Kenneth A. Lambert, Fundamentals of python - Data structures. 3. Mark Summerfield, Programming in python 3. 4. Yaswanth Kanetkar, Aditya Kanetkar,Let Us Python, BPB Publications, 2020
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm 3. https://wiki.python.org/moin/PythonBooks

20EE1202 - ELECTRICAL CIRCUITS

(ECE)

Course category:	Professional core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Fundamentals in engineering mathematics and concepts of Electricity in physics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives

Students undergoing this course are expected to understand:

1. The basic concepts of R, L, C elements and network reduction techniques.
2. The concept of form factor, Crest factor and j notation.
3. The concept of power triangle, series and parallel connection of R, L & C elements with sinusoidal Excitation.
4. About the network theorems and their applications.
5. The two port network parameters for the given network.
6. The transient response of RL, RC, RLC series circuit for DC excitation.

Course Outcomes

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

CO1	Perform the equivalent resistance calculation of electrical circuits and also find the solution of DC circuits by Nodal and Mesh analysis.
CO2	Compute the average, RMS, form factor &crest factor of a periodic waveform.
CO3	Enumerates real power, reactive power, apparent power and power factor for a given circuit and also evaluate the resonant frequency, Quality factor, band width.
CO4	Calculate the response for a given network using network theorems.
CO5	Evaluate the two port network parameters for the given network.
CO6	Determine the time constant and transient response of a given circuit with and without D.C excitation.

Course Content

UNIT- I

CONCEPT OF ELECTRIC CIRCUITS: Introduction, Active and passive elements, V-I Characteristics of R, L and C elements, Ideal & Practical Sources, Source transformation, Network reduction techniques, Star-Delta transformation, Kirchhoff's laws - Mesh and Nodal analysis of DC circuits with independent sources.

UNIT – II

FUNDAMENTALS OF AC CIRCUITS: R.M.S, Average values , Form factor and Crest factor for different periodic waveforms, Sinusoidal alternating quantities - Phase and Phase difference, Complex and Polar forms of representations, j-Notation. Concept of Reactance, Impedance, Susceptance and Admittance.

UNIT – III

SINGLE PHASE AC CIRCUITS: Concept of Active and reactive power, power factor –power triangle -Examples -Steady state analysis of R, L and C elements (series, parallel and series-parallel combinations) with sinusoidal excitation - Phasor diagrams-Examples.

RESONANCE: Series and parallel resonance, Half power frequencies, Bandwidth and Q factor, Relation between half power frequencies, Bandwidth & Quality factor.

Course Content	**UNIT- IV** **NETWORK THEOREMS:** Superposition, Reciprocity, Thevenin's and Norton's theorems, Maximum power transfer theorem. Application of these theorems to DC excitation with dependent and independent sources. **UNIT – V** **TWO PORT NETWORK PARAMETERS** - Open circuit parameters – Short circuit parameters – Transmission parameters - Hybrid parameters –Inter-relationships of different parameters - Condition for reciprocity and symmetry of networks with different two port parameters. **UNIT – VI** **D.C TRANSIENT ANALYSIS:** Transient response of R-L, R-C & R-L-C circuits for DC excitations - initial conditions -Time constants -solution using Differential equation & Laplace transform methods.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Engineering Circuit Analysis", by Hayt & Kemmerly, 2nd Edition,TMH publishers 2. "Network Analysis", by M.E Van Valkenburg,Third Edition,PHI learning private Limited, 2006. 3. "Fundamentals of Electric circuits", by Charles k Alexander,Mathew N O Sadiku,Tata McGraw Hill Education private Limited, 6th Edition,2017. **REFERENCE BOOKS:** 1. "Circuits & Networks", by A.Sudhakar and Shyam Mohan , 5th Edition(2015),TMH 2. "Circuit Theory", by A.Chakrabarti, Dhanpat Rai publishers 6th Edition (2014). 3. "Circuits & Systems", by Dr K.M.Soni, S.K.Kataria& sons Publication(2014).
E-Resources	1. http://nptel.ac.in/courses 2. http://iete-elan.ac.in 3. http://freevideolectures.com/university/iitm

20SH12P3-APPLIED PHYSICS LABORATORY

(Common to ECE, ME & CE)

Course Category:	Basic Science	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practical:**	0-0-3
Pre-requisite:	Fundamental concepts of physics	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	To provide student to learn about some important experimental techniques in physics with knowledge in theoretical aspects so that they can excel in that particular field.
Course Outcomes	1. These experiments in the laboratory are helpful in exploring important concepts of physics through involvement in the experiments by applying theoretical knowledge. 2. It helps to recognize where the ideas of the students agree with those accepted by physics and where they do not.
Course Content	Minimum of 8 experiments to be conducted out of the following **LIST OF EXPERIMENTS** 1. Determination of rigidity modulus of a wire material – Torsional pendulum. 2. Melde's experiment – Transverse & longitudinal modes. 3. Resonance in LCR circuit. 4. Magnetic field along the axis of a coil (Stewart – Gee's Method). 5. Study of characteristics of LED. 6. Newton rings. 7. Wedge method. 8. Diffraction grating - Wavelength of given source. 9. Dispersive power of prism material using spectrometer. 10. P-N- junction diode characteristics. 11. Evaluation of Numerical Aperture of given optical fiber. 12. Energy gap of a P-N junction diode material. 13. Transistor characteristics. 14. Solar cell characteristics . 15. Logic gates .

20CS12P2 –PYTHON PROGRAMMING LABORATORY

<table>
<tr><td>Course Category:</td><td>Professional Core</td><td>Credits:</td><td>1.5</td></tr>
<tr><td>Course Type:</td><td>Practical</td><td>Lecture – Tutorial – Practical:</td><td>0-0-3</td></tr>
<tr><td>Pre-requisite:</td><td>Fundamentals of Computers and basic Mathematics</td><td>Sessional Evaluation:
Univ.Exam Evaluation:
Total Marks:</td><td>40
60
100</td></tr>
<tr><td rowspan="2">Course Objectives</td><td colspan="3">• Students undergoing this course are expected:</td></tr>
<tr><td colspan="3">• To learn and practice the fundamental blocks of Python Programming</td></tr>
<tr><td rowspan="2">Course Outcomes</td><td colspan="3">• After completing the course, the student will be able to</td></tr>
<tr><td colspan="3">Gain knowledge on Python programming</td></tr>
<tr><td>Course Content</td><td colspan="3">16. Check whether the given year is leap year or not.
17. Compute GCD of two numbers using python.
18. Check whether the given number is palindrome.
19. Find all prime numbers within a given range.
20. Print ‘n’ terms of Fibonacci series using recursion
21. Implement matrix multiplication.
22. Demonstrate use of slicing in string.
23. Build an application using lists & list methods.
24. Demonstrate use Dictionary& related functions.
25. Implement a program to show usage of tuples, sets & their methods.
26. Demonstrate read and write from a file.
27. Write a program to copy a file.
28. Demonstrate working of classes and objects.
29. Write a program to demonstrate constructors.
30. Write a program to demonstrate inheritance.</td></tr>
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Reference Books:
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4. R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019</td></tr>
<tr><td>E-Resources</td><td colspan="3">6. https://Wiki.python.org/moin/WebProgrammingBooks
7. https://realpython.com/tutorials/web-dev/
8. https://nptel.ac.in/courses</td></tr>
</table>

20ME12P1- ENGINEERING WORKSHOP LABORATORY

(Common to ECE, ME &CE)

Course Category	Engineering Science	**Credits**	1
Course type	Practical	**Lecture- Tutorial-Practical**	0-0- 2
Pre-requisite:	No Prerequisite	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to learn:	
	1. The usage of work shop tools and prepare the models in the trades such as carpentry, fitting, sheet metal & foundry. 2. The usage of wiring tools and to execute house wiring connections. 3. To demonstrate the usage of tools of welding, black smithy and machine tools.	
Course Outcomes	After completing the course the student will be able to:	
	CO1	Identify, Distinguish and Choose the tools of various trades (carpentry, fitting, sheet metal, foundry, wiring, welding, black smithy and machine tools).
	CO2	Demonstrate and Describe the usage of tools of various trades (carpentry, fitting, sheet metal, foundry, wiring, welding, black smithy and machine tools).
	CO3	Documenting the procedure adopted while preparing the model.
Course Content	1. **Carpentry**: Half Lap, Mortise and Tenon and Bridle joint. 2. **Fitting:** Square, V, half round and dovetail fittings 3. **Tin-Smithy:** Tray, cylinder, hopper, cone 4. **House-wiring:** One lamp controlled by one switch, Two lamps (bulbs) controlled by two switches independently, Stair - case connection, Two lamps controlled by one switch in series, Two lamps controlled by on switch in parallel and Water pump connected with single phase starter. 5. **Foundry**: single-piece pattern and Two- piece pattern **TRADES FOR DEMONSTRATION:** 6. Machine Tools 7. Welding 8. Black Smithy	
Text Books	**Text Books** 1. Engineering Work shop practice for JNTU, V. Ramesh Babu, VRB Publishers Pvt. Ltd,2009 2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers,2004 3. Engineering Practices Lab Manual, Jeyapoovan, SaravanaPandian, Vikas publishers,2007.	

20MC1201-UNIVERSAL HUMAN VALUES

(Common to all branches)

Course Category:	Human Values Courses	**Credits:**	0
Course Type:	Theory	**Lecture -Tutorial-Practical:**	3-0-0
Pre – requisite:	SIP-Universal Human Values 1 (desirable)	**Sessional Evaluation:**	40
		External Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected:	
	1. Development of a holistic perspective based on self-exploration about human being, family, society and nature/existence. 2. Developing clear understanding of the harmony in the human being, family, society and nature/existence. 3. Strengthening of self-reflection. 4. Development of commitment and courage to act. 5. Know about appropriate management patterns with harmony.	
Course Outcomes	After completing the course, the student will be able to	
	CO1	Understand more about of themselves, and their surroundings (family, society, nature);
	CO2	Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
	CO3	Develop as a socially and ecologically responsible engineers
	CO4	Justify the need for universal human values and harmonious existence
	CO5	Relate human values with human relationship and human society
	CO6	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Course Content

UNIT-I

Introduction to Value Education:

Universal Human Values-I - Self-Exploration - content and process; 'Natural Acceptance' and Experiential Validation - Self-exploration - Continuous Happiness and Prosperity - Basic Human Aspirations - Current scenario - Method to fulfill the above human aspirations- Understanding and living in harmony at various levels.

UNIT-II

Understanding Harmony in the Human Being - Harmony in Myself: Human being as a co-existence of the sentient 'I' and the material 'Body' - The needs, happiness and physical facility - The Body as an instrument of 'I' - The characteristics and activities of 'I' and harmony in 'I' - The harmony of I with the Body

UNIT-III

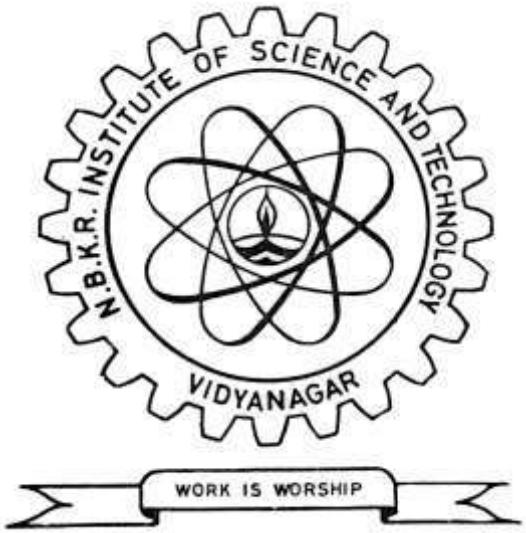
Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Values in human relationship; meaning of Justice; Trust and Respect; Difference between intention and competence; the other salient values in relationship - the harmony in the society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

	UNIT-IV **Understanding Harmony in the Nature and Existence - Whole existence as Coexistence:** The harmony in the Nature - Interconnectedness and mutual fulfilment among the four orders of nature- Recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space - Holistic perception of harmony at all levels of existence. **UNIT-V** **Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basic for Humanistic Education - Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: Professional competence –People-friendly and eco-friendly production systems - Appropriate technologies and management patterns for above production systems. **UNIT-VI** **Case studies and Strategy:** Case studies of typical holistic technologies, management models and production systems - Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
Textbooks & Reference books	**TEXTBOOK(S)***:* 1.A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. **REFERENCE BOOKS** : 1.Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. 2. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999. 3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. 4. The Story of Stuff (Book). 5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi 6. Small is Beautiful - E. F Schumacher. 7. Slow is Beautiful - Cecile Andrews 8. Economy of Permanence - J C Kumarappa 9. Bharat Mein Angreji Raj - PanditSunderlal 10. Rediscovering India - by Dharampal 11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi 12. India Wins Freedom - Maulana Abdul Kalam Azad 13. Vivekananda - Romain Rolland (English) 14. Gandhi - Romain Rolland (English)
E-Resources	1. https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ 2. https://aktu.ac.in/hvpe 3. http://www.storyofstuff.com 4. https://fdp-si.aicte-india.org/download.php#1

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

(AUTONOMOUS)

COLLEGE WITH POTENTIAL FOR EXCELLENCE (CPE)
Affiliated to JNTUA, Anantapuramu
Re-Accredited by NAAC with 'A' Grade
B.Tech. Courses Accredited by NBA under TIER-I



SYLLABUS

B.TECH. DEGREE COURSE

II B.TECH

I & II Semesters

ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from the batch admitted in the academic year 2020-2021)

VIDYANAGAR - 524413
SPSR Nellore-Dist. Andhra Pradesh
www.nbkrist.org

INSTITUTE:

Vision:

To emerge as a comprehensive Institute that provides quality technical education and research thereby building up a precious human resource for the industry and society.

Mission:

1. To provide a learner-centered environment that challenges individuals to actively participate in the education process.

2. To empower the faculty to excel in teaching while engaging in research, creativity and public service.

3. To develop effective learning skills enabling students pick up critical thinking thus crafting them professionally fit and ethically strong.

4. To reach out industries, schools and public agencies to partner and share human and academic resources.

VISION AND MISSION OF THE DEPARTMENT

Vision:

To develop high quality engineers with sound technical knowledge, skills, ethics and morals in order to meet the global technological and industrial requirements in the area of Electronics and Communication Engineering.

Mission:

1. To produce high quality graduates and post-graduates of Electronics and Communication Engineering with modern technical knowledge, professional skills and good attitudes in order to meet industry and society demands.
2. To develop graduates with an ability to work productively in a team with professional ethics and social responsibility.
3. To develop highly employable graduates and post graduates who can meet industrial requirements and bring innovations.
4. Moulding the students with foundation knowledge and skills to enable them to take up postgraduate programmes and research programmes at the premier institutes.

Programme Educational Objectives (PEOs):

1. To provide the students with strong fundamental and advanced knowledge in mathematics, Science and Engineering with respect to Electronics and Communication Engineering discipline with an emphasis to solve Engineering problems.

2. To prepare the students through well - designed curriculum to excel in bachelor degree programme in Electronics and Communication Engineering in order to engage in teaching or industrial or any technical profession and to pursue higher studies.

3. To train students with intensive and extensive engineering knowledge and skill so as to understand, analyze, design and create novel products and solutions in the field of Electronics and Communication Engineering.

4. To inculcate in students the professional and ethical attitude, effective communication skills, team spirit, multidisciplinary approach and ability to relate engineering issues to broader social context.

5. To provide students with an excellent academic environment to promote leadership qualities, character molding and lifelong learning as required for a successful professional career.

Program Outcomes (POs):

PO1: Ability to acquire and apply knowledge of science and engineering fundamentals in problem solving.

PO2: Acquire in-depth technical competence in a specific information technology discipline.

PO3: Ability to undertake problem identification, formulation and providing optimum solution.

PO4: Ability to utilize systems approach to design and evaluate operational performance.

PO5: Understanding of the principles of inter-disciplinary domains for sustainable development.

PO6: Understanding of professional & ethical responsibilities and commitment to them.

PO7: Ability to communicate effectively, not only with engineers but also with the community at large.

PO8: Ability to Communicate effectively on complex engineering activities with the engineering community and with society at large.

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

PO10: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO11: Understanding of the social, cultural, global and environmental responsibilities as a professional engineer.

PO12: Recognizing the need to undertake life-long learning, and possess/acquire the capacity to do so.

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR

(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

II YEAR OF FOUR YEAR B.TECH DEGREE COURSE – I SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2021-2022)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional-I Marks			Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks		Duration In Hours	Max. Marks	100
1	20SH2101	Engineering Mathematics-III**	2	1	-	3	34	6	40	34	6	40	0.8*Best of two+0.2* least of two	3	60	100
2	20EC2101	Electronic Circuit Analysis	3	0	-	3	34	6	40	34	6	40		3	60	100
3	20EC2102	Fundamentals of Digital Circuits	3	0	-	3	34	6	40	34	6	40		3	60	100
4	20EC2103	Signals and Systems*	3	0	-	3	34	6	40	34	6	40		3	60	100
5	20EC2104	Pulse and Analog Circuits	3	0	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	20EC21P1	Electronic Devices Lab	-	-	3	1.5	-	-	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	20EC21P2	Electronic Circuit Analysis Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
8	20EE21P4	Electrical Circuits Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
		SOFT SKILLS														
9	20EC21S1	Electronic Circuits Designing using Multisim	-	-	4	2	-	-	-	-	-	40		3	60	100
		MANDATORY											0.8*Best of two+0.2* least of two			
10	20MC2102	Managerial Economics and Financial Accounting**	2	-	-	-	34	6	40	34	6	40		3	60	100
		TOTAL	16	1	13	21.5	-	-	-	-	-	400	-	-	600	1000

***** Common to ECE & EEE. **Common to ECE, CE, EEE & ME.

A for Assignment (continuous evaluation), $ Test (Descriptive & Objective) duration = 2 Hours

20SH2101 – ENGINEERING MATHEMATICS-III

(Common to ECE, MECH, EEE & CE)

Course category:	Basic Sciences	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 1 – 0
Prerequisite:	Intermediate Mathematics	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The basic concepts of numerical solutions of simultaneous linear and non-linear algebraic equations. 2. The numerical methods to solve Ordinary Differential Equations by using Taylor's series method, Picard's method, Euler's and Modified Euler's Methods and Runge-Kutta methods of 2^{nd} and 4^{th} order. 3. The concepts of Cauchy - Riemann equations, Construction of Analytic function, Line integral, Cauchy's theorem and Cauchy's integral formula. 4. The concepts of Residues. 5. The Properties of Z- Transforms, shifting properties, initial value and final value theorems and the applications of difference equations. 6. Foundation of the probability and statistical methods.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Have a sound knowledge in analyzing the simultaneous linear and non-linear algebraic equations by various numerical methods.
	CO2	Understand effectively the significance numerical methods to solve Ordinary Differential Equations.
	CO3	Understand effectively the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations and also Cauchy's integral formula.
	CO4	Compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues.
	CO5	Attains skills in analyzing the Z-Transforms and their applications.
	CO6	Have a well-founded knowledge of standard distributions (Binomial, Poisson and Normal distributions) which can describe real life phenomena.
Course Content	**UNIT - I** **SOLUTION OF SIMULTANEOUS LINEAR AND NON-LINEAR ALGEBRAIC EQUATIONS:** Iteration method, Gauss Jordon method, Gauss Elimination with Pivotal condensation method, Triangular Factorization method, Gauss-Seidal method and Newton-Raphson method **UNIT - II** **NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:** Solution by Taylor's Series, Picard's Method of Successive Approximations, Euler's Methods and Runge-Kutta Method of 2^{nd} order and 4^{th} order.	

Course Content	**UNIT-III** **COMPLEX ANALYSIS:** Analytical functions, Cauchy - Riemann equations, Construction of Analytic function, Complex integration - Line integral, Cauchy's theorem, Cauchy's integral formula and Generalized Cauchy's integral formula. **UNIT-IV** **RESIDUES**: Taylor's theorem and Laurent's theorem (without proof), Singularities, Poles, Residues, Residue theorem and Evaluation of real definite integrals. **UNIT-V** **Z-Transforms:** Z-Transform of some standard functions, Properties of Z-Transforms, Shifting Properties, Initial value theorem and final value theorem, Inverse Z-Transform, Convolution theorem, Inversion by partial fractions and Applications to difference equations. **UNIT-VI** **PROBABILITY AND STATISTICS**: Introduction, Random variables, Discrete and Continuous distributions, Binomial distribution, Poisson distribution and Normal distribution. **COMPLEX ANALYSIS:** Analytical functions, Cauchy - Riemann equations, Construction of Analytic function, Complex integration - Line integral, Cauchy's theorem, Cauchy's integral formula and Generalized Cauchy's integral formula.
Text Books and Reference Books	**TEXT BOOKS:** 1. Higher Engineering Mathematics - B.S. Grewal, Khanna Publishers, New Delhi. 2. Engineering Mathematics - B.V. Ramana, Tata McGraw-Hill Education Pvt. Ltd, New Delhi 3. Advanced Engineering Mathematics - Erwin Kreyszig, Wiley, India **REFERENCES:** 1. Higher Engineering Mathematics - H.K. Dass, Er. Rajnish Verma, S. Chand Publication, New Delhi. 2. Engineering Mathematics -III - Dr.T.K.V. Iyengar, Dr.B. Krishna Gandhi, S. Ranganatham, Dr.M.V.S.S.N. Prasad, S. Chand Publication, New Delhi 3. Special functions and complex variables (Engineering Mathematics-III) – Shahnaz Bathul, PHI, New Delhi.

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	-	-	-	-	-	-	3
CO2	3	2	2	3	2	-	-	-	-	-	-	3
CO3	3	2	2	3	2	-	-	-	-	-	-	3
CO4	3	2	2	3	2	-	-	-	-	-	-	3
CO5	3	2	1	3	2	-	-	-	-	-	-	3
CO6	3	2	1	3	2	-	-	-	-	-	-	2

20EC2101 – ELECTRONIC CIRCUIT ANALYSIS

Course Category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Knowledge in electronic devices and its operations with various applications.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The concept of rectifiers and other Diode applications 2. The Hybrid model, Small signal analysis of single stage BJT amplifiers 3. The FET biasing schemes, high frequency response. 4. The types of coupling, Darlington and Bootstrap circuits. 5. The hybrid π model at high frequency. 6. Different types of feedback circuits as well as Sinusoidal oscillators	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the concept of rectifiers and other applications of diodes.
	CO2	Analyze the stability and biasing concepts of BJT and to design Single Stage amplifiers.
	CO3	Design a FET amplifier and compare with BJT
	CO4	Know different methods of coupling and able to design multistage amplifiers
	CO5	Represent the Hybrid π model at high frequency.
	CO6	Design feedback amplifiers and able to understand oscillators.
Course Content	**UNIT I** **RECTIFIERS:** Half Wave, Full Wave & Bridge Rectifiers, Analysis of FWR with filters (L, C, LC) & regulation. **UNIT II** **TRANSISTOR BIASING AND STABILITY:** Operating Point, Bias Stability against variation in I_{CO}, V_{BE} & β, fixed bias, Collector to Base Bias, Self-Bias, Thermal runaway, Compensation Methods. **UNIT III** **SINGLE STAGE AMPLIFIERS:** BJT Amplifier, h-parameter model, analysis of common emitter, common collector and common base amplifier using exact model & Approximate model, Millers Theorem and its Dual. **FET AMPLIFIERS:** FET Equivalent model, Analysis of Common Source, Common Drain Amplifiers. **UNIT IV** **MULTISTAGE AMPLIFIERS:** Methods of Coupling, Analysis of Two Stage RC Coupled Amplifier, High Input Impedance Circuits: Boot strap & Darlington amplifier. **UNIT V** **HIGH FREQUENCY ANALYSIS:** Transistor at High Frequency, Hybrid π CE Model, Determination of High Frequency Parameters, CE Short circuit Current Gain, Current Gain with Resistive Loads, Cut-off Frequencies, Frequency Response, parameters f_T and f_β. Analysis of CS amplifier at High Frequency.	

Course Content	**UNIT VI** **FEEDBACK AMPLIFIER:** Feedback Concept, Types of Feedback, Feedback Topology, Characteristics, Analysis of Feedback Amplifiers.
Text Books and Reference Books	**TEXT BOOKS:** 1. Allen Mottershead, "Electronic Devices and Circuits-An Introduction", PHI, 18th Reprint, 2006. 2. Millman and Halkias, "Integrated Electronics", McGraw- Hill Co 2nd Ed, 2017. **REFERENCES:** 1. Boylestad, Louis Nashelsky "Electronic devices and circuits" 11th ed., 2012 PH. 2. David. A. Bell. "Electronic Devices and circuits", Oxford, 5th Ed., 2008.
E-Resources	1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iit

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	-	-	-	-	-	-	2
CO2	3	2	2	2	1	-	-	-	-	-	-	2
CO3	3	2	2	2	1	-	-	-	-	-	-	2
CO4	2	2	2	2	1	-	-	-	-	-	-	3
CO5	3	2	1	2	1	-	-	-	-	-	-	3
CO6	3	2	1	2	1	-	-	-	-	-	-	2

20EC2102 – FUNDAMENTALS OF DIGITAL CIRCUITS

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0– 0
Prerequisite:	Number systems ,Semiconductor device operations, basic Arithmetic operations	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. Introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions. 2. Introduce the methods for simplifying Boolean expressions. 3. Outline the formal procedures for the analysis and design of combinational circuits 4. Illustrate the concept of synchronous and asynchronous sequential circuits 5. Introduce the concept of various counters and Registers 6. Introduce the concept of memories and Memory expansion	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the fundamental concepts and techniques used in digital electronics and examine the structure of various number systems and its application in digital design
	CO2	Identify basic requirements for a design application and propose a cost effective solution
	CO3	Understand, analyze and design various combinational circuits
	CO4	Understand, analyze and design various sequential circuits.
	CO5	Identify and prevent various hazards and timing problems in a digital design.
	CO6	Understand the memories
Course Content	**UNIT – I** **NUMBER SYSTEMS AND CODES:** Number systems, Signed binary numbers, Base conversions, Binary arithmetic, Complements, Binary codes–(BCD, Excess-3, Grey, ASCII). **BOOLEAN ALGEBRA AND LOGIC GATES**: Theorems of Boolean algebra, De-Morgan's theorem, Realization of logic gates using Universal gates. **UNIT – II** **MINIMIZATION OF DIGITAL CIRCUITS:** Standard forms of logical functions, Min-term and max-term specifications, Simplification by K-maps, incompletely specified functions, Realization of logic functions using gates. **UNIT -III** **COMBINATIONAL LOGIC CIRCUITS:** Design procedure, Binary adder, Sub-tractor, Decimal adder, Magnitude comparator, Decoders, Encoders, Multiplexers and De-multiplexers. **UNIT – IV** **SEQUENTIAL CIRCUITS:** Sequential circuits, Storage Elements: (Latches & Flip-flops), Master-Slave Flip-flop, Race around condition, Flip-flop conversions, Timing and triggering considerations, State diagrams, state tables, reduction of state tables and	

Course Content	state assignment, design procedures. **UNIT – V** **REGISTERS AND COUNTERS:** Registers, Shift registers, Ripple counters, Synchronous counters, Ring and Johnson counters. **UNIT-VI** **MEMORY AND PROGRAMMABLE DEVICES:** Random-Access Memory, Memory Decoding, Read-only Memory, Programmable Logic Array, Programmable Array Logic, Sequential programmable devices.
Text Books and Reference Books	**TEXT BOOKS:** 1. Digital design by Morris Mano, Pearson Education Asia, 5th Ed., 2012 2. Fundamentals of logic design by Roth & Charles, 6th Edition, West Publishing Company, 2009. **REFERENCES:** 1. Fundamentals of logic circuits by A. Anand Kumar, PHI Learing, 2016 2. Jon M, Yarbrough, "Digital logic — applications and design", Thomson-Brooks India edition 3. Fundamental of Digital Design By M. Senthil Sivakumar, S.Chand publications, 2014.
E-Resources	1. http://nptel.ac.in/cources 2. https:// iete-elan.ac.in 3. https://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	-	-	-	-	-	-	2
CO2	2	3	2	2	2	-	-	-	-	-	-	3
CO3	2	2	2	2	2	-	-	-	-	-	-	2
CO4	3	3	2	1	2	-	-	-	-	-	-	3
CO5	3	2	1	1	2	-	-	-	-	-	-	2
CO6	2	2	3	2	2	-	-	-	-	-	-	1

20EC2103 – SIGNALS AND SYSTEMS

(Common to ECE and EEE)

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3- 0 – 0
Prerequisite:	Knowledge of vectors Trigonometry, Differentiation & Integration	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. Various analysis and operations on signals. 2. The Fourier series for periodic signals. 3. The Fourier Transform of various signals. 4. The different type of sampling technique. 5. The response of systems. 6. The discrete time signals and systems.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Define a signal and perform various operation on signals.
	CO2	Find the Fourier series of various Periodic signals.
	CO3	Analyse a signal in frequency domain by applying FT and its properties
	CO4	Establish the need for sampling and gaining various sampling technique.
	CO5	Perform distortion less transmission through a system.
	CO6	Apply signal analysis using DTFT.
Course Content	**UNIT-I** **SIGNAL ANALYSIS**: 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, Classification of Signals, Concepts of Impulse function, Unit Step function, Signum function. Operations on signals. **UNIT-II** **FOURIER SERIES**: Representation of Fourier series, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum. **UNIT III** **FOURIER TRANSFORMS**: Deriving Fourier Transform from Fourier Series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform. **UNIT-IV** **SAMPLING**: Sampling theorem – Graphical and analytical proof for Band Limited Signals, Types of Sampling – Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling. **UNIT-V** **SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS**: Linear System, Convolution, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system,	

Course Content	Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and Rise time. **UNIT-VI** **DISCRETE TIME SIGNALS AND SYSTEMS**: Linear Shift Invariant(LSI) system – Stability – Causality – Convolution and Correlation –Linear constant coefficient difference equation – Impulse response -Definition of Discrete Time Fourier Transform – Properties – Transfer function – System analysis using DTFT.
Text Books and Reference Books	**TEXT BOOKS:** 1. Signals and Systems – A.V. Oppenheim, A.S. Willsky and S.H. Nawab, 2nd Ed., Pearson New international Edition-2014 2. Principles of Linear Systems and Signals, 2nd Ed, B. P. Lathi, 2009, Oxford. 3. Signals and Systems , 4th Edition, Ramesh Babu, Scitech Publications (India), 2010 **REFERENCES:** 1. Signals & Systems – Simon Haykin and Van Veen, Wiley, 2 Ed.-2018 2. Signals and Systems – A.Rama Krishna Rao – 2008, TMH, 2014 3. Fundamentals of Signals and Systems – Michel J. Robert, 2017, MGH International Edition.
E-Resources	1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iit

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	-	-	2
CO2	3	3	2	2	1	-	-	-	-	-	-	2
CO3	3	2	2	2	1	-	-	-	-	-	-	3
CO4	3	2	2	2	1	-	-	-	-	-	-	2
CO5	3	2	2	1	1	-	-	-	-	-	-	2
CO6	3	3	2	1	2	-	-	-	-	-	-	2

20EC2104 – PULSE AND ANALOG CIRCUITS

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	Knowledge in active & passive components and mathematical representation of different waves.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. Design of wave shaping circuits. 2. Functioning of Switching Circuits. 3. Concept of multi-vibrators. 4. Principle and operation of time base generators. 5. various Power Amplifiers and their operation 6. LC tuned amplifiers.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Design RC circuits for triggering
	CO2	Understand Switching circuits (BJT Inverter, NMOS, PMOS and CMOS switching circuits)
	CO3	Design a Multi-vibrator and Schmitt trigger
	CO4	Analyse Voltage/ Current Sweep Circuits
	CO5	Categorize Power Amplifiers and understand the essence
	CO6	Understand principle and operation of a Tuned amplifiers
Course Content	**UNIT-I** **LINEAR WAVE SHAPING**: Types of waveforms, RC low pass and high pass circuits, rise time, tilt. **UNIT-II** **NON LINEAR WAVE SHAPING**: Diode as a switch, BJT as a switch and switching times, Diode clippers and clampers. **UNIT-III** **MULTIVIBRATORS:** Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors, triggering methods. **UNIT-IV** **TIME BASE GENERATORS:** RC sweep circuits, constant current Miller and Bootstrap time base generators using BJT's and UJT relaxation oscillator. **UNIT-V** **TUNED AMPLIFIERS:** Introduction, Q-factor, small signal tuned amplifiers, effect of cascading single tuned amplifier on bandwidth and stagger-tuned amplifiers. **OSCILLATORS:** Oscillator Principles, Barkhausan Criteria, RC Phase shift and Wien Bridge Oscillator, Hartley and Colpitts Oscillators, Crystal Oscillator. **UNIT-VI** **POWER AMPLIFIERS:** Classification of Power Amplifiers, Class-A, Transformer coupled Class-A, cross over distortion, Class-B push-pull amplifier, Distortions in amplifiers.	

Text Books and Reference Books	**TEXT BOOKS:** 1. "Pulse & Digital switching waveforms" by J. Milliman & H. Taub Mc Graw-Hill, 2nd edition 2008. 2. Millman and Halkias,"Integrated Electronics", McGraw-Hill Co 2nd Ed, 2017. **REFERENCE:** 1. Solid State Pulse Circuits, by David A. Bell, PHI.4th edition 2008. 2. Boylestad, Louis Nashelsky "Electronic devices and circuits" 11th ed., 2012 PH.
E-Resources	1. http://nptel.ac.in/cources 2. https:// iete-elan.ac.in 3. https://freevideolectures.com/university/iit

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	3
CO2	3	2	2	2	1	-	-	-	-	-	-	2
CO3	3	3	2	2	1	-	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	-	3
CO5	3	2	3	1	1	-	-	-	-	-	-	2
CO6	3	2	3	1	1	-	-	-	-	-	-	2

20MC2102- MANAGERIAL ECONOMICS AND FINANCIAL ACCOUNTING

(Common to ECE, EEE, CE & ME)

Course Category:	Humanities	**Credits**	0
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-0-0
Pre-requisite:	Nil	**Sessional Evaluation:**	40
		External Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting, Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis. 2. The nature of markets, methods of Pricing in the different market structures and to know the different forms of Business organization 3. The preparation of Financial Statements and use of Capital Budgeting techniques to evaluate Capital Budgeting proposals.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Adopt the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services.
	CO2	Know the role of various cost concepts in managerial decisions and the managerial uses of production function and to compute breakeven point to illustrate the various uses of breakeven analysis.
	CO3	Understand how to determine price and output decisions under various market structures.
	CO4	Know in brief formalities to be fulfilled to start a business organization.
	CO5	Adopt the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts.
	CO6	Apply capital budgeting techniques in evaluating various long term investment opportunities.
Course Content	**UNIT – I** **INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS**: Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other disciplines. Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule- Demand curve- Law of Demand and its limitations- Elasticity of Demand: Types and significance. **UNIT – II** **PRODUCTION & COST ANALYSIS**: Production Function- Isoquants and Isocosts- Cobb-Douglas Production function- Law of variable Proportions- Laws of Returns- Internal and External Economies of Scale. Cost Analysis: Cost concepts- Break-even Analysis. **UNIT – III** **THEORY OF PRICING:** Types of competition and Markets- Features of Perfect competition, Monopoly and Monopolistic Competition- Price-Output Determination in case of Perfect Competition and Monopoly. Pricing: Objectives and Policies of Pricing. Methods of Pricing.	

Course Content	**UNIT – IV** **TYPES OF BUSINESS ORGANIZATIONS AND BANKING SYSTEM:** Sole proprietorship- partnership - Joint Stock Company – Shares and debentures. **BANKING SYSTEM**: Central bank- Commercial banks and their functions- Impact of technology in banking sector. **UNIT – V** **FINANCIAL ACCOUNTING:** Accounting principles- Double-Entry system of Accounting- Rules for maintaining Books of Accounts- Journal- Posting to Ledger- Preparation of Trial Balance- Preparation of Final Accounts (with simple adjustments). **UNIT-VI** **CAPITAL AND CAPITAL BUDGETING**: Capital and its significance- Types of Capital- Sources of raising capital. Capital Budgeting: features of capital budgeting proposals- Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method and Internal Rate of Return (IRR) (simple problems).
Text Books and Reference Books	**TEXT BOOKS:** 1. Varshney & Maheswari: Managerial Economics, S. Chand Publishers 2. Business Organizations: C.B.Gupta , S.Chand Publishers 3. Managerial Economics and Financial Accounting: A.R.Arya Sri, Tata Mcgraw Hills publishers. **REFERENCE BOOKS:** 1. Economic Analysis: S.Sankaran, Margham Publications. 2. S.N.Maheswari& S.K. Maheswari, Financial Accounting, Vikas Publishers. 3. S. A. Siddiqui& A. S. Siddiqui, Managerial Economics & Financial Analysis, New age International Space Publications. 4. M. Sugunatha Reddy: Managerial Economics and Financial Analysis, Research India Publication, New Delhi.

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	-	2	3	-	-	2	2	2	2
CO2	2	1	2	-	2	3	-	-	2	2	2	2
CO3	2	1	2	-	2	3	-	-	2	2	2	2
CO4	2	1	2	-	2	3	-	-	2	2	2	2
CO5	2	1	1	-	2	3	-	-	2	2	2	1
CO6	2	1	1	-	2	3	-	-	2	2	2	1

20EC21P1 – ELECTRONIC DEVICES LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Basic Electrical Sciences and Electronic Devices	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The behaviour of various semiconductor devices. 2. The V-I characteristics of various semiconductor devices.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Analyse the electronic circuits experimentally.
	CO2	Verify the V-I characteristics of various semiconductor devices experimentally.
	CO3	Analyse& Calculate the cut-in voltage and forward resistance of P-N Junction diode practically.
	CO4	Examine the performance of JFET and UJT.
	CO5	Understand the performance LED and DIAC
	CO6	Inspect the input and output characteristics of BJT.
Course Content	Minimum of **TEN** experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. P-N Junction Diode Characteristics(Si Diode) 2. Zener Diode Characteristics 3. Bi-Polar Junction Transistor Characteristics (CE Configuration) 4. Junction Field Effect Transistor Characteristics 5. Uni-Junction Transistor Characteristics 6. Light Dependent Resistor Characteristics 7. Photo Transistor Characteristics 8. Thermistor Characteristics 9. LED Characteristics 10. DIAC Characteristics 11. SCR Characteristics 12. Solar Cell Characteristics	

20EC21P2 – ELECTRONIC CIRCUIT ANALYSIS LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Electronic Devices & Circuits and Analysis of Electronic Circuits	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The design and analysis of various electronic circuits. 2. The behaviour of various rectifiers and amplifiers.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Analyse the electronic circuits experimentally.
	CO2	Design & Analyse the rectifiers (With & Without filters).
	CO3	Calculate the frequency response of the RC coupled amplifier practically.
	CO4	Analyse the Transistor Voltage Regulator (Series and Shunt).
	CO5	Understand the performance of feedback amplifiers practically
	CO6	Design & Analyse the various oscillators.
Course Content	Minimum of **TEN** experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Rectifiers without Filters (HWR, FWR, BR). 2. Rectifiers with Filters (C, LC, CLC). 3. R-C Coupled Amplifier. 4. FET Amplifier. 5. C88olpitts Oscillator. 6. Current Series Feedback Amplifier (With & Without feedback). 7. Determination of f_T of a Transistor. 8. R-C Phase Shift Oscillator. 9. Wien Bridge Oscillator. 10. Darlington Pair Amplifier. 11. Transistor Voltage Regulator (Series and Shunt) 12. Voltage Series Feedback Amplifier (With & Without feedback).	

20EE21P4 – ELECTRICAL CIRCUITS LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Basic concepts of Ohm's Law, Kirchhoff's Laws. Basic knowledge of Network Theorems is required.	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The design and analysis of various electronic circuits. 2. The behaviour of various rectifiers and amplifiers.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Analyse and design electrical circuits using circuit elements.
	CO2	Understand the concept of different electrical theorems practically.
	CO3	Analyse and design Two port networks
	CO4	Analyse and calculate mutual inductance of coupled coils.
	CO5	Understand power and power factor concepts practically.
	CO6	Understand the concepts of resonance in R-L-C circuits.
Course Content	Minimum of **TEN** experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Verification of Kirchhoff's Laws 2. Verification of Superposition Theorem 3. Verification of Reciprocity Theorem 4. Verification of Maximum Power Transfer Theorem 5. Determination of Two-Port Network Parameters 6. Measurement of Mutual Inductance 7. Locus Diagram of RC Series Circuit 8. Measurement of Power Using Wattmeter 9. Verification of Thevenin's Theorem 10. Resonance In RLC Series Circuit 11. Measurement of Time Constant & Rise Time in a RC Series Circuit 12. Measurement of Power Using (i) 3-Ammeter Method (ii) 3-Voltmeter Method	

20EC21S1 – ELECTRONIC CIRCUIT DESIGNING USING MULTISIM

Course Category:	Program Core	**Credits:**	1
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 2
Prerequisite:	Electronic Devices, Signals and Systems	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The design and analysis of various electronic circuits. 2. The behaviour of various rectifiers and amplifiers.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Simulate and Verification the Class-A Power Amplifier.
	CO2	Design & simulate the Rectifiers.
	CO3	Analyse& Calculate the frequency response CE and CS Amplifier.
	CO4	Analyse the Transistor Voltage Regulator.
	CO5	Design and Verification the Pre-emphasis and De-emphasis circuits.
	CO6	Simulation and Verification of Logic Gates.
Course Content	Minimum of **TEN** experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Verification of Half–Wave and Full-Wave Rectifier 2. Frequency Response of CE Amplifier 3. Frequency Response of CS Amplifier 4. Half adder / Full adder circuits using gates 5. Design and Verification of Pre-emphasis and De-emphasis circuits 6. Verification of Clippers 7. Verification of Clampers 8. Design and Verification of RC coupled amplifier 9. Design and Verification of Voltage Regulator 10. Design and Verification of Logic Gates 11. Characteristics of the UJT 12. Astable multivibrator	

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR

(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

II YEAR OF FOUR-YEAR B.TECH DEGREE COURSE – II SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2021-2022)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional-I Marks			Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks		Duration In Hours	Max. Marks	100
1	20EC2201	Probability Theory and Stochastic Processes	3	0	-	3	34	6	40	34	6	40	0.8*Best of two+0.2* least of two	3	60	100
2	20EC2202	Analog IC Applications	2	1	-	3	34	6	40	34	6	40		3	60	100
3	20EC2203	Electromagnetic Fields & Waves	3	0	-	3	34	6	40	34	6	40		3	60	100
4	20EC2204	Analog Communication	3	0	-	3	34	6	40	34	6	40		3	60	100
5	20EC2205	Digital IC Applications	3	0	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	20EC22P1	IC Applications Lab	-	-	3	1.5	-	-	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	20EC22P2	Analog Communication Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
8	20EC22P3	Pulse and Digital Circuits Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
		SOFT SKILLS														
9	20EC22S1	Signals & Systems Simulation using MAT Lab	-	-	4	2	-	-	-	-	-	40		3	60	100
		MANDATORY											0.8*Best of two+0.2* least of two			
10	20MC2201	Environmental Science**	3	0	-	-	34	6	40	34	6	40		3	60	100
		TOTAL	17	1	8	21.5	-	-	-	-	-	400	-	-	600	1000

***** Common to ECE & EEE. **Common to ECE, CE, EEE & ME.

A for Assignment (continuous evaluation),

$ Test (Descriptive & Objective) duration = 2 Hours

20EC2201 – PROBABILITY THEORY AND STOCHASTIC PROCESSES

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Knowledge of Signals and systems, integrations and differential equations.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. Provide mathematical background and probability theory. 2. Understand the random variable concepts with distribution and density functions. 3. Know basic concepts of multiple random variables, Conditional probability and conditional expectation, joint distribution and independence. 4. Make the difference between time averages and statistical averages. 5. Analysis of random process and application to the signal processing in the communication system. 6. Demonstrate the students how to model a noise source and design of filters for white and coloured noises and maximize S/N ratio.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand fundamentals of probability theory
	CO2	Learn the fundamentals of random variables.
	CO3	Illustrate the concepts of vector random variables and related problems.
	CO4	Remember the characterization of random processes and their properties
	CO5	Evaluate response of a system to random signal and noise
	CO6	Know the noise and how these noises are effecting the communication system
Course Content	**UNIT-I** **PROBABILITY**: Introduction, Set theory and Venn diagrams -Axioms- Joint and conditional probability - Bayes' theorem - Bernoulli trials. **UNIT –II** **RANDOM VARIABLE**: Concept — Distribution function — Density functions — Conditional density functions — Expectation — Conditional expected value — Moments — Chebyshev, Markov's and Chernoff's inequalities — Characteristics and moment generating functions - Transformation of continuous and discrete random variables. **UNIT –III** **MULTIPLE RANDOM VARIABLES**: Vector random variables — Joint distribution / Density functions — Conditional density / Distribution functions - Statistical independence — PDF and CDF for sum of random variables — Central limits theorem - Operations on multiple random variables — Expected value of function of random variables — Joint characteristic function — Joint by Gaussian random variables — Transformations of multiple random variables. **UNIT – IV** **RANDOM PROCESSES:** Concept — Stationarity — Independence — Time averages — Ergodicity — Correlation function and its Properties. Gaussian process— Power spectral density and its properties — Relation between power spectral density and auto-correlation — Cross power spectral density and its properties— Definition of white and coloured noise.	

Course Content	**UNIT-V** **LINEAR SYSTEMS WITH RANDOM INPUTS:** Random signal response of linear system — System evaluation using random noise— Spectral characteristics of system response - Band pass, Band limited and Narrow band processes — Properties of band limited processes. **UNIT-VI** **MODELING OF NOISE SOURCES:** Classification of noise sources — Resistive (Thermal) noise — Effective noise temperature — Antenna as a noise source — Available power gain — Equivalent networks — Input noise temperature — Noise figure. **OPTIMUM LINEAR SYSTEMS:** Maximization of (S/N); Matched filter for coloured and white noise — Minimization of Mean Squared Error — Wiener filter.
Text Books and Reference Books	**TEXT BOOKS:** 1. P.Z.Peebles Jr., "Probability Random Variables and Random Signal Principles". Tata McGraw-Hill, 4th edition, 2001. 2. A.Papoulis and S.Unnikrishna Pillai, "Probability Random Variables and Stochastic Processes", PHI, 4th edition, 2008 3. J.LAunon and V.Chandrasekhar, "Introduction to Probability and Random Processes", McGraw-Hill 2nd edition , 1997. **REFERENCE:** 1. D.G. Childer, "Probability and Random Processes", McGraw Hill, 2nd edition 1997. 2. GR.Babu and K. Pushpa, "Probability Theory and Stochastic Processes", Premier Publishing House, 3rd edition 2010.
E-Resources	1. http://nptel.ac.in/cources 2. https:// iete-elan.ac.in 3. https://freevideolectures.com/university/iit

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	-	-	3
CO2	2	2	2	2	1	-	-	-	-	-	-	3
CO3	3	3	2	2	2	-	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	-	2
CO5	2	2	3	1	1	-	-	-	-	-	-	2
CO6	2	2	3	1	1	-	-	-	-	-	-	2

20EC2202 – ANALOG IC APPLICATIONS

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 1 - 0
Prerequisite:	Circuit & Networks, Electronics Devices & Circuits and Pulse & Analog Circuits	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. Learn the basic building blocks of Op-amp & its characteristics. 2. Study linear and non-linear applications of operational amplifiers. 3. Design Multivibrators. 4. Understand the theory and applications of 555 timer and P.L.L. 5. Design of various filters using op amp. 6. Learn theory of A.D.C.s and D.A.C.s.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Gain the basics of op-amp characteristics and its applications.
	CO2	Study and analyse each building blocks of op-amp and its applications.
	CO3	Analyse and design of Multivibrators, Oscillators and comparators using op-amp.
	CO4	Illustrate and design of Multi-vibrators using 555 timer, understand of PLL and its applications.
	CO5	Analyze and design of Active filters and regulators.
	CO6	Apply and Analyze A/D and D/A converters and their applications.
Course Content	**UNIT – I** **OPERATIONAL AMPLIFIER :** Introduction to I.C.s, Op-Amp Ideal Characteristics, DC & AC Characteristics, Internal Circuit, Inverting and Non-Inverting Modes of Operation, Differential Amplifier and its Transfer Characteristics, Derivation of C.M.R.R. & Improvement Methods of Differential Amplifier Characteristics **UNIT – II** **OPERATIONAL AMPLIFIER APPLICATIONS:** Summer, Integrator, Differentiator, Voltage Follower, Instrumentation Amplifier, V-I and I-V Converters, Precision Rectifiers, Analog multiplier (AD 534 IC) **UNIT – III** **COMPARATORS AND WAVEFORM GENERATORS:** Comparator, Regenerative Comparator, Astable and Mono stable Multi-vibrators using Op-Amp, Sine Wave Generators using Op-Amp (R.C. Phase Shift oscillator). **UNIT – IV** **IC TIMERS:** 555 Timer, Astable and Monostable Modes (without applications). **PHASE LOCKED LOOPS:** Basic Principle, First and Second order PLL concepts. **UNIT – V** **ACTIVE FILTERS:** Low Pass, High Pass, Band Pass and State Variable Filters. **VOLTAGE REGULATORS:** Series Op-Amp Regulator, I.C. Voltage Regulators 78XX, I.C.-723 Regulator, Switching Regulators, Step up and step down regulators	

Course Content	(buck & boost). **UNIT – VI** **ELECTRONIC DATA CONVERTERS:** Introduction, D.A.C.s-Weighted Resistor, R-2R. A.D.C.s-Parallel Comparator Type, Successive Approximation and Dual Slope.
Text Books and Reference Books	**TEXT BOOKS:** 1. D. Roy Choudary, Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 5th edition 2018. 2. Sergio Franco's "Design With Operational Amplifiers and Analog Integrated Circuits", 4th edition, 2016. **REFERENCE BOOKS:** 1. J. Michael Jacob, "Applications and Design with Analog Integrated Circuits", PHI, EEE, 2nd edition, 1996. 2. Ramkant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", LPE, Pearson Education, 4th Edition, 2015
E-Resources	1. http://www.nptel.ac.in 2. http:/www.ebookee.com/linearintegratedcircuits.

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	2	2	1	2	-	-	-	-	-	-	-	1
CO3	3	3	1	2	-	-	-	-	-	-	-	1
CO4	2	3	1	1	-	-	-	-	-	-	-	1
CO5	3	2	3	2	-	-	-	-	-	-	-	1
CO6	3	2	3	1	-	-	-	-	-	-	-	3

20EC2203 – ELECTROMAGNET IC FIELDS & WAVES

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	Basic concepts of coordinate system & fundamentals of electricity & magnetism	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. Co-ordinate systems, Vector calculus. 2. Electrostatics, Coulomb's law, Mathematical analysis of Gauss's law. 3. Behaviour of conductors with regard to Current, Current Density, Resistance. Understand the significance of Ohm's law for EM fields. 4. Magnetic Static Fields and various laws applicable to magnetic fields. 5. Dipole Moment of materials, Boundary conditions governing Magnetic interfaces and study about energy stored in Magnetic Fields. 6. Maxwell's equations in different forms and their applications to EM fields, Uniform plane wave propagation.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Know the conversions of one co-ordinate system to other forms.
	CO2	Remember Gauss Law, Coulomb's law to find fields and potentials for a various situations.
	CO3	Derive the Continuity equation and give the importance of current density.
	CO4	Understand Biot-Savart's Law and Ampere's Circuital law and apply to solve problems on these.
	CO5	Acquire the knowledge of Dipole moment, Boundary conditions of Magnetic Fields
	CO6	Know the Maxwell's equation in differential and integral forms, Faraday's law, Uniform plane wave propagation
Course Content	**UNIT-I** **REVIEW OF COORDINATE SYSTEMS:** Introduction to coordinate systems, Cartesian, Cylindrical and Spherical coordinate systems, Vector transformations, Vector calculus. **UNIT-II** **ELECTROSTATIC FIELDS:** Coulomb's Law, Electric Field Intensity, Electric Flux Density –Gauss's Law, Gauss's law in point form, Electric Potential, Potential Gradient and Energy Stored in Electric Field. **UNIT-III** **CONDUCTORS AND DIELECTRICS:** Current and Current Density- Continuity Equation-Conductors-Ohms Law, Resistance, power dissipation and Joules law. Dielectrics: Dipole Moment-Polarization-bound Charge Densities-Boundary Conditions, Capacitance. **UNIT-IV** **MAGNETOSTATIC FIELDS:** Ampere's force law, Biot-Savart's Law, Lorentz force law, Ampere's circuital law in point form, Magnetic Vector Potential. **UNIT-V** **MAGNETIC FIELD IN MATERIALS:** Dipole Moment, Magnetization and bound current densities, Boundary Conditions, Inductance, Energy Stored in Magnetic Field.	

Course Content	**UNIT-VI** **MAXWELL'S EQUATIONS:** Faraday's law, Motional and transformer induced EMFs, Faraday's law in point form, Displacement current, Maxwell's equations in differential and integral forms, Poynting theorem, Wave Equation – Uniform Plane Waves in Lossless Media and in Lossy Media.
Text Books and Reference Books	**TEXT BOOKS:** 1. Matthew N.O.Sadiku: "Elements of Engineering Electromagnetics" Oxford University Press, 4th edition, 2007. 2. E.C. Jordan & K.G. Balmain "Electromagnetic Waves and Radiating Systems." Pearson Education/PHI 4th edition 2006. **REFERENCES:** 1. NarayanaRao, N: "Elements of Engineering Electromagnetics" 6th edition, Pearson Education, New Delhi, 2006. 2. G.S.N. Raju, Electromagnetic Field Theory & Transmission Lines, Pearson Education, 2006.
E-Resources	1. https://nptel.ac.in/courses 2. https://iete-elan.ac.in 3. https://freevideolectures.com/university/iit

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	-	3	-	-	-	-	-	-	3
CO2	3	3	3	1	2	-	-	-	-	-	-	2
CO3	3	2	3	1	1	-	-	-	-	-	-	3
CO4	2	2	2	1	2	-	-	-	-	-	-	2
CO5	3	2	3	1	1	-	-	-	-	-	-	3
CO6	3	2	3	-	3	-	-	-	-	-	-	3

20EC2204 – ANALOG COMMUNICATION

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 - 0
Prerequisite:	Knowledge in Fourier series and Fourier transforms.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The Generation and Detection of A.M waves. 2. DSB & SSB modulation and demodulation. 3. The difference between SSB-SC, DSB-SC and VSB modulation schemes. 4. The discriminate between Frequency Modulation and Phase Modulation generation and detection methods. 5. The effect of noise on different modulation schemes and to design some circuits like pre - emphasis and de - emphasis networks. 6. The concepts to realize or implement the circuits required for modulation and demodulation of AM and FM Schemes such as Transmitters and receivers.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the need for modulation, Generation and detection of AM waves.
	CO2	Know the SSB-SC modulation and demodulation techniques
	CO3	Demonstrate FM signal generation and detection.
	CO4	Get familiarized with the different types of noises present in the Analog Communication.
	CO5	State and prove Sampling theorem.
	CO6	Analyze the Characteristics of AM and F.M radio Transmitter and receiver.

Course Content

UNIT –I

AMPLITUDE MODULATION: Introduction to communication system, need for modulation and its types.

Amplitude Modulation: Definition, Time domain and frequency domain description, Single tone and multi tone modulations, Power relations in AM waves.

Generation of AM waves: Square law Modulator, Switching Modulator.

Detection of AM Waves: Square Law Detector, Envelop Detector.

UNIT –II

DSB MODULATION AND DEMODULATION: Introduction to Double Side Band Suppressed Carrier modulation, Generation of DSB-SC Modulated waves: COSTAS Loop, Frequency discrimination.

SSB MODULATION AND DEMODULATION: Introduction to SSB-SC, Frequency discrimination, Phase discrimination methods for generating SSB-SC, Demodulation of SSB Waves, VSB generation, detection and its applications. Comparison of AM schemes, Applications of different AM Systems.

UNIT –III

ANGLE MODULATION: Frequency Modulation, Phase modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Transmission bandwidth of FM Wave, Generation of FM Waves, Direct and Indirect methods of FM, Detection of FM Waves: Discriminators and its types, Phase Locked Loop.

Course Content	**UNIT –IV** **NOISE IN ANALOG COMMUNICATION:** Noise in AM, DSB-SC and SSB-SC Systems, Noise in Angle Modulation Systems, Threshold Effect. Pre-Emphasis and De-Emphasis. **UNIT –V** **SAMPLING THEOREM**: Definition, Nyquist rate, Types of Sampling, Aliasing Effect and Sampling of Band Pass Signals. **PULSE ANALOG MODULATION:** Types of Pulse Analog Modulations, Generation and Detection methods of PAM, PWM, PPM, Comparison of Pulse Analog Modulation schemes. **UNIT-VI** **RADIO TRANSMITERS:** Block diagram of AM transmitter, Frequency Scintillation, Radio Broadcast Transmitter, Armstrong FM Transmitter and Simple FM Transmitter using Reactance Modulator. **RADIO RECEIVERS:** TRF Receiver, Super Heterodyne Receiver, Intermediate Frequency, Image Frequency, AGC, AFC.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Communication Systems" Simon Haykin, Wiley, 2nd Ed., 2007 2. "Electronic Communication Systems" John Kennedy, TMH, 5th Ed., 2011. 3. "Analog Communication Systems" Sanjay Sharma, Katson Books, 2013. **REFERENCE BOOKS:** 1. "Communication Systems Engineering" John Proakis, MasoudSaleb, Pearson, 2nd Ed, 2002. 2. "Principles of Communication Systems" Taub and Schilling, McGraw-Hill ISE, 4th Ed, 2017. 3. "Analog Communication Systems" P. Chakrabarthi, Dhanapat Rai & Sons, 2018.
E-Resources	1. http://nptel.ac.in/cources 2. https:// iete-elan.ac.in 3. https://freevideolectures.com/university/iit

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	-	-	-	-	-	-	3
CO2	3	2	2	2	1	-	-	-	-	-	-	2
CO3	3	3	2	2	1	-	-	-	-	-	-	2
CO4	3	2	2	2	1	-	-	-	-	-	-	3
CO5	3	2	3	1	1	-	-	-	-	-	-	2
CO6	3	2	3	1	1	-	-	-	-	-	-	2

20EC2205 – DIGITAL IC APPLICATIONS

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0– 0
Prerequisite:	Electronic Devices, Digital System Design & Programming Skills,	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. Implementing logic gates and Boolean expressions using different logic families. 2. Explain how digital circuit of large complexity can be built in a methodological way, starting from Boolean logic and applying a set of rigorous techniques. 3. Create minimal realizations of single and multiple output Boolean functions. 4. Design and analyze combinational circuits using V.H.D.L. language. 5. Design and analyze sequential circuits using V.H.D.L. language. 6. To have a profound understanding of the design of complex digital VLSI circuits and synthesis tool for hardware design.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the process of integration and characteristics of different logic families
	CO2	Demonstrate knowledge of V.H.D.L. History & Language fundamentals
	CO3	Demonstrate knowledge of Objects in V.H.D.L
	CO4	Design and analyze combinational circuits for various practical problems using basic gates
	CO5	Design and analyze sequential circuits for various practical problems using flip flops
	CO6	Understand the synthesis tool for hardware design
Course Content	**UNIT – I** **DIGITAL INTEGRATED CIRCUITS:** Evaluation of ICs, Advantages and classification of ICs. Digital IC characteristics, Digital IC families- DTL, HTL, ECL, MOS, CMOS, TTL-Totem-pole, Open collector and Tristate outputs and IC packaging's. **UNIT – II** **VHDL INTRODUCTION AND LANGUAGE FUNDAMENTALS:** VHDL History – **Design methodology: -** Description style, Direction of design, design flow, step in digital system design -**Hardware modeling issue:** concurrency, delays, delta time and back annotation – organization of a VHDL design file – libraries. **Language fundamentals:** Basic sequential statements – Date types – Assignment statements and operators **UNIT – III** **OBJECTS IN VHDL:** Signals, Variable, constants, files-attributes of objects – VHDL package, package body and configurations – Entity declarations and statements, Logic gates using VHDL	

Course Content	**UNIT – IV** **COMBINATIONAL CIRCUIT BUILDING BLOCKS:** Multiplexers, Decoders, Encoders – Code converters and their implémentation using VHDL. **UNIT – V** **SEQUENTIAL LOGIC DESIGN:** Latches and flip-flops, registers, counters (Asynchronous and synchronous) BCD, Ring and Johnson counter, FSM: Meelay and Moore-Machines and their implementation using VHDL. **UNIT – VI** **VHDL SYNTHESIS:** VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools.
Text Books and Reference Books	**TEXT BOOKS:** 1. B.S .sonde, "Introduction to system design using ICs", Wiley Eastern,2nd Ed, 1980 2. J Bhasker, "VHDL primer", PEARSON Education, 3rd Ed, 2015. 3. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 4th Ed. 2007 4. Pucknell Douglas A ," Basic VLSI Design", Prentice-Hall of India Pvt.Ltd , 3rd Ed., 2009. **REFERENCE BOOKS:** 1. Stephen Brown and zvonkovranesic, 'Fundamentals of digital design with VHDL, TMH 3rd Ed., 2017. 2. A.P.Godse & Bakshi Digital IC Application-Technical Publications, 2014. 3. S.S. Limaye, 'VHDL – A design oriented Approach, 'TMH edition (2009).
E-Resources	1. http://nptel.ac.in/cources 2. https:// iete-elan.ac.in 3. https://freevideolectures.com/university/iit

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	-	-	-	-	-	-	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	-	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2
CO5	3	2	3	1	1	-	-	-	-	-	-	3
CO6	3	2	3	1	1	-	-	-	-	-	-	3

20EC22P1 – IC APPLICATIONS LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Analog Integrated Circuit Applications	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The basic applications of Op-Amp 2. The R-2R ladder network used as an A/D converter in interfacing between Analog and digital. 3. 555 Timer applications –in various timer circuits and Delay circuits.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Design Rectifiers without and with Filters (HWR, FWR, BR).
	CO2	Design various amplifier circuits using op-amp
	CO3	Design various oscillator circuits using op-amp
	CO4	Design regulator circuit using op-amp
	CO5	Design various feedback amplifier circuits using op-amp
	CO6	Determine the f_T of a given Transistor.
Course Content	Minimum of **TEN** experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Voltage Follower, Inverting Amplifier 2. Summing Amplifier & Difference Amplifier 3. Astable Multivibrator using Op-Amp. 4. Astable Multivibrator using 555 Timer. 5. Comparator using Op-Amp. 6. Zero crossing Detector using Op-Amp. 7. Ramp Generator using 555 Timer. 8. Op-Amp Frequency Response. 9. Narrow band pass filter using IC 747. 10. Full Wave Rectifier using Op-Amp. 11. R-2R Ladder Network. 12. Schmitt Trigger using Op-Amp.	

20EC22P2 – ANALOG COMMUNICATION LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Electronic Devices and Circuits, Signals and Systems	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The design and analysis of various communication circuits. 2. To study and verify the various modulation techniques.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Analyse the electronic circuits experimentally.
	CO2	Design & Analyse the Amplitude Modulation and De-Modulation system.
	CO3	Study and verify the Mixer Characteristics.
	CO4	examine the PAM and PPM practically
	CO5	Understand the performance of transmission lines.
	CO6	Design & Analyse the Frequency Modulation and De-Modulation system.
Course Content	Minimum of 10 experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Amplitude Modulation. 2. Amplitude De-Modulation. 3. Frequency Modulation. 4. Pulse Amplitude Modulation. 5. Pulse Position Modulation. 6. Pulse Width Modulation. 7. Proto Type Filters. 8. Pre-Emphasis and De-Emphasis. 9. Transmission Lines. 10. FM using Variable Reactance Method. 11. Frequency De-Modulation. 12. Mixer Characteristics.	

20EC22P3– PULSE AND DIGITAL CIRCUITS LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Electronic Devices and Circuits, Pulse and Analog Circuits, Switching Theory and Logic design.	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The behaviour of various semiconductor devices. 2. The V-I characteristics of various semiconductor devices.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand function of logic gates and can implement logic circuits using gates.
	CO2	Implement the combinational logic circuits.
	CO3	Elucidate differences between synchronous and asynchronous circuits.
	CO4	Demonstrate linear and non-linear wave Shaping.
	CO5	Design Multivibrators.
	CO6	Design Schmitt Trigger
Course Content	Minimum of **TEN** experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. (a). Logic Gates (b). Realization of logic gates using NAND and NOR Gates 2. Full Adder 3. Decoder 4. Divide by N-Ripple Counter 5. Multiplexer 6. Divide by N-Synchronous Counter 7. RC Differentiator and Integrator 8. Diode Clippers & Clampers 9. Astable Multivibrator using BJT 10. Bistable Multivibrator using BJT 11. Schmitt Trigger using BJT 12. Bootstrap sweep circuit.	

20EC22S1 – SIGNALS & SYSTEMS SIMULATION USING MATLAB

Course Category:	Program Core	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 4
Prerequisite:	Signals and Systems	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. Basic operations of matrices and varies signals. 2. Verification of various systems and sampling theorem.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Perform the Operations on Matrices
	CO2	Generate various signals using MAT lab.
	CO3	Find the Even and Odd parts of Signal/Sequence and Real and Imaginary part of Signal.
	CO4	Verify the linearity and time invariance properties of a given continuous /discrete system.
	CO5	Find LT for some signals and system
	CO6	Compute the unit sample, unit step and sinusoidal response of the given LTI system
Course Content	Minimum of 10 experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Basic Operations on Matrices 2. Generation on various Signals and Sequences (periodic and aperiodic) 3. Operations on Signals and Sequences 4. Finding the Even and Odd parts of Signal/Sequence and Real and Imaginary part of Signal. 5. Convolution between Signals and Sequences 6. Auto Correlation and Cross Correlation between Signals and Sequences. 7. Verification of linearity and time invariance properties of a given continuous /discrete system. 8. Computation of unit sample, unit step and sinusoidal response of the given LTI system and verifying its physical reliability and stability properties. 9. Finding the Fourier transform of a given signal and plotting its magnitude and phase spectrum. 10. Waveform synthesis using Laplace Transform. 11. Locating the zeros, poles and plotting the pole zero maps in s-plane and z-plane for the given transfer function. 12. Sampling theorem verification	

20MC2201 – ENVIRONMENTAL SCIENCE

(Common to ECE, EEE, CE & ME)

Course Category:	Mandatory course	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic idea on environment, Environmental pollution causes, effects and control measures.	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. To know the importance of Environmental Sciences and understand the various components of environment. 2. To know the value of natural resources and need to protect them. 3. To know the value of biodiversity and it`s conservation methods. 4. To describe advanced methods to solve problems related to environmental pollution. 5. To understand the social issues and provide plans to minimize the problems. 6. To articulate various environmental acts in order to protect the environment.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Know the importance of Environmental sciences and understand the various components of environment.
	CO2	Understand the value of natural resources
	CO3	Summarize the function of ecosystem, values of biodiversity and conservation.
	CO4	Identify how the environment is polluted and suggest the mitigation measures.
	CO5	Understand the environmental problems in India and way to minimize the effects.
	CO6	Categorize the environmental protection laws in our country and role of information technology in environment protection.
Course Content	**UNIT-I** **FUNDAMENTALS OF ENVIRONMENTAL SCIENCE** Introduction, Definition, Scope and Importance of environmental science - Various components of environment – Atmosphere, lithosphere, hydrosphere and biosphere – Multidisciplinary nature of environmental science-public awareness. **UNIT-II** **NATURAL RESOURCES:** Introduction- Classification of Natural resources. **FOREST RESOURCES**: Importance of Forests, over-exploitation of forest resources-Deforestation-causes, effects and control methods. **WATER RESOURCES:** Use and over-utilization of surface and ground water – Dams - Benefits and problems-conflicts over water. **ENERGY RESOURCES:** Renewable and non-renewable energy sources. Need to use of alternate energy sources, Impact of energy use on environment. **LAND RESOURCES:** Importance, Land degradation, Soil erosion and desertification. **UNIT-III** **ECOSYSTEM**: Definition, types, structure of ecosystem (biotic and abiotic components) and functions of an Ecosystem – Energy flow, Food chains, food web, ecological pyramids and Ecological succession. **BIO-DIVERSITY AND ITS CONSERVATION:** Definition - Genetic, Species and Ecosystem diversity- value of biodiversity - Hotspots of biodiversity in India - Threats to biodiversity – conservation of biodiversity (In-situ and Ex-situ conservation).	

Course Content	**UNIT-IV** **ENVIRONMENTAL POLLUTION:** Introduction, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and nuclear hazards. **SOLID WASTE MANAGEMENT**: sources, effects of Municipal solid waste, Industrial solid waste and management of solid waste. **DISASTER MANAGEMENT:** Floods, Droughts, earthquakes and cyclones. **UNIT-V** **SOCIAL ISSUES AND THE ENVIRONMENT:** From unsustainable to sustainable development, urban problems related to energy, water conservation, rainwater harvesting and water shed management. **CLIMATE CHANGE-** Global warming, Acid rain and Ozone layer depletion. **ENVIRONMENTAL ACTS:** Water (Prevention and control of pollution) Act-Air (Prevention and control of pollution) Act – Wildlife protection Act and Forest conservation Act **UNIT-VI** **HUMAN POPULATION AND ENVIRONMENT:** Population growth, variation among nations and population Explosion- Role of information technology in environment and human health. **CASE STUDIES:** Silent valley project, Madhura Oil Refinery and Taj Mahal, Kolleru Lake Aquaculture and Fluorosis in Andhra Pradesh **FIELD WORK:** Visit to a Local Area having river/Forest/grass land/hill/mountain to document environmental assets. Study of common plants, insects and birds.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Environmental science and Engineering" by Anubha Kaushik and C.P.Kaushik, New Age International publishers. Sixth Edition 2018. 2. "Environmental science and Engineering" by N. Arumugam,V Kumaresan, Saras Publication; 2 edition (2014) **REFERENCE BOOKS:** 1. "Introduction to Environmental science" by Y.Anjaneyulu, B.S Publications.2004. 2. Perspectives in Environmental Studies, Anubha Kaushik and C.P.Kaushik, New Age International publishers, Third Edition 2019. 3. "Environmental science" by M. Chandrasekhar, Hi-Tech Publications. 2009.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes (3-High, 2-Medium, 1-Low)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	1	3	3	-	-	-	3	-
CO2	2	2	2	2	1	2	2	-	-	-	2	-
CO3	2	2	2	2	1	2	2	-	-	-	2	-
CO4	3	3	3	3	1	3	3	-	-	-	3	-
CO5	2	2	2	2	1	2	2	-	-	-	2	-
CO6	2	2	2	2	1	2	2	-	-	-	2	-

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

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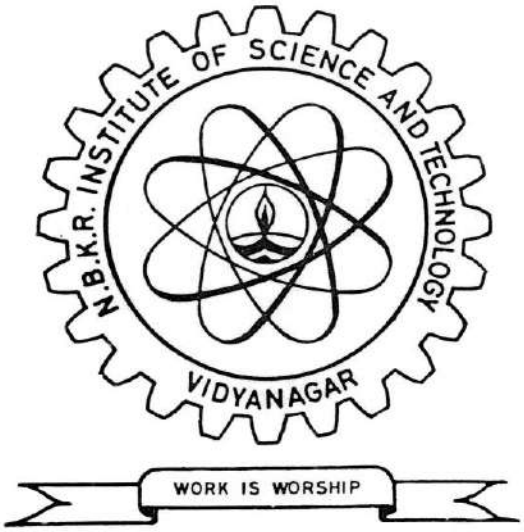

SYLLABUS

B.TECH. DEGREE COURSE

III B.TECH

I & II Semesters

ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from the batch admitted in the academic year 2020-2021)

VIDYANAGAR - 524413
SPSR Nellore-Dist. Andhra Pradesh
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(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

III YEAR OF FOUR-YEAR B.TECH DEGREE COURSE – I SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2021-2022)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
			Sessional-I Marks							Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks		Duration In Hours	Max. Marks	100
1	20EC3101	Microprocessors And Microcontrollers	3	0	-	3	34	6	40	34	6	40	0.8*Best of two+0.2* least of two	3	60	100
2	20EC3102	Antenna & Wave Propagation	3	0	-	3	34	6	40	34	6	40		3	60	100
3	20EC3103	Digital Communication	3	0	-	3	34	6	40	34	6	40		3	60	100
4	20EC31EX	Program Elective	3	0	-	3	34	6	40	34	6	40		3	60	100
5	20XX31XX	Open Elective	3	0	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	20EC31P1	MP & MC Lab	-	-	3	1.5	-	-	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	20EC31P2	Digital Communication Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
8	20EC31IS	Summer Internship (Community Service Project)	-	-	-	1.5	-	-	-	-	-	40		3	60	100
		SOFT SKILLS														
9	20EC31SC	Digital System Designing Using VHDL	1	-	2	2	-	-	-	-	-	40		3	60	100
		MANDATORY											0.8*Best of two+0.2* least of two			
10	20MC3101	Professional Ethics & IPR	3	0	-	-	34	6	40	34	6	40		3	60	100
		TOTAL	19	0	8	21.5	-	-	-	-	-	400	-	-	600	1000

***** Common to ECE & EEE. **Common to ECE, CE, EEE & ME. @Open Electives: List is enclosed.

A for Assignment (continuous evaluation),

$ Test (Descriptive & Objective) duration = 2 Hours

20EC3101-MICROPROCESSORS AND MICROCONTROLLERS

Course Category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 2 – 0
Prerequisite:	Computer architecture and Basic programming.	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The history and need of different types of microprocessors and learn the internal architecture details, pin configuration and their timing diagrams of 8085µp. 2. To develop various projects, by learning programming and interfacing details of 8085 microprocessor. 3. The internal architecture details, pin configuration, Interrupts and their timing diagrams of 8086µp and development of Assembly Language Programs. 4. The internal architecture details of 8259,8257 & 8253 and their interfacing with 8086 µp. 5. The programming and interfacing details of ADC, DAC, Stepper motor etc. and memory interfacing too. 6. The internal architecture details, pipelining, addressing modes, C.P.U. Registers of 8051 µc including simple programs.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the evaluation of different types of microprocessors and features of 8085 µp along with memory interfacing.
	CO2	Assess and solve basic binary math operations using the microprocessor and explain the microprocessor 8085 internal architecture and its operation within the area of manufacturing and performance.
	CO3	Gain the knowledge on internal architecture of 8086µp and its modes of operations along with timing diagrams.
	CO4	Design electrical circuitry in order to interface the processor to external devices 8259,8257 & 8253.
	CO5	Illustrate how the different peripherals are interfaced with 8086 µc and develop hardware projects using DAC, ADC & 7-Segment Display.
	CO6	Gain the knowledge on internal architecture of 8051µp and its modes of operations along with timing diagrams by which improving programming skills on microcontroller.
Course Content	**UNIT-I** **INTRODUCTION TO MICROPROCESSORS:** Evolution of Microprocessors, Types of microprocessors, Features of 8085 microprocessor, Architecture of 8085 microprocessor, pin configuration, Register set, Instruction Cycle, Timing Diagrams, Stack and Subroutines **UNIT-II** **INSTRUCTION SET OF 8085 MICROPROCESSOR:** Addressing modes, Assembly Language Programs (8085) for addition, subtraction, multiplication, division etc., Interrupts of 8085, Memory interfacing of 8085 microprocessor. **UNIT-III** **ARCHITECTURE OF 8086 MICROPROCESSOR:** Architecture, pin description, Instruction set, Addressing modes, Interrupt system, Minimum mode and Maximum mode operations of 8086 and its timing diagrams, Assembler directives, Assembly language	

Course Content	programs (8086). **UNIT- IV** **DATA TRANSFER SCHEMES:** Programmable interrupt controller (8259) and its interfacing, Programmable DMA controller (8257) and its interfacing, Programmable Interval Timer (8253) and its interfacing. **UNIT-V** **MEMORY INTERFACING TO 8086:** Interfacing various types of RAM and ROM chips, PPI (8255) and its interfacing, ADC and DAC Interfacing, Waveform generation, Stepper motor control, temperature measurement and control. **UNIT-VI** **8051 MICROCONTROLLER:** Architecture, pin description, Register set, Instruction set, Interrupt structure, timer & serial port operations, Simple Assembly Language Programs on general arithmetic and logical operations.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Fundamentals of Microprocessors and Microcontrollers", by Ram. B, Dhanpat Rai publications Pvt. Ltd, 2012. 2. "Microprocessors and interfacing", by Douglas V. Hall,Tata McGraw Hill Education **,** 3rd edition, 2017. 3. "The 8051 Microcontrollers", by Kenneth J. Ayala, 3rd Edition, Thomson Publications, 2015. 4. "Design with PIC Microcontrollers" by John B. Peatman, Pearson Educations, 1st edition 2002. **REFERENCES BOOKS:** 1. "Advanced Microprocessors and Peripherals", by A.K. Ray and K.M. Bhurchandi, TMH, 3rd edition, 2017. 2. "Microprocessor Architecture, Programming and Applications with the 8085" by Ramesh S. Gaonkar, Prentice Hall of India, 6th edition, 2013. 3. Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Prentium Proprocessor, Pentium II, III, IV by Barry B.Brey,Pearson Education, 2011.
E-Resources	1. http://w3.ualg.pt/~jmcardo/ensino/ihs2004/Benner93.pdf 2. http://engreric.com/wpcontent/uploads/2014/06/Syllabus_CECS346_Fall15.pdf

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	1	-	2	-	2	3	3
CO2	3	3	2	2	1	-	-	1	-	2	-	2	3	2
CO3	3	3	3	1	1	-	-	1	-	2	-	2	2	3
CO4	3	3	2	2	1	-	-	1	-	2	-	2	3	2
CO5	3	3	2	2	1	-	-	1	-	2	-	2	3	3
CO6	3	3	2	2	1	-	-	1	-	2	-	2	2	2

20EC3102- ANTENNA AND WAVE PROPAGATION

Course category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 1 – 0
Prerequisite:	Vector Calculus, Basics of Electromagnetic Fields and Waves	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. Study the propagation of signals; calculate various line parameters. 2. Study the concept of polarization and its significance in wireless communications. 3. Learn antenna basics, antenna parameters and calculation of radiation resistances of various antennas. 4. Learn the methods to measure antenna parameters. 5. Understand the basic working principle of VHF and UHF antennas. 6. Understand different kinds of Wave Propagation.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the fundamentals of Transmission Line Theory.
	CO2	Learn antenna basics, Antenna Parameters and calculation of Radiation Resistances.
	CO3	Describe various Antennas, Arrays And Draw Radiation Patterns.
	CO4	Measure the antenna's fundamental parameter.
	CO5	Learn different types of Antennas to be employed in V.H.F. and U.H.F.
	CO6	Classify Radio Wave Propagation in the Atmosphere.
Course Content	**UNIT-I** **TRANSMISSION LINES:** Primary and Secondary Constants of the Line, Transmission Line Equations, Propagation Constant, Characteristic Impedance, Distortion less Line, Input Impedance of Open and Short-Circuited Lines, Standing Waves, Reflection Coefficient, Smith Chart. **UNIT II** **RADIATION FUNDAMENTALS:** Definition of antenna, Retarded Potentials, Far Field Approximation, Radiation from a current Element, Half Wave Dipole and Monopole Antennas. **ANTENNA PARAMETERS:** Radiation Pattern, Radiation Intensity, Directivity, Gain, H.P.B.W., Effective Aperture, Relation between Directivity and Maximum Effective Aperture. **UNIT III** **LINEAR WIRE ANTENNAS:** Current Distribution on Thin Linear Wire Antennas, Array of Two Point Sources, Principle of Pattern Multiplication, Uniform Linear Arrays: Broad Side and End fire Array and Binomial Arrays. **V.H.F AND U.H.F ANTENNAS:** Long Wire and Rhombic Antennas, Yagi-Uda Antenna, Folded Dipole Antennas (Without Analysis)	

Course Content	**UNIT IV** **ANTENNA MEASUREMENTS:** Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods) **UNIT V** **SURFACE AND SPACE WAVE PROPAGATION:** Friis Transmission Equation, Salient Features of Somerfield Theory, Ground Wave Field Strength Calculation, Effect of Curvature of Earth, Refraction of Radio Waves in Troposphere, Effective Radius of Earth, Radio Horizon and Maximum Radio Range. **UNIT VI** **SKY WAVE PROPAGATION:** Structure of Ionosphere, Mechanism of Wave Refraction in Ionosphere, Critical Frequency, M.U.F., Virtual Height, Skip Distance, Effect of Earth's Magnetic Field, Faraday's rotation.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Antennas", by John D Krauss, McGraw-Hill Education (ISE), 3rd edition 2001. 2. "Antenna and Wave Propagation", by K.D. Prasad - satya prakashan pvt.ltd, 2020. **REFERENCE BOOKS:** 1. "Transmission Lines and Networks" by Umesh Sinha , Sathya Prakashan pvt.ltd, 2010. 2. "Electromagnetic Waves and Radiating Systems", by Jordan E.C. and Balmain H. G.-pearson education, 2nd edition, 2015.
E-Resources	1. http://www.nptel.ac.in. 2. http:/www.ebookee.com/antennaandwavepropagation.

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	1	-	2	-	2	3	3
CO2	3	3	2	2	1	-	-	1	-	2	-	2	3	2
CO3	3	3	3	1	1	-	-	1	-	2	-	2	2	3
CO4	3	3	2	2	1	-	-	1	-	2	-	2	3	2
CO5	3	3	2	2	1	-	-	1	-	2	-	2	3	3
CO6	3	3	2	2	1	-	-	1	-	2	-	2	2	2

20EC3103 - DIGITAL COMMUNICATION

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Prerequisite:	Random Signals and Stochastic Processes, Signals & Systems, Analog Communication.	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives

Students undergoing this course are expected to:

1. Understand basic components of digital communication system.
2. Apply suitable pulse code modulation schemes for various applications.
3. Understand transmission and detection of digital passband modulation schemes.
4. Analyze error performance of a digital communication system in presence of noise and other interferences.
5. Understand various M-ary modulation techniques.
6. Understand various Spread-Spectrum techniques.

Course Outcomes

After completing the course, the student will be able to

CO1	Illustrate merits and demerits of digital transmission with the help of block diagram.
CO2	Describe each block in PCM with help of digital communication system.
CO3	Acquire knowledge of ISI and Nyquist criterion.
CO4	Discuss the generation and detection of ASK and FSK, BPSK and QPSK schemes.
CO5	Derive equations for error probabilities of BPSK, QPSK, BFSK and BASK Schemes.
CO6	Explain different types of Spread-Spectrum techniques.

Course Content

UNIT – I

ELEMENTS OF DIGITAL COMMUNICATION SYSTEMS: Block diagram of Digital Communication System, merits and demerits of digital transmission, Line Coding.

MULTIPLEXING TECHNIQUES: FDM, TDM& CDM, Comparison of FDM, TDM and CDM, Digital Multiplexers.

UNIT – II

PULSE CODE MODULATION: Introduction to PCM, Transmitter and Receiver, Uniform Quantization, Non uniform Quantization, Companding, DPCM Transmitter and Receiver, Delta Modulation Transmitter and Receiver, Adaptive Delta Modulation Transmitter and Receiver, Noise in PCM and DM systems. Comparison of Pulse Code Modulation schemes.

UNIT – III

BASEBAND PULSE TRANSMISSION: Introduction, Inter-Symbol Interference (ISI), Nyquist Criterion for distortion less baseband binary transmission, Ideal Nyquist Channel, Raised Cosine Filter & its Spectrum, Correlative-Level Coding – Duo binary & Modified Duo binary signaling, Partial-Response signaling, baseband M-array PAM Transmission, Eye Pattern.

UNIT – IV

PASSBAND DATA TRANSMISSION: Introduction, Passband Transmission Model,

Course Content	generation and detection of Coherent Binary Amplitude Shift Keying (ASK), Binary Phase Shift Keying (BPSK), Quadrature Phase Shift Keying (QPSK) and Binary Frequency Shift Keying (BFSK), Generation and Detection of Non-Coherent BFSK, DPSK, Comparison of BPSK, DPSK QPSK, BFSK & BASK Schemes. **UNIT – V** **M-ARY MODULATION TECHNIQUES:** M-ary PSK, M-ary Quadrature Amplitude Modulation (M-ary QAM), Comparison of M-ary Digital Modulation Techniques. **RECEIVERS:** Matched Filter, Properties of Matched Filter, Matched Filter for Rectangular Pulse, error rate due to noise, error probabilities of BPSK, QPSK, BFSK. **UNIT – VI** **SPREAD-SPECTRUM MODULATION:** Introduction, Pseudo Noise Sequences, Direct Sequence Spread-Spectrum, Frequency Hop Spread-Spectrum: Slow frequency hopping, Fast frequency hopping.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Communication Systems" , by Simon Haykin - Wiley India Edition, 5th Edition, 2010. 2. "Digital and Analog Communication Systems", by k.Sam Shanmugam, Wiley - edition, 2019. **REFERENCE BOOKS:** 1. "Principles of Communication Systems", by Herbert Taub. Donald L Schilling-Goutam Sana- 4th Edition-McGraw-Hill- 2017. 2. "Communication Systems- Analog & Digital", by R. P. Singh & S.D. Sapre-T.M.H. Publications. 3rd Edition, 2017. 3. "Digital Communications",by John G. Proakis. Masoud salehi – 5th Edition-McGraw-Hill- 2014.
E-Resources	1. http://www.nptel.ac.in. 2. http:/www.ebookee.com/digitalcommunicationsystems.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	1	1	-	-	1	-	-	2	2	3
CO4	3	3	2	2	1	1	-	-	-	-	-	2	2	3
CO5	3	3	2	2	1	1	-	-	1	-	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	-	-	2	3	2

20EC31P1-MP & MC LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Basic knowledge in programming C, knowledge in microprocessors and programming	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The features of the software tool – TASAM simulator. 2. The arithmetic and data transfer instructions of 8086. 3. The various hardware modules to be interfaced with µp and µc. 4. The interfacing knowledge with Microprocessor kit. 5. How to develop the ALP for simple logical and arithmetic operations. 6. Develop assembly language programs for various applications using 8051µc.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Set up programming strategies and select proper mnemonics and run their program on the training boards.
	CO2	Acquire interfacing knowledge with microprocessor kit.
	CO3	Design the high-speed communication circuits using serial bus connection.
	CO4	Use a commercial CPU(s) as realistic vehicles to demonstrate these concepts by introducing students to CPU instructions and internal register structures
	CO5	Understand the full internal workings of a typical simple CPU including the utilization of the various hardware resources during the execution of instructions.
	CO6	Develop testing and experimental procedures on Microprocessor and Microcontroller analyse their operation under different cases.
Course Content	**LIST OF EXPERIMENTS** 1. Summation & Block Transfer of Data a) Write and execute 8086 to add the given series of BCD numbers and show the result. b) Write and execute 8086 A.L.P. to transfer a Block of data from one memory area to another memory area. c) Write and execute 8086 A.L.P. to perform the following multiplications. 1) Repeated addition 2) Using SHIFT and ADD instruction d) Write and execute 8086 A.L.P. to perform the following. 1)Binary division 2)BCD division 2. Searching & Sorting Data a) Write and execute 8086 A.L.P. to find the minimum and maximum number from a given data array b) Write and execute 8086 A.L.P. to arrange the given data array in ascending order and descending order	

Course Content	3. Logic Controller Module Write and execute 8086 A.L.P. to design the logical expression using Logic controller interface module 4. Stepper Motor Module Write and execute 8086 A.L.P. to rotate a stepper motor either in clockwise direction or in anticlockwise direction and to control the speed of rotation 5. Serial Input Display Unit Module (S.I.D.U.) Write and execute 8086 A.L.P. to display the desired word in a display of serial input display unit interface module 6. Parallel Input Display Unit Module (P.I.D.U.) Write and execute 8086 A.L.P. to design an up and down counter using P.I.D.U. Interface module 7. Digital to Analog Converter Interface Module Write and execute 8086 A.L.P. to generate given waveform through C.R.O. using D.A.C. 8. Arithmetic & Logical operations using 8051. 9. (a) To find smallest number from given array of numbers using 8051. (b) To find largest number from given array of numbers using 8051. 10. Programming using arithmetic, logical and bit manipulation instructions of 8051.
Reference Books	1. "Advanced Microprocessors & Peripherals", by A K Ray and K M Bhurchandi, 3rd ed., TMH, 2017. 2. "The 8051 microcontroller and embedded systems", by Mohamed Ali Mazidi, Janice Gillispie Mazidi, Pearson education, second edition, 2005.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	1	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	1	-	1	-	2	3	2
CO3	3	3	3	1	1	1	1	1	2	-	-	2	2	3
CO4	3	3	2	2	1	1	-	1	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	1	1	-	-	2	3	2
CO6	3	3	2	2	1	-	-	1	-	-	-	2	3	2

20EC31P2-DIGITAL COMMUNICATIONS LAB

Course Category:	Program Core	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Electronic Devices and Circuits, Signals and Systems, Analog and Digital Communications.	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The design and analysis of various digital communication circuits. 2. To study and verify the various digital modulation techniques.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Verify Sampling Theorem experimentally.
	CO2	Study Time Division Multiplexing and De-multiplexing.
	CO3	Examine the PCM and DPCM practically
	CO4	Demonstrate Amplitude Shift Keying: Modulation and Demodulation.
	CO5	Understand the performance of QPSK generation and detection circuits.
	CO6	Analyze the Linear Block code Encoder and Decoder.
Course Content	Minimum of 10 experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Verification of Sampling Theorem. 2. Time Division Multiplexing and De-Multiplexing. 3. Pulse Code Modulation and Demodulation. 4. Differential Pulse Code Modulation and Demodulation. 5. Delta Modulation and Demodulation. 6. Amplitude Shift Keying: Generation and Detection. 7. Frequency Shift Keying: Generation and Detection. 8. Binary Phase Shift Keying: Generation and Detection. 9. Differential Phase Shift Keying: Generation and Detection. 10. Quadrature Phase Shift Keying :Generation and Detection. 11. Linear Block Code Encoder and Decoder. 12. Binary Cyclic Code Encoder and Decoder.	

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	1	-	-	-	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	-	-	2	3	2

20EC31S1-DIGITAL SYSTEM DESIGN USING VHDL

Course Category:	Program Core	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Switching theory & logic design, Digital design and digital IC's	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. How to write VHDL programs of different digital circuits. 2. How to simulate the VHDL programs of different digital circuits.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Write and simulate the various logic gates by using VHDL.
	CO2	Write and simulate the adders and subtractors by using VHDL.
	CO3	Verify the truth table of various digital circuits and IC's.
	CO4	Design the various digital circuits.
	CO5	Write and simulate the various counters by using VHDL.
	CO6	Write and simulate the various registers by using VHDL.
Course Content	Minimum of **TEN** experiments to be completed out of the following: **LIST OF EXPERIMENTS** 1. Logic Gates 2. Full Adder & Full Subtractor 3. 3 to 8 Decoder 4. 8 to 3 Encoder 5. 4 bit Comparator 6. 8x1 Multiplexer 7. 1x4 Demultiplexer 8. D Flip-Flop 9. Decade Counter 10. Shift Register 11. BCD to 7-segment display code converter 12. 3 bit up/down Ripple counter 13. 2 bit synchronous counter 14. Bi-directional shift register	

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	1	1	-	1	-	-	1	-	2	2	3
CO4	3	3	2	2	1	-	1	-	-	1	-	2	2	3
CO5	3	3	2	2	1	1	1	-	-	1	-	2	3	2
CO6	3	3	2	2	1	1	-	-	-	-	-	2	3	2

PROGRAM ELECTIVES		
1.	20EC31E1	Electronic Measurement And Techniques
2.	20EC31E2	Information Theory & Coding
3.	20EC31E3	Optoelectronics
4.	20EC31E4	Cognitive Radio

20EC31E1- ELECTRONIC MEASUREMENT & TECHNIQUES

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3-0 - 0
Prerequisite:	Electronic Devices and Circuits, Pulse and Analog Circuits, Signals & Systems	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The various standards and units of measurements, electronic instruments, their construction, applications, and principles of operation. 2. The internal structure of analog and digital instruments that are used in measuring parameters and also difference between analog meters and digital meters and their performance characteristics. 3. The importance of different waveforms and their generation. 4. The functioning of CRO including digital oscilloscope and its operation. 5. The measurement using bridges for resistances, inductance and capacitances. 6. Different type of sensors and transducers and their application.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Explain various performance characteristics of instruments like accuracy, sensitivity, resolution and speed of response and their importance in meters.
	CO2	Design basic meters with good performance characteristics.
	CO3	Generate various signals using signal generators and harmonic distortion analyzer with the help of oscilloscope.
	CO4	Analyse the waveforms and signals with the help of oscilloscopes.
	CO5	Understand precision measurement techniques to measure resistance, capacitance using different transducers.
	CO6	Identify the transducers for various applications like to measurement of force, voltage, and speed with the help of bridges.

Course Content

UNIT-I

SCIENCE OF MEASUREMENTS:
Measurement System, Instrumentation, Characteristics of measurement systems – Static and Dynamic, Errors in Measurements, Calibration and Standards.

UNIT-II

METERS: D.C. Voltmeters- D.C. Ammeters Multi range, Range extension, A.C. voltmeters- multi range, Ohmmeters - series type, shunt type, Multimeter.

UNIT-III

FIXED AND VARIABLE SIGNAL GENERATORS: AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Random noise, sweep, Arbitrary waveform generators, Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzer.

UNIT-IV

OSCILLOSCOPES: C.R.T. features, vertical amplifiers, horizontal deflection system, sweep circuit, delay line, sync selector circuits, triggered sweep C.R.O., Dual beam and Dual Trace Oscilloscopes, Digital Storage Oscilloscope, Measurements – Lissajous method of frequency measurement.

Course Content	**UNIT-V** **COMPARATIVE METHODS OF MEASUREMENTS:** D.C potentiometers, D.C bridges (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), Q-meter. **UNIT-VI** **TRANSDUCERS AND DATA ACQUISITION SYSTEMS:** Classification of transducers, Selection of transducers, Resistive, capacitive & inductive Transducers, Piezoelectric, Hall effect, optical and digital transducers, Elements of data acquisition system – Introduction to Smart sensors.
Text Books and Reference Books	**TEXT BOOKS:** 1. Modern Electronic Instrumentation and Measurement Techniques – A. D. Helfrick and W. D. Cooper, Pearson, 1st Edition, 2015. 2. Electronic instrumentation, 3rd edition - H. S. Kalsi, Tata McGraw Hill, 2017. 3. Ernest O Doebelin and Dhanesh N Manik, "Measurement Systems", McGraw-Hill, 6th Edition, 2017. **REFERENCE BOOKS:** 1. Electronic Instrumentation & Measurements - David A. Bell, P.H.I., 2nd Edition, 2003. 2. Principles of Industrial Instrumentation-Patranabis D.McGraw Hill US, 3rd Edition.
E-Resources	1. http://www.nptel.ac.in. 2. http:/www.ebookee.com/electronicmeasurementand instrumentation.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	1	2	-	1	-	-	2	3	2
CO3	3	3	3	2	2	2	-	-	1	-	-	2	2	3
CO4	3	3	2	2	1	2	-	1	2	2	-	2	2	3
CO5	3	3	2	2	1	2	-	1	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	-	-	2	3	2

20EC31E2- INFORMATION THEORY AND CODING

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Data types, Communication theory, basics of computer networks	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The Mutual information, information rate, channel capacity, redundancy and efficiency of channels. 2. The discrete and continuous channels. 3. The Construction of basic source codes – Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding. 4. The Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. 5. The Decoding of cyclic codes, BCH codes, RS codes, Burst error correction. 6. The Sequential decoding, Stack algorithm, Block and convolutional interleaving.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the fundamentals of information Theory.
	CO2	Explain different type of discrete channels and continuous channels
	CO3	Learn various coding techniques and algorithms.
	CO4	Know the different types of Codes for Error Detection and Correction
	CO5	Understand the Syndrome computation and error detection, Decoding of cyclic codes
	CO6	Know the Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes
Course Content	**UNIT I** **INFORMATION THEORY** – Concept of amount of information -units, Entropy - Marginal, Conditional and Joint entropies -Relation among entropies, Mutual information, information rate, channel capacity, redundancy and efficiency of channels. **UNIT II** **DISCRETE CHANNELS** – Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, Shannon theorem. **CONTINUOUS CHANNELS** – Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Tradeoff between Bandwidth and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system. **UNIT III** **SOURCE CODING** – Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes, Kraft's inequality, Coding efficiency and redundancy, Noiseless coding theorem. Construction of basic source codes – Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding. **UNIT IV** **CODES FOR ERROR DETECTION AND CORRECTION** – Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes.	

Course Content	**UNIT V** **CYCLIC CODES –** Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction. **UNIT VI** **CONVOLUTIONAL CODES** – Encoding- State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterby algorithm, Sequential decoding - Stack algorithm. Block and convolutional interleaving, CIRC encoding and decoding.
Text Books and Reference Books	**TEXT BOOKS:** 1"Communication Systems" , by Simon Haykin - Wiley India Edition, 5th Edition, 2010. 2. "Principles of Communication Systems", by Herbert Taub. Donald L Schilling-Goutam Sana- 4th Edition-McGraw-Hill- 2017 3. "Principles of Digital Communication" by Das, Mullick & Chatterjee, New Age Publications, 2nd edition, 2012. **REFERENCE BOOKS:** 1. "Error Control Coding Fundamentals and Applications", by Shu Lin & Daniel J. Costello Jr., Prentice Hall Inc.,2nd edition, 2010. 2. "Digital Communications Fundamentals and Applications" by Bernard Sklar and fred harris, Pearson Education Asia, 2nd edition 2001.
E-Resources	1. https://nptel.ac.in/courses/106105082

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	1	-	-	-	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	-	-	2	3	2

20EC31E3- OPTOELETRONICS

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Engineering physics	**Sessional Evaluation :**	40
		External Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The operation of semiconductor optoelectronic devices. 2. The Hetero junctions and quantum wells and their application to Optoelectronic devices. 3. The design, analysis and modelling of semiconductor lasers (D.C. & Modulation Properties). 4. The design and small-signal circuit modelling of various types of Photo Detectors. 5. The Fourier optics, nonlinear optical signal processing. 6. The Holography, pattern recognition.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Acquire knowledge about optical radiation, black body radiation and material interactions.
	CO2	Analyse radioactive processes, laser excitations and Gaussian characteristics of laser beam.
	CO3	Analyse Q-switching and mode locking.
	CO4	Analyse specific lasers, Helium, Neon, Argon ion, carbon dioxide, neodymium and Semiconductor free electron.
	CO5	Understand modulation of light, electro optic modulation, Acousto-optic modulation and magneto optic devices.
	CO6	Understand Image Binarization using photographic process.
Course Content	**UNIT-I** **OPTICAL RADIATION:** Radiometric and Photometric definitions, Blackbody radiation, Material interactions, Temperature. **UNIT-II** **LASERS:** Radioactive Processes, Laser excitations, Gaussian characteristics of the laser beam, optical feedback, Q-switching and mode locking. **UNIT-III** **SPECIFIC LASERS** – Helium – Neon Laser, Argon ion Laser, Carbon dioxide Laser, Neodymium Laser, Semiconductor Laser, Free electron Laser **UNIT-IV** **MODULATION OF LIGHT:** Polarization, Light propagation in crystals, Electro-optic modulation, Acousto-optic modulation, Magneto-optic devices, Image Binarization using photographic process **UNIT-V** **FOURIER OPTICS:** Scalar theory of diffraction, Fourier transform properties of Lenses, Optical information processing systems, special filtering using binary filters, Nonlinear optical signal processing using contact screens, Apodization. **UNIT-VI**	

	ELECTRO-OPTIC SYSTEMS: Holography, phase contrast microscopy, Pattern recognition, Optical computing systems.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Electro-Optical Devices and systems", by M. A. Karim, PWS-KENT publishing company. 2. "Optical Electronics", by A. K. Ghatak and K. Thyagarajan, Cambridge University press, 2017. **REFERENCE BOOKS:** 1. "Optoelectronics", by Emmanual Rosencher & Borge Vinter, Cambridge University press, 1st edition, 2002. 2. "Laser Principles and Applications", by J. Wilson, J. F. B. Hawkes, PHI Publications, 1987.
E-Resources	1. http://nptel.ac.in/courses/117103063/26 2. https://www.youtube.com/user/nptelhrd

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	1	1	-	1	1	-	-	-	2	2	3
CO4	3	3	2	2	1	-	1	1	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	-	-	2	3	2

20EC31E4- COGNITIVE RADIO

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Computer networks, basic concepts of embedded systems.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The spectrum scarcity problem and how cognitive radio deals with this problem. 2. The contribution of cognitive radio systems in wireless networks and its architectures that enable the development of the cognitive radio network (both Centralized and distributed). 3. The technologies to allow an efficient use of TVWS for radio communications Discussion about various cognitive radio standards. 4. The various research challenges for deployment of cognitive radio network. 5. The knowledge in issues in next generation wireless networks 6. The current research scenario in this field	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Identify fundamental issues regarding dynamic spectrum access and radio-resource management.
	CO2	Understand Essential functions of the software radio, architecture of SDR
	CO3	Demonstrate energy issues in cognitive radio.
	CO4	Understand principle of cognitive techniques and AI techniques
	CO5	Illustrate functions and design rules of cognitive radio
	CO6	Identify layer issues and design cross layer
Course Content	**UNIT I** **INTRODUCTION TO SOFTWARE DEFINED RADIO**: Definitions and Potential Benefits, Software defined Radio, Architecture, Evolution, Technology Tradeoffs and Architecture Implications. **UNIT II** **SDR ARCHITECTURE**: Essential Functions of The Software defined Radio, Basic SDR, Hardware Architecture, Computational Processing Resources, Software Architecture, Top Level Component Interfaces, Interface Topologies Among Plug And Play Modules. **UNIT III** **INTRODUCTION TO COGNITIVE RADIOS**: Marking Radio Self-Aware, Cognitive Techniques – Position Awareness, Environment Awareness in Cognitive Radios, Optimization of Radio Resources, Artificial Intelligence Techniques. **UNIT IV** **COGNITIVE RADIO ARCHITECTURE:** Cognitive Radio – Functions, Components And Design Rules, Cognition Cycle – Orient, Plan, Decide and act Phases, Inference Hierarchy, Architecture Maps, Building the Cognitive Radio Architecture On Software Defined Radio Architecture. **UNIT V** **NEXT GENERATION WIRELESS NETWORKS**: The XG Network Architecture, Spectrum Sensing, Spectrum Management, Spectrum Mobility, Spectrum Sharing, Upper Layer Issues, Cross – Layer Design.	

Course Content	**UNIT VI** **COGNITIVE TECHNIQUES: PHYSICAL AND LINK LAYERS:** Introduction, Optimizing physical and Link Layers for Multiple-Objectives, Under Current Channel Conditions, Defining the Cognitive Radio, developing Radio Controls (Knobs) and Performance Measures (Meters), multi object decision making Theory and Its Application to Cognitive Radio , The Multi-objective genetic algorithm for Cognitive Radios, Advanced GA Techniques ,Need for a Higher-Layer Intelligence.
Text Books and Reference Books	**TEXT BOOKS:** 1. ”Software Radio Architecture: Object-Oriented Approaches To Wireless System Engineering”, by Joseph Mitola III, John Wiley & Sons Ltd. 2000. 2. “Artificial Intelligence in Wireless Communication”, by Thomas W.Rondeau, Charles W. Bostain, Artech House publishers .2009. 3. “Cognitive Radio Technology”, by Bruce A. Fette, Elsevier, 2nd edition, 2009. 4. “Next Generation / Dynamic Spectrum Access / Cognitive Radio Wireless Networks: A Survey”, by Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, Elsevier Computer Networks, May 2006. **REFERENCES BOOKS:** 1. “Cognitive Radio: Brain –Empowered Wireless Communications”, by Simon Haykin, IEEE Journal on Selected Areas in Communications, Feb 2005. 2. “Enabling Location And Environment Awareness In Cognitive Radios”, by Hasari Celebi, Huseyin Arslan, Elsevier Computer Communications, Jan 2008. 3. “Software Defined Radio”, by Markus Dillinger, Kambiz Madani, Nancy Alonistioti, John Wiley, 1st edition, 2003.
E-Resources	1. http://www.nptel.ac.in. 2. http:/www.ebookee.com/ Cognitive Radio Communication and Networks.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	1	-	-	-	2	3	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	1	2	1	-	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	1	-	-	-	2	3	2

R-20 Open Electives		
1.	20EE3101	Linear Control Systems
2.	20CS3103	Computer Networks
3.	20CS3104	Object Oriented Programming Through Java
4.	20CE3103	Environmental Impact and Management

20EE31O1 - LINEAR CONTROL SYSTEMS

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basic knowledge of differentiation, integration and Laplace transform techniques.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about: 1. The various types of control systems and methods to obtain transfer function. 2. The mathematical models of physical systems. 3. The time domain responses of first and second-order systems for different input signals. 4. The stability of a control system using different techniques. 5. The frequency domain techniques to assess the system performance. 6. The different types of compensators for linear systems.	
Course Outcomes:	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the various types of control systems and methods to obtain transfer function.
	CO2	Develop mathematical models of physical systems.
	CO3	Determine the time domain responses of first and second-order systems for different input signals.
	CO4	Evaluate the stability of a control system using different techniques.
	CO5	Apply frequency domain techniques to assess the system performance.
	CO6	Design the different types of compensators for linear systems.
Course Content:	**UNIT –I** **Introduction to classical control systems:** Introduction, Classification of control systems, Difference between Open loop and Closed loop control systems, Feedback-Need of feedback -types of feedback and its effects, transfer functions, Block diagrams-Block diagram of a simple closed loop system-Block diagrams reduction, Signal flow graphs-Terminologies used in Signal Flow Graphs-Rules for Signal Flow Graphs-mason's gain formula. **UNIT-II** **Mathematical modeling of physical systems:** Mechanical Translational System-Force Balance Equations of Idealized Elements,Mechanical Rotational System-Torque Balance Equations of Idealized Elements,Transfer Function of Armature Controlled DC Motor,Transfer Function of Field Controlled DC Motor,Analogous Systems- Electrical Analogous Of Mechanical Translational System ,Electrical Analogous of Mechanical Rotational Systems, DC Servo Motors,Two-Phase AC Servo Motors , Synchros. **UNIT-III** **Time domain analysis:** Introduction, Standard Test Signals,Order of a System,Characteristic Equation of a Transfer Function, Second Order System,Response of Second Order System for Unit Step Input, Time Response Specifications, Expressions for Time Domain Specifications,	

	Type Number of Control Systems, Steady State Error, Static Error Constants, Steady State Error for Unit Step, Unit Ramp And Unit Parabolic Input Signals. **UNIT-IV** **Stability of control systems:**Absolutely Stable System,Unstable System , Critically Stable System,Relative Stability,Location of Poles on S-Plane for Stability, Necessary Conditions for Stability, Routh-Hurwitz Criterion- Root Locus- Rules For The Construction of Root Loci, Introduction to Proportional, Derivative and Integral Controllers. **UNIT-V** **Frequency domain Analysis:**Sinusoidal Transfer Function and Frequency Response,Frequency Domain Specifications,Frequency Domain Specifications of Second Order System , Bode Plots-Basic Factors of a Typical Transfer Function- Procedure for Magnitude Plot and Phase Plot of Bode Plot, Polar Plots-Typical Sketches of Polar Plot-Determination of Gain Margin and Phase Margin from Polar Plot, Nyquist Stability Criterion-Mathematical Preliminaries for Nyquist Stability Criterion-Arbitrary S-Plane Contours and their Corresponding F(S)-Plane Contours- Principle of Argument. **UNIT-VI** **Design of compensators:** Introduction to Design using Compensators, Lag Compensators- S-Plane Representation of Lag Compensator-Realization of Lag Compensator using Electrical Network- Frequency Response of Lag Compensator, Lead Compensators- S-Plane Representation of Lead Compensator-Realization of Lead Compensator using Electrical Network- Frequency Response of Lead Compensator.
Text books & Reference books:	**Text books:** 1. "Control system engineering", by I.J.Nagrath and M.Gopal, 6th Edition, New age International (P) Ltd. 2. "Control systems", by A.Nagoorkani, 2nd Edition, RBA publishers. 3. "Control systems" by A.Anandkumar, 2nd Edition, PHI publishers. **Reference books:** 1. "Automatic control systems", by B.C.Kuo, 7thEdition, PHI publishers. 2. "Discrete time control systems", by K.Ogata, PHI Publishers. 3. "Control systems engineering", by Norman S Nise, Wiley, 2000.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	3	-	-	1	-	-	-	2	3	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	1	2	3	-	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	1	-	-	-	2	3	2

20CS31O3 - COMPUTER NETWORKS

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Knowledge in computer fundamentals and basic network essentials.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100
Objectives:	• To equip the students with a general overview of the concepts of computer networks. • Familiarize the students with the standard networks layer models. • To establish the communication and their applicability.		

Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the basic concepts of computer networks.
	CO2	Acquire the knowledge about various types of application layer protocols.
	CO3	Exposure on transport layer functions.
	CO4	Learn the concept of IPv4 issues and supporting mechanism.
	CO5	Know about working principle of router and routing protocols.
	CO6	Understand the design issues, protocols and their applicability in data link layer.

Course Content

UNIT-I

Computer networks and the Internet: What is the Internet, the Network edge, the Network core, delay, loss, and throughput in Packet-Switched Networks, Protocol Layers and their service models.

UNIT-II

Application Layer: Principles of network applications, the Web and HTTP, Electronic mail in the Internet, DNS—the Internet's directory service.

UNIT-III

Transport Layer: Introduction and Transport-layer Services, Multiplexing and Demultiplexing, Principles of reliable data transfer, Connectionless Transport: UDP, Connection-oriented transport: TCP.

UNIT-IV

Introduction to Network layer: Forwarding and Routing, Network Service Models.

Virtual circuit and Datagram networks: Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks.
The internet protocol: Datagram Format, IPv4 Addressing, ICMP.

UNIT-V

What's inside a router: Input Processing, Switching, Output Processing, Where does queuing occur, the Routing Control Plane.

	Routing algorithms: The Link-State Routing Algorithm, the Distance-Vector Routing Algorithm, Hierarchical Routing. **Routing in the internet:** RIP, OSPF, BGP. **UNIT-VI** **The link layer:** Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks.
Text Books & References Books	**TEXT BOOKS:** 1. Computer Networking: A Top-Down Approach, James F. Kurose, K. W. Ross, 6th Edition, Pearson Education. **REFERENCE BOOKS:** 1. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education. 2. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition. 3. An Engineering Approach to Computer Networks - S. Keshav, 2nd Edition, Pearson Education. 4. Computer Networks, L. L. Peterson and B. S. Davie, 4th edition, ELSEVIER.
E-Resources	1. https://nptel.ac.in/courses

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	3	-	-	1	-	-	-	2	3	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	1	2	3	-	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	1	-	-	-	2	3	2

20CS31O4 - OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Basic knowledge of programming.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100
Objectives:	• Acquire knowledge on basics of Java • Learn the fundamental constructs of string handling functions in Java • Gain knowledge of using inheritance and packages • Explore the knowledge to create Graphical User Interfaces by using event handling mechanisms. • Learn the exception handling mechanisms.		

Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the basic concepts of Java and control statements.
	CO2	Acquire the knowledge of Classes and Methods
	CO3	Conceptualize the techniques of inheritance and String handling functions.
	CO4	Understand Interfaces and packages in java.
	CO5	Know the Exception Handling mechanisms and thread Programs.
	CO6	Understand the concept of Event Handling mechanisms and its applicability.

Course Content

UNIT-I

Java Basics: Buzz words, Data types, Variables and Arrays
Operators: Arithmetic, Bitwise, Relational, Boolean, Assignment, Ternary, Precedence and Associativity.
Control statements: Selection, Iteration and Jump statements

UNIT-II

Classes: Fundamentals, Assigning Object Reference Variables, Constructors, Garbage collection.
Methods: Overloading of Methods, Passing Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, Static, Final, Variable-length Arguments.

UNIT-III

String Handling: Constructors, length(), Special String Operations, Character Extraction, String Comparison – equals(), equalsIgnoreCase(), startsWith(), endsWith(), Deep Vs Shallow comparisons, String Buffer – constructors, length(), capacity(), reverse() and replace().
Inheritance: Basics, use of super keyword, Method overriding, Dynamic method dispatch, Using final with Inheritance.

UNIT-IV

Interfaces: Definitions and Implementations, Nested and Applying Interfaces, Variables in interfaces, Extending interfaces, Default and Static Interface Methods.
Packages: Basics, Member Access, Importing Packages.

	UNIT-V **Exception Handling:** Fundamentals, Types, Uncaught Exceptions, Usage of try and catch clauses, Multiple catch clauses, throw, throws and finally keywords. **UNIT-VI** **Event Handling:** Delegation Event Model, Event Classes, KeyEvent Class, Listener Interfaces, Handling Mouse Events, usage of delegation model, Adapter Classes, Inner Classes.
Text Books & References Books	**TEXT BOOKS:** 1. Java: The Complete Reference, 10th Edition, Herbert Schildt TMH. **REFERENCE BOOKS:** 1. Understanding Object-oriented Programming with Java, Timothy Budd, Addison Wesley. 2. Object-Oriented Programming and Java, Danny Poo, Derek Kiong, Swarnalatha Ashok, Second Edition, Springer. 3. Object-Oriented Programming using Java, Simon Kendal, Simon Kendal & Ventus Publication Aps.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	3	-	-	1	-	-	-	2	3	2
CO3	3	3	3	1	2	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	1	2	3	-	-	-	-	2	2	3
CO5	3	3	2	2	2	-	-	1	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	1	-	-	-	2	3	2

20CE31O3 – ENVIRONMENTAL IMPACT AND MANAGEMENT

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Carry out scoping and screening of developmental projects for environmental and social assessments.
	CO2	Explain different methodologies for environmental impact prediction and assessment.
	CO3	Explain impact of development activities and land use.
	CO4	Plan Environmental impact assessments and environmental management plans.
	CO5	Evaluate mitigation and impacts
	CO6	Know the problems related to environment due to industries.
Course Content		**UNIT – I** **INTRODUCTION TO EIA:** Environmental ethics – Need of EIA for Engineering projects – Classification of environmental parameters – Purposes of EIA – Goals of EIA. **UNIT – II** **EIA METHODOLOGIES:** Introduction – Criteria for the selection of EIA methodology – Categorization of methodologies – Matrix methods – Network method – Environmental Media quality index method – Cost / benefit analysis. **UNIT – III** **IMPACT OF DEVELOPMENTAL ACTIVITIES AND LAND USE:** Introduction and methodology for the assessment of soil and ground water – delineation of study area – identification of activities – Procurement of relevant soil quality – Impact prediction – Assessment of impacts. **UNIT – IV** **METHODOLOGY FOR THE ASSESMENT OF IMPACTS OF SOME ATTRIBUTES:** Surface water – Air and biological environment – Methodology and generalized approach for the assessment of impact of development activities on vegetation and wildlife – Environmental impact of deforestation and incorporation of mitigation measures. **UNIT – V** **MITIGATION AND IMPACT ASSESMENT:** EIA process and mitigation, elements of mitigation, approaches to mitigation, typical mitigation measures. **UNIT – VI** **CASE STUDIES:** Environmental impact of large scale water resources projects – environmental impact of thermal and nuclear power plants and on oil refineries.

Textbooks and References	**TEXTBOOKS:** 1. Anji reddy Maredy, *Environmental Impact Assessment*, Butterworth-Heinemann, 2017. 2. R.R. Barthwal, *Environmental Impact Assessment* New Age International Private Limited; 2nd edition, 2012. 3. Shukla, S.K. and Srivastava, P.R., *Concepts in Environmental Impact Analysis*, Commonwealth Publishers, 1992. **REFERENCES:** 1. Dr. N.S. Raman, Dr. Y.R.M Rao, Environmental Impact Assessment, Laxmi Publications Pvt. Ltd., 2017. 2. R.L Canter, *Environmental Impact Assessment*, McGraw Hill Inc., 1977. 3. John G. Rau and David C Hooten, *Environmental Impact Analysis Handbook*, McGraw Hill higher education, 1980.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	3	-	-	1	-	-	-	2	3	2
CO3	3	3	3	1	1	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	1	2	3	-	-	-	-	2	2	3
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	2
CO6	3	3	2	2	1	-	-	1	-	-	-	2	3	2

MANDATORY COURSE

20ME31MC – PROFESSIONAL ETHICS AND INTELLECTUAL PROPERTY RIGHTS
(Common to ME & ECE)

<table>
<tr><td>Course Category:</td><td colspan="2">Mandatory</td><td>Credits:</td><td>0</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>3-0-0</td></tr>
<tr><td rowspan="4">Pre-requisite:</td><td colspan="2" rowspan="4"></td><td>Sessional Evaluation:</td><td>40</td></tr>
<tr><td>End Exam Evaluation:</td><td>60</td></tr>
<tr><td>Total Marks:</td><td>100</td></tr>
<tr><td>Duration of External Exam:</td><td>3 hrs.</td></tr>
<tr><td>Course Objectives:</td><td colspan="4">Students undergoing this course are expected to:
1. Explain different kind of ethics and values.
2. Apply professional ethics in Engineering.
3. Explain the role of IPRs in professional life.
4. Elucidate the importance of patents and copyrights</td></tr>
<tr><td rowspan="7">Course Outcomes:</td><td colspan="4">After completing the course, the student will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Understand Ethics and different types of values.</td></tr>
<tr><td>CO2</td><td colspan="3">Understand Engineering Ethics and their usage.</td></tr>
<tr><td>CO3</td><td colspan="3">Understand IPR.</td></tr>
<tr><td>CO4</td><td colspan="3">Understand Patents.</td></tr>
<tr><td>CO5</td><td colspan="3">Understand Copyrights and their need.</td></tr>
<tr><td>CO6</td><td colspan="3">Understand Trademark and their need.</td></tr>
<tr><td>Course Content:</td><td colspan="4">UNIT – I
Human Values : Morals, Values-types of values, Ethics, Integrity, Work ethics, Service learning, Virtues-civic virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place. Spirituality-Spirituality in the Workplace, Spirituality for Corporate Excellence. Introduction to Yoga and meditation for professional excellence and stress management.
UNIT – II
Engineering Ethics: Senses of “Engineering Ethics”, Variety of moral issues, Types of inquiries, Moral dilemma-Definition, Steps to solve dilemma. Moral Autonomy, Moral development–Kohlberg theory, Gilligan’s theory. Consensus and Controversy. Profession-Definition, Characteristics. Models of professional roles, Responsibility-Senses, Types, Responsible Professionalism, Social Responsibility, Accountability, Obligation. Theories about right action-Uses and criteria, Ethical theories. Self-interest, Customs and Religion, Self-respect.</td></tr>
</table>

	UNIT – III **Intellectual Property Rights:** Introduction to Intellectual property law, Types of intellectual property, Importance of intellectual property, Agencies responsible for intellectual property Registration, Regulatory-Compliance and Liability issues. **UNIT – IV** **Patents:** Introduction to Patents, What can be patented, What can be not patented, Publication Vs Patent, Types of Patents, Objects for Patenting an invention, Main steps of patenting procedure, Patent application procedure in India, Obtaining Patents, Rights and Obligations of a Patentee. **UNIT – V** **Protection of Patents –** Introduction, Applying for Patent Protection in a Single Country, Protection under the Paris Convention, Protection under the Patent Cooperation Treaty. Royalty of Patents, Types of Royalties. Legal Problems with patents, Solutions to patent problems. **UNIT – VI** **Trade Marks:** Definition, Function of trademark, Essentials of trade mark, Trade mark registration, Key features of trade mark, Advantages of trade mark assignment, Protectable matter, Selecting and evaluating trademark.
Text Books:	1. R.S. Naagarazan: Professional Ethics and Human Values, New Age International Publishers. 2. Deborah E Bouchoux: Intellectual Property - The Law of Trademarks, Copyrights, Patents and Trade Secrets, DELMAR CENGAGE Learning, 4th Edition, 2013.
References:	1. Narayanan P.: Intellectual Property Law, Eastern Law House (2007) 3rd Edition. 2. P. Radhakrishnan - Intellectual Property Rights.
e-Resources:	http://nptel.ac.in/courses

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2	-	-	-	-	-	-	3	-	-
CO2	2	2	2	3	2	-	-	-	-	-	-	3	-	-
CO3	2	2	2	3	2	-	-	-	-	-	-	3	-	-
CO4	2	2	2	3	2	-	-	-	-	-	-	3	-	-
CO5	2	2	2	3	2	-	-	-	-	-	-	2	-	-
CO6	2	2	2	3	2	-	-	-	-	-	-	3	-	-

20EC31IS- SUMMER INTERNSHIP

(COMMUNITY SERVICE PROJECT)

Credits	Sessional Marks	End Examination Marks	Maximum Total Marks
1.5	40	60	100

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR

(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

III YEAR OF FOUR-YEAR B.TECH DEGREE COURSE – II SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2021-2022)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
			Sessional-I Marks							Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks		Duration In Hours	Max. Marks	100
1	20EC3201	Digital Signal Processing	3	0	-	3	34	6	40	34	6	40	0.8*Best of two+0.2* least of two	3	60	100
2	20EC3202	Microwave Theory and Techniques	2	1	-	3	34	6	40	34	6	40		3	60	100
3	20EC3203	Fiber Optic Communication	3	0	-	3	34	6	40	34	6	40		3	60	100
4	20EC32EX	Program elective	3	0	-	3	34	6	40	34	6	40		3	60	100
5	20XX32XX	Open elective	3	0	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS														
6	20EC32P1	Digital Signal Processing Lab	-	-	3	1.5	-	-	-	-	-	40	Day to Day Evaluation and a test (40 Marks)	3	60	100
7	20EC32P2	Microwave & Optical Communication Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
8	20EC32P3	Embedded Systems & IOT Lab	-	-	3	1.5	-	-	-	-	-	40		3	60	100
		SOFT SKILLS														
9	20EC32S1	Mobile app development	1	-	2	2	-	-	-	-	-	40		3	60	100
		MANDATORY											0.8*Best of two+0.2* least of two			
10	20MC3201	Entrepreneurship	3	0	-	-	34	6	40	34	6	40		3	60	100
		TOTAL	18	1	8	21.5	-	-	-	-	-	400	-	-	600	1000

***** Common to ECE & EEE. **Common to ECE, CE, EEE & ME. @Open Electives: List is enclosed.

A for Assignment (continuous evaluation),

$ Test (Descriptive & Objective) duration = 2 Hours

20EC3201-DIGITAL SIGNAL PROCESSING

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 1 - 0
Prerequisite:	Signal & System, Fourier transform, Laplace Transform & Z transform	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The basic concepts and analytical methods of Z-transform. 2. The various DFT & FFT algorithms. 3. The techniques and tools for digital filter structures. 4. The design of FIR filters. 5. The various IIR filters. 6. The truncation and Rounding errors, Quantization noise	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Explain the concept of Z-transform, its properties and understand the concept of discrete and fast Fourier trans forms.
	CO2	Understand the concept of IDFT and IZT.
	CO3	Apply the Concept of FIR, IIR Structures and frequency domain filter models.
	CO4	Design Parallel and cascade structure and Butterworth, Chebyshev filters.
	CO5	Design FIR filter using Fourier series method and understand the concept of fixed point and floating-point representation.
	CO6	Understand limit cycle oscillations concept and windowing technique.
Course Content	**UNIT – I** **REVIEW OF Z-Transforms:** Z-transform and Inverse Z-Transform, Theorems and Properties, system function, Fourier representation of finite duration sequences. **UNIT – II** **DISCRETE & FAST FOURIER TRANSFORM**: DFT, properties of DFT, FFT, FFT algorithms, Use of DFT for fast computation of convolution, IDFT. **UNIT – III** **DIGITAL FILTER STRUCTURES:** Basic FIR structures, IIR structures: Direct form-I, Direct form-II, Parallel form, Cascade form. **UNIT – IV** **DESIGN OF IIR FILTERS:** Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Impulse Invariant and Bilinear Transformation Method. **UNIT – V** **DESIGN OF FIR FILTERS**: Introduction to FIR filter, Methods of FIR filters: Fourier series method, Windowing, Sampling. **UNIT-VI** **FINITE WORDLENGTH EFFECTS**: Fixed point and floating-point number representations – Truncation and Rounding errors – Quantization noise – coefficient quantization error – Product quantization error – Overflow error – Round off noise power – limit cycle oscillations due to product round off and overflow errors.	

Text Books and Reference Books	**TEXTBOOKS:** 1. "Digital Signal Processing", by A.V Oppenheim and R.W. Schafer, Pearson Education India, First edition, 2015. 2. "Digital Signal Processing", by S. Salivahanan – TMH, fourth edition 2019. 3. "Digital Signal Processing Computer Based Approach", by Sanjit.K. Mitra – Tata McGraw-Hill, 4e,2013. **REFERENCES BOOKS:** 1. "Digital Signal Processing", by P. Ramesh Babu, Scitech Publications, seventh edition 2018. 2. "Digital Signal Processing", by John G Proakis and manolakis- Pearson Education, 4th edition, 2014.
E-Resources	1. http://nptel.ac.in/courses 2. https://dspace.mit.edu/handle/1721.1/57007 3. http://dl.acm.org/citation.cfm?id=562622

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	1	1	-	-	1	-	-	2	2	3
CO4	3	3	2	2	1	1	-	-	-	-	-	2	2	3
CO5	3	3	2	2	1	1	-	-	1	-	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	-	-	2	3	2

20EC3202-MICROWAVE THEORY & TECHNIQUES

Course category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 2 - 0
Prerequisite:	Electro Magnetic Fields & Waves, Antenna & wave Propagation.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To understand the operation of Klystron amplifier, Reflex Klystron oscillator, Travelling Wave Tube amplifier and Magnetron oscillators. 2. To study the operation of different microwave semiconductor devices like Tunnel diode, Gunn diode, IMPATT diode, Schottkey Barrier diode, PIN diode and varactor diodes. 3. To understand different microwave components like Resonators, attenuators, TEEs, Directional couplers, Isolators and S-parameters of networks. 4. To study the measurement of frequency, VSWR, impedance, S-parameter and 'Q' of a cavity. 5. To study parabolic reflector antenna, Horn and Lens antennas. 6. To study Hybrid MICs, strip lines, micro strip lines	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Demonstrate the Magnetron and tunnel diode as oscillator.
	CO2	Derive the power efficiency in parametric amplifier and klystron amplifier.
	CO3	Understand the measurement of impedance using Microwave TEEs.
	CO4	Measure various parameters like power, VSWR at microwave frequencies with the help of various microwave components.
	CO5	Design Parabolic antenna and explain MIC.
	CO6	Understand the fabrication technique of MICs and radiation pattern of Horn Antenna.
Course Content	**UNIT-I** **MICRO WAVE TUBES:** Klystron Amplifier, Reflex Klystron Oscillator, Travelling Wave Tube Amplifier and Magnetron Oscillator. **UNIT-II** **MICROWAVE SEMOCONDUCTOR DEVICES:** Tunnel Diode, Gunn Diode, IMPATT Diode, PIN Diode, SchottKey Barrier Diode, Varactor Diode and Parametric Amplifier, MASER. **UNIT-III** **MICROWAVE COMPONENTS:** Waveguides, Probes & Loops,Cavity Resonators, Attenuators, TEEs, Bends, Corners, Windows, Phase Shifters, Directional Couplers, Matching elements, Faraday rotation-Isolators, Circulators, S-Parameters of Networks.	

Course Content	**UNIT-IV** **MICROWAVE MEASUREMENTS:** Measurement of Frequency, Power, VSWR, Impedance, Reflection Coefficient, Attenuation Constant and Dielectric Constant, S-parameters, 'Q'- of a Cavity. **UNIT-V** **MICROWAVE ANTENNAS:** Parabolic Reflector Antenna, Passive Reflector Antenna, Helical antenna, Horn and Lens Antennas **UNIT-VI** **MICs:** Fabrication of MICs, Advantages of MICs, Hybrid MICs, Strip Lines, and Microstrip Lines, Monolithic MICs
Text Books and Reference Books	**TEXT BOOKS:** 1. Microwave Devices and Circuits by Samuel Y Liao, Prentice Hall, 3rd Edition 1999. 2. Microwave and Radar Engineering by M. Kulkarni, Umesh Publications, 5th Edition 2016. 3. Microwave Engineering by Annapurna Das and Sisir K. Das, TMH, 3rd Edition 2017. **REFERENCE BOOKS:** 1. Microwave Devices and Applications by D. C. Dube, Narosa Publications, 2011. 2. Microwave Engineering by David M. Pozar, Wiley Publications, 4th Edition 2016. 3. Foundations for Microwave Engineering by Robert E. Collin, John Wiley and Sons, 2nd Edition, 2007.
E-Resources	1. http://nptel.ac.in/syllabus/117105029/ 2. https://www.youtube.com/user/nptelhrd

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	1	1	-	-	-	-	2	3	2
CO3	3	3	3	3	2	-	-	-	-	1	-	2	2	3
CO4	3	3	2	2	1	2	1	-	-	2	1	2	2	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO6	3	3	2	2	1	-	1	1	-	-	-	2	3	2

20EC3203-FIBER OPTIC COMMUNICATIONS

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Electro Magnetic Fields and Waves, Antenna and Wave Propagation, Electronic Devices and Circuits.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand the:	
	1. Overview of the Ray theory. 2. Optical materials, dispersion, diffraction, absorption, scattering, fiber losses, fiber modes and configurations, fiber types and rays and fiber materials. 3. LED, LASERs and their excitations and noises of light sources and coupling to single mode fibers, splicing and connectors. 4. Operating principles of optical detectors and receivers. 5. Behavior of the optical amplifiers, semiconductor and doped optical amplifiers, and optical networks. 6. Knowledge of measurement of attenuation and dispersion.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Acquire knowledge about optical materials, fiber characteristics, classification with different losses.
	CO2	Understand the transmission characteristics and fiber materials for proper optical propagation.
	CO3	Acquire knowledge of LED, LASER excitations, fiber noises, coupling of fibers and its receivers.
	CO4	Analyze optical sources,detectors and receivers performance and calculation.
	CO5	Understand the optical amplifiers and basic noise networks in optical fiber applications.
	CO6	Understand the measurements of attenuation and dispersion.
Course Content	**UNIT-I** **INTRODUCTION TO OPTICAL FIBERS**: Introduction, Basic optical laws and definitions: Ray theory transmission, Total internal reflection, Acceptance angle, Numerical aperture, Skew Rays, optical fiber modes and configurations, mode theory for circular waveguides, light propagation in single mode and multi-mode fibers, fiber materials. **UNIT –II** TRANSMISSION CHARACTERISTICS OF OPTICAL FIBER: Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides: Information Capacity determination, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion. Pulse broadening in graded-index waveguides, Mode coupling, Design optimization of single mode fibers, Refractive Index profile and cut-off wavelength of fibers. **UNIT –III** **FIBER OPTICAL SOURCES**: Light Emitting Diode (LED): LED structures, Light source materials, Surface and Edge Emitting LEDs, Quantum efficiency and LED power. **LASER Diodes:** Injection LASER diode structures, Quantum efficiency and	

Content	comparison of LED and LASER diodes. fiber - to- fiber joints, fiber splicing, Optical Connectors. **UNIT –IV** **FIBER OPTICAL DETECTORS AND RECEIVERS:** **OPTICAL DETECTORS**: PIN Photo detectors, Avalanche Photo diodes, construction, characteristics and properties, comparison of photo detectors, photo detector noise,noise sources, Signal to Noise Ratio, detector response time. **OPTICAL RECEIVERS**: Fundamental receiver operation, digital receiver performance. **UNIT- V** **FIBER OPTICAL AMPLIFIERS AND NETWORKS**: Semiconductor Optical amplifiers – EDFA- Raman amplifier. **WDM SYSTEM**: Operational principles of WDM, Types of WDM Systems, Passive components. **UNIT- VI** **FIBER OPTICAL MEASUREMENTS**: Fiber attenuation measurements: The cutback techniques, Insertion loss method. Dispersion measurements: Intermodal dispersion, time- domain intermodal dispersion measurements, frequency - domain intermodal dispersion measurements, chromatic dispersion, polarization mode dispersion, Eye Patterns.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Optical fiber Communications", by Gerd Keiser, McGraw-Hill, 5th Edition,2017. 2. "Optical Fiber Communication", by John M Senior, Pearson publications, 3rd edition, 2014. 3. "Optical Communication Systems", by Satinder Bal Gupta & Ashish Goel, University Science Press, 2nd edition, 2011. **REFERENCE BOOKS:** 1. "Electronic Communications Systems", by Williams Schweber, Prentice Hall, 4th edition, 2002. 2. "Optical Fiber Communication Systems" , by C.P. Saud Bance, John Wiley. 3. "Modern Electronic Communication" by G.M. Miller, Prentice Hall,9th edition 2007.
E-Resources	1. http://nptel.ac.in/courses/117103063/1 2. https://www.youtube.com/user/nptelhrd

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	1	-	-	-	1	-	2	3	2
CO3	3	3	3	1	1	-	1	-	-	1	-	2	2	3
CO4	3	3	2	2	1	1	2	-	-	-	-	2	2	3
CO5	3	3	2	2	1	1	-	-	-	1	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	1	-	2	3	2

20EC32P1 – DIGITAL SIGNAL PROCESSING LAB

Course Category:	Program Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Signals and system, digital signal processing and digital image processing.	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. Basic operations varies filters and images. 2. Verification of various systems.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Generate various filters using MAT lab.
	CO2	Find the Inverse z-transform using residue method.
	CO3	Perform linear convolution and cross correlation of two sequences.
	CO4	Compute the DFT and IDFT of a given sequence.
	CO5	Perform linear convolution using DFT
	CO6	Design digital band pass and band stop filters.

Course Content

LIST OF SIGNAL PROCESSING EXPRIMENTS

1. Generation of discrete time signals like sine, cosine, exponential, square and sawtooth
2. Perform linear convolution and cross correlation of two sequences.
3. Constant co-efficient difference equation.
4. Computation of the DTFT of a given sequence x (n).
5. Computation of the DFT and IDFT of a given sequence.
6. Computation of the efficiency of FFT algorithm with the DFT algorithm.
7. Linear convolution using DFT.
8. Inverse Z-transform using residue method.
9. Design Chebyshew digital low pass filter using bilinear transformation.
10. Design a Butterworth digital low pass filter.
11. Design FIR digital low pass filter.
12. Design digital band pass filter.
13. Design digital band stop filter.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	1	-	-	2	-	-	-	2	3	3
CO2	3	3	2	2	2	-	-	-	2	-	-	2	3	2
CO3	3	3	3	2	2	1	-	-	-	-	-	2	2	3
CO4	3	3	2	2	2	1	-	1	-	2	-	2	2	3
CO5	3	3	2	2	2	1	-	-	1	-	-	2	3	2
CO6	3	3	2	2	2	1	-	1	2	-	-	2	3	2

20EC32P2 –MICROWAVE & OPTICAL COMMUNICATION LAB

Course Category:	Program Core	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0 - 0 - 3
Prerequisite:	Microwave techniques, Fiber Optic Communications.	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand: 1. The Reflex Klystron, it is used as amplifier and oscillator in radar stations and radio stations etc. 2. The wave-guide characteristics 3. The antenna parameters 4. The unknown load impedance measurement using VSWR method. 5. The working of directional couplers.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Study Reflex Klystron characteristics and understands how it can be used as an amplifier, oscillator in microwave applications
	CO2	Calculate the power in the parts of direction couplers
	CO3	Know the cut off, free space and guided wavelength of waveguide.
	CO4	Know how to power can be mixed and split up phase reversal etc. using magic tee
	CO5	Measure Antenna Parameters like Gain , Aperture Area and the directivity
	CO6	Know how to measure numerical aperture and bending losses of OFC
Course Content	**LIST OF EXPERIMENTS** 1. Reflex Klystron Characteristics –I 2. Reflex Klystron Characteristics –II 3. Direction Couplers 4. Wave Guide Parameters 5. Characteristics of GUNN Diode 6. Characteristics of MAGIC TEE 7. Antenna Measurements 8. Measurement of VSWR 9. Measurement of Impedance 10. Establishment of Analog and Digital Optical Links. 11. Measurement of Numerical Aperture 12. Measurement of Bending Losses.	

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	1	1	2	-	-	-	2	3	3
CO2	3	3	2	2	2	-	-	2	-	-	2	2	3	2
CO3	3	3	3	1	2	-	-	2	-	-	-	2	2	3
CO4	3	3	2	2	2	-	-	2	-	-	1	2	2	3
CO5	3	3	2	2	2	1	1	2	-	2	-	2	3	2
CO6	3	3	2	2	2	1	1	2	-	-	1	2	3	2

20EC32P3 – EMBEDDED SYSTEMS & IOT LAB

Course Category:	Program Core	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial- Practice:**	0 - 0 - 3
Prerequisite:	Micro controllers and embedded systems	**Sessional Evaluation:** **External Evaluation :** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. Use Embedded C language to develop embedded applications. 2. Apply, Construct and demonstrate various in-build interfaces/modules of Aurdino and MSP430 for specific applications. 3. Apply Embedded C code for utilizing Low power modes of MSP430.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Design the home appliances and toys using Microcontroller chips.
	CO2	Design Logic controller module and SIDU module.
	CO3	Design the high speed communication circuits using serial bus connection
	CO4	Interfacing and programming GPIO ports in c using MSP430
	CO5	Understand the PWM generation using timer on MSP430 GPIO
	CO6	Know how to connect and communicate to cloud

Course Content

LIST OF EXPERIMENTS

1. BASIC LED PROGRAMMING IN C USING AURDINO
   - 1.1 Study and Install IDE of Arduino and different types of Arduino
   - 1.2 Write program using Arduino IDE for Blink LED
   - 1.3 Write Program for RGB LED using Arduino

2. INTERFACING AND PROGRAMMING GPIO PORTS IN C USING MSP430
   - 2.1: Blink LED
   - 2.2: Fade RGB LED (PWM)
   - 2.3:Push Button (Input)

3. INTERFACING AND PROGRAMMING GPIO PORTS IN C USING MSP430
   - 3.1: Multiple LED (Many Outputs)
   - 3.2:Shift Register (Integrated Circuit)
   - 3.3: Photoresistor (Light Sensor)

4. INTERFACING AND PROGRAMMING GPIO PORTS IN C USING MSP430
   - 4.1: Spin the Motor
   - 4.2: Seven-Segment Display (Digital Display)

5. A BASIC WI-FI APPLICATION – COMMUNICATION BETWEEN TWO SENSOR NODES

6. INTERFACING POTENTIOMETER WITH MSP430

Course Content	6.1: Alter the threshold to 75% of Vcc for the LED to turn on. 6.2: Modify the code to change the Reference Voltage from Vcc to 2.5V. 7. CONNECT AND COMMUNICATE TO CLOUD 7.1: Creating a simple HTML web server using MSP430 Launch Pad& CC3100 Wi-Fi Booster Pack 7.2: Create a Wi-Fi-connected IOT sensor that calls you when sensor values exceed a threshold 8. CONNECT AND COMMUNICATE TO CLOUD 8.1: Playing Music – (Buzzer) 8.2: Potentiometer – (Rotary Angle Sensor) 9. PWM GENERATION USING TIMER ON MSP430 GPIO 9.1: Observe the PWM waveform on a particular pin using CRO. 9.2: What is the maximum resolution of PWM circuitry in MSP430G2 Launch Pad? 9.3: Change the above code to create a PWM signal of 75% duty cycle on particular PWM pin. 10. PWM BASED SPEED CONTROL OF MOTOR CONTROLLED BY POTENTIOMETER CONNECTED TO MSP430 GPIO 10.1: Interface a Stepper motor with MSP-EXP430G2 Launch Pad to run it in a Predetermined uniform speed. 10.2: Describe the applications of PWM in a digital power supply control. 10.3: Create Switch case code from the example code to run the DC Motor in 3 set of Speeds. 11. A BASIC WI-FI APPLICATION 11.1: In the terminal output window, we have received a debug message "Pinging…!" Search in the code and change the message to "Pinging the Website". Repeat the experiment to observe this change in the Serial Window. 12. INTERRUPT PROGRAMMING EXAMPLES THROUGH GPIOS 12.1: Write the code to enable a Timer interrupt for the pin P1.1. 12.2: Write the code to turn on interrupts globally.

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	1	-	-	1	-	2	3	3
CO2	3	3	2	2	2	2	1	-	-	-	-	2	3	2
CO3	3	3	3	1	2	1	1	-	-	2	-	2	2	3
CO4	3	3	2	2	2	1	-	-	-	-	-	2	2	3
CO5	3	3	2	2	2	2	-	-	-	1	-	2	3	2
CO6	3	3	2	2	2	1	-	-	-	1	-	2	3	2

PROGRAM ELECTIVES		
1.	20EC32E1	Embedded Systems & IOT
2.	20EC32E2	Error Control Coding
3.	20EC32E3	Telecommunication & Switching Networks
4.	20EC32E4	Advanced Digital Communication

20EC32E1-EMBEDDED SYSTEMS & IOT

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Microcontrollers and Microprocessors, C-Programming.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The basic idea regarding the nature of embedded systems. 2. The advantages of using Aurdino and MSP430 microcontrollers in Embedded and IoT applications. 3. The Basics of MSP430 controller. 4. The skill in simple program writing for MSP430 and applications. 5. The basics of IoT concepts. 6. The different Wireless services to access/control IoT devices.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand the selection procedure of Processors in the Embedded domain.
	CO2	Develop Embedded Systems on Arduino and MSP430.
	CO3	Know the internal architecture and organization of MSP430.
	CO4	Understand the interfacing techniques to MSP 430 and can design and implement programs on MSP430 controller.
	CO5	Know the application areas of IoT.
	CO6	Develop Wireless Technologies to access/control IoT devices.
Course Content	**UNIT-I** **INTRODUCTION TO EMBEDDED SYSTEMS**: Introduction, Hardware and Software requirements, Processor selection, categories of embedded system, applications of embedded systems. Development Process: Development process of embedded systems, linkers and locators **UNIT – II** **INTRODUCTION TO AURDINO AND MSP430:** **ARDUINO**: AVR Family with Arduino ATMega 328- Interfaces - Arduino IDE – Programming – Interfacing LED- Interfacing LED and Switch with Arduino. **MSP430:** Introduction, Features of MSP430, Architecture of MSP430, Exceptions, Addressing Modes of MSP430, Instruction Set, Interrupts, Timers. **UNIT – III** **MSP430 I/O REGISTERS AND MODES:** I/O ports pull up/down registers concepts, Interrupts and interrupt programming. Watchdog timer. System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability. **UNIT – IV** **MSP430 INTERFACING:** Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and	

Course Content	Comparator in MSP430, data transfer using DMA. **UNIT – V** **INTRODUCTION TO IOT:** Definition & Characteristics of IoT, Physical design, Logical design, IoT Enabling Technologies, IoT Levels and Deployment Templates, IoT vs M2M. **UNIT-VI** **WIRELESS TECHNOLOGIES FOR IOT (LAYER 1 & 2):**WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBeeSmart , UWB (IEEE 802.15.4).
Text Books and Reference Books	**TEXT BOOKS :** 1. "Introduction to Embedded Systems", by Shibu K.V, Mc Graw Hil, 2nd edition, 2017. 2. "Intel® Galileo and Intel® Galileo Gen 2:API Features and Arduino Projects for Linux Programmers", by Manoel Carlos Ramon, Apress, 2014. 3. "MSP430 microcontroller basics", by. John H. Davies, Newnes Publication, I st Edition, 2008. 4. "Internet of Things A Hands-On- Approach", byVijay Madisetti, Arshdeep Bahga,Orient Blackswan Private Limited, First edition ,2015, ISBN:978-1-118-43062-0 **REFERENCE BOOKS :** 1. "Designing the Internet of Things", by Adrian McEwen, Hakim Cassimally, Wiley Publishers, 2nd edition, 2015. 2. "Internet of Things with the Arduino Yun", by Marco Schwartz, , Packt Publishing, 2014. 3. "The Silent Intelligence: The Internet of Things". by Daniel Kellmereit, Lightning Source Inc; 1st edition, 2014. 4. 'Learning Internet of Things', by Peter Waher, Packt Publishing, 2015. 5. Internet of Things – From Research and Innovation to Market deployment", by OvidiuVermesan,Peter Friess,River Publishers; 1st edition,2014.
E-Resources	1. http://processors.wiki.ti.com/index.php/MSP430_LaunchPad_Low_Power_Mode 2. http://processors.wiki.ti.com/index.php/MSP430_16-Bit_UltraLow_Power_MCU_Training

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	2	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	2	-	-	-	2	3	2
CO3	3	3	3	2	1	-	-	2	-	-	-	2	2	3
CO4	3	3	2	2	1	-	-	2	-	2	-	2	2	3
CO5	3	3	2	2	1	-	-	2	-	-	-	2	3	2
CO6	3	3	2	2	1	2	2	2	-	2	2	2	3	2

20EC32E2- ERROR CONTROL CODING

Course Category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practical:**	3-0-0
Prerequisite:	Knowledge of Probability, Matrices, Modulation.	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected tounderstand:	
	1. Know some aspects of mutual information, channels, coding, in particular to source coding, linear block codes, cyclic codes, convolutional coding and error control in data storage systems.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Acquire knowledge about various information sources, Fixed Length and Variable Length Coding.
	CO2	Develop skills in obtainingthe Entropy and finding the Efficiency of source codes.
	CO3	Attain skills in creating various Hamming Codes,Syndrome decoding and parity check matrices
	CO4	Acquire knowledgeinError correction using syndrome vector and Cyclic Redundancy Check (CRC).
	CO5	Apply appropriate coding methods such as Golay Codes- BCH code and Error control for computer main processor.
	CO6	Develop skills for theError control in IBM 3850 main storage system and able to compare the performance of Convolutional codes and Block codes.
Course Content	**UNIT – I** **INFORMATION AND CODING**: DefinitionofInformation- sources-types - mathematical models-information content of discrete memory less source- information content of a symbol-Entropy-Information Rate-Discrete Memory less Channels-Types of channels-Mutual information-over view of error control coding techniques-classification of codes. **UNIT – II** **SOURCE CODING**: Fixed Length and Variable Length Coding, properties of Prefix codes, Shannon-Fanon Coding, Huffman code, Huffman code applied for pair of Symbols, Efficiency Calculations, Lempel-Ziv Codes **UNIT – III** **LINEAR BLOCK CODES**: Structure of linear block code- Hamming Codes-Error detection and correction capabilities of Hamming code-Encoder of (7, 4) Hamming code-Syndrome decoding-Error correction using syndrome vector. **UNIT – IV** **CYCLIC CODES:** Definition- Generator polynomial for cyclic code-systematic and Non-systematic code words-Generator and parity check matrices of cyclic codes-Encoder	

Course Content	for (n, k) cyclic code. Syndrome decoding –Cyclic Redundancy Check (CRC). **UNIT – V** **CONVOLUTIONALCODES**: Golay Codes-Bose Chaudhri Hocquenghem (BCH) codes-Encoder for Convolutional code-Graphical representation for Convolutional encoding-Decoding methods- Viterbi algorithm-performance comparison of Convolutional codes and Block codes.Application of Viterbi and Sequential Decoding. **UNIT – VI** **ERROR CONTROL IN DATA STORAGE SYSTEMS**: Error control for computer main processor- Error control for magnetic tapes-syndrome computation-Error control in IBM 3850 main storage system.
Text Books and Reference Books	**TEXT BOOKS:** 1. Communication Systems – Dr.Sanjay Sharma-S.K. Kataria &sons-New Delhi. 2. Shu lin and Daniel J. Costello, Jr. "Error Control Coding – Fundamentals and Applications", Prentice Hall Inc. **REFERENCE BOOKS:** 1. Digital Communications-John G.Proakis, Masoud Salehi-Mc Graw Hill-5e 2. Bernard Sklar,"Digital Communications Fundamental and Application", Pearson Education, Asia. 3. B.P.Lathi,Zhi Ding-Modern Digitl and Analog communication systems-4/e - Oxford university press-2016 4. Simon Haykin- Communication systems-4/e,Wiley India,2011

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	2	-	-	-	2	3	3
CO2	3	3	2	2	2	-	-	2	-	-	-	2	3	2
CO3	3	3	3	2	1	-	-	2	-	-	-	2	1	3
CO4	3	3	2	2	1	-	-	2	-	2	-	1	2	3
CO5	3	3	2	2	1	-	-	2	-	-	-	2	3	2
CO6	3	3	2	2	1	2	2	1	-	2	2	2	3	2

20EC32E3-TELECOMMUNICATION & SWITCHING NETWORKS

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Basics of Analog and Digital communication signals and Systems	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To teach the basic concepts of analog and digital communication principles. 2. To educate the students about the concepts and principles of optical fiber communications 3. To get the knowledge and principles learnt to analyze, design, install and manage typical wired and wireless communication systems and networks 4. To educate the students satellite communication systems, public switched telephone networks, digital transmission system standards. 5. To get the knowledge about network planning and principle of digital Switching systems. 6. To educate the students about tele traffic theory	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understand various multiplexers techniques like TDM, FDM, BPSK in different communication networks.
	CO2	Memorize SONET optical standards and describes frequency justification and utilization with different techniques.
	CO3	Describe network planning and principle of digital switching systems for proper network management.
	CO4	Understand the principles of network synchronization control and management with switching techniques.
	CO5	Gain the knowledge and principles digital subscriber access, ISDN and Network Blocking.
	CO6	Understand the Public switched telephone networks, tele traffic theory, digital transmission system standards and Digital Subscriber Loops.
Course Content	**UNIT-I** **MULTIPLEXING:** Introduction, Transmission Systems, FDM Multiplexing And Modulation, Time Division Multiplexing, Digital Transmission and Multiplexing, Pulse Transmission and line coding, Binary n-zero substitution, Digital bi phase, differential encoding, Time Division Multiplex loops and rings. **UNIT-II** SONET Multiplexing Overview, SONET Frame Formats, SONET operations, Administration and maintenance, Payload framing and frequency justification ,Virtual tributaries, ds3 Payload mapping, E4Payload mapping, SONET optical standards, networks, SONET rings: unidirectional, path switched bidirectional line switched rings **UNIT-III** **DIGITAL SWITCHING:** Switching Functions, Space division Switching, Time Division Switching, Two dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross Connect Systems, Digital Switching In Analog Environment, Elements of SS7signaling.	

Course Content	**UNIT-IV** **NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT:** Timing, timing recovery, Phase locked loop, Clock instability, jitter measurements, Systematic jitter, Timing inaccuracies: slips, Asynchronous Multiplexing, Network synchronization, U.S. Network synchronization, Network Control, Network Management **UNIT-V** **DIGITAL SUBSCRIBER ACCESS, ISDN:** ISDN Basic Rate Access Architecture, ISDN U interface, ISDN D channel protocol, High Data Rate Digital Subscriber Loops, Asymmetric Digital Subscriber Line, VDSL, Digital Loop Carrier Systems, Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next generation Digital Loop Carrier , Fiber in the loop, Hybrid fiber coax systems, Voice band modems: pcm modems, Local microwave distribution service, Digital satellite services **UNIT-VI** **TRAFFIC ANALYSIS:** Traffic Characterization, Arrival Distribution, Holding Time Distribution, Loss Systems, Network Blocking Probabilities, End To End Blocking Probabilities, Overflow Traffic, Delay Systems, Exponential Service Times, Constant Service Time, Finite Queues
Text Books and Reference Books	**TEXT BOOKS:** 1. "Telecommunication Switching, Traffic and Networks", by JE FLOOD, Pearson Education India, 1st edition,2011. 2. "Telecommunication Switching systems and networks", by Thiagarajan Viswanathan, Manav Bhatnagar, PHI Learning; 2nd edition, 2015. **REFERENCE:** 1. "Digital Telephony", by J.C.Bellamy, john wiley publishers, 3rd edition,2006. 2. "Fundamentals of Telecommunication Networks", by T.N.Saadiwi, Wiley Series, ISBN: 978-0-471-51582-1,
E-Resources	1. http://www.nptel.ac.in. 2. http:/www.ebookee.com/Telecommunication switching networks

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	-	-	-	-	2	3	3	3
CO2	3	3	1	2	1	-	2	-	-	2	-	-	3	2
CO3	3	3	3	1	1	2	-	-	-	1	1	1	2	3
CO4	3	3	2	2	1	1	1	-	-	2	-	1	2	3
CO5	3	3	2	2	1	2	2	-	-	-	-	1	3	2
CO6	3	3	2	2	1	1	1	-	-	-	-	1	3	2

20EC32E4- ADVANCED DIGITAL COMMUNICATION

Course Category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practical:**	3-0-0
Prerequisite:	Digital Communication	**Sessional Evaluation:**	40
		External Evaluation:	60
		Total Marks:	100

Course Objectives	Students undergoing this course are expected to understand:	
	1.To teach the concept different modules of Digital communication system 2.To get the knowledge of modulation techniques 3.To educate the students about white Gaussian noise, matched filter, coherent demodulator, symbol rate for coherent and non-coherent schemes. 4.To teach the students about the concept of pulse shape design of signals,ISI, Nyquist rate, Channel with distortion: Design of transmitting and receiving filters for a known channel and for time varying channel (equalization) 5.To get the knowledge of Different synchronization techniques 6.To educate the students about Characteristics of fading channels, Rayleigh and Rician channels, receiver performance-average SNR, outage probability, amount of fading and average bit/symbol error rate.	
Course Outcomes	Upon successful completion of the course , the students will be able to:	
	CO1	Understsand the concept different modules of Digital communication system
	CO2	Learn the concepts of modulation techniques
	CO3	Understand the concept of additive white Gaussian noise channels
	CO4	Obtain the knowledge of band limited channels
	CO5	Know about the different types of synchronization techniques
	CO6	Understand the concept of communication over fading channels
Course Content	**UNIT I** **INTRODUCTION:** : Digital communication system (description of different modules of the block diagram), Complex baseband representation of signals, Gram-Schmidt orthogonalization procedure. M-ary orthogonal signals, bi-orthogonal signals, simplex signal waveforms. **UNIT II** **MODULATION:** Pulse amplitude modulation (binary and M-ary, QAM), Pulse position modulation (binary and M-ary), Carrier Modulation (M-ary ASK, PSK, FSK, DPSK), Continuous phase modulation (QPSK and variants, MSK, GMSK). **UNIT III** **RECEIVER IN ADDITIVE WHITE GAUSSIAN NOISE CHANNELS:** Coherent and non-coherent demodulation: Matched filter, Correlator demodulator, square-law, and envelope detection; Detector: Optimum rule for ML and MAP detection Performance: Bit-error-rate, symbol error rate for Coherent and non-coherent schemes. **UNIT IV** **BAND-LIMITED CHANNELS:** Pulse shape design for channels with ISI: Nyquist pulse, Partial response signalling (duo binary and modified duo binary pulses) and demodulation; Channel with distortion: Design of transmitting and receiving filters for a known channel	

Course Content	and for time varying channel (equalization); Performance: Symbol by symbol detection and BER, symbol and sequence detection, Viterbi algorithm. **UNIT-V** **SYNCHRONIZATION:** Different synchronization techniques (Early-Late Gate, MMSE, ML and spectral line methods). **UNIT-VI** **COMMUNICATION OVER FADING CHANNELS:** Characteristics of fading channels, Rayleigh and Rician channels, receiver performance-average SNR, outage probability, amount of fading and average bit/symbol error rate.
Text Books and Reference Books	**TEXT BOOKS:** 1. J. G. Proakis and M. Salehi, "Fundamentals of Communication Systems", Pearson Education, 2005. 2. S. Haykins, "Communication Systems", 5th ed., John wiley, 2008. 3. M. K. Simon, S. M. Hinedi and W. C. Lindsey, "Digital Communication Techniques: Signaling and detection", Prentice Hall India, N. Delhi, 1995.. **REFERENCE BOOKS:** 1. W. Tomasi, "Advanced Electronic Communication Systems", 4th Ed., Pearson Education,1998. 2. M. K. Simon and M. S. Alouini, "Digital Communication over Fading Channels", 2000

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	1	1	-	-	1	-	-	2	2	3
CO4	3	3	2	2	1	1	-	-	-	-	-	2	2	3
CO5	3	3	2	2	1	1	-	-	1	-	-	2	3	2
CO6	3	3	2	2	1	-	-	-	-	-	-	2	3	2

PROGRAM ELECTIVES		
1.	20EE3203	Basics of Power Systems
2.	20CS3202	Operating Systems
3.	20CS3204	Artificial Intelligence
4.	20CE3204	Disaster Management

20EE32O3- BASICS OF POWER SYSTEMS

Course Category:	Open Elective	**Credits:**	03
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Engineering physics, Basics of Electrical engineering.	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to :	
	1. Learn concepts of non-renewable and renewable power generation methods 2. Learn about the performance of transmission lines. 3. Learn the concepts of utilization of electric power.	
Course Outcomes	**At the end of this course the student will be able to**	
	CO1	To get the knowledge on the operation and construction of hydro power plant
	CO2	To get the knowledge on the operation and construction of thermal power plant
	CO3	To get the knowledge on the operation and construction of nuclear power generation.
	CO4	To understand the basic concepts of illumination
	CO5	To analyze the regulation and efficiency of transmission lines
	CO6	To formulate D.C distribution networks for necessary variable calculation.
Course Content	**UNIT- I** **Hydel Power Generation:** The growth of electrical power generation, transmission and distribution systems – Typical layout of Hydro electric power generation–Types of Hydro electric power stations–Advantages and disadvantages. **UNIT – II** **Thermal Power Generation:** Line diagram of Thermal Power Stations (TPS) showing paths of coal, steam, water, air, ash and flue gases–Advantages and disadvantages. **UNIT – III** **Nuclear Power Generation:** Nuclear fission and chain reaction, Nuclear fuels – Principal of operation of Nuclear reactor – Advantages and disadvantages. **Renewable Power Generating:** Principles of electric power generation using renewable energy sources– Solar, Wind and Wave energy. **UNIT – IV** **Illumination:** Terms used in illumination, Laws of illumination, sources of light, Illumination methods– Tungsten filament, Discharge lamps, Mercury vapour and Sodium vapour lamps. **UNIT – V** **Performance of Transmission Lines:** Classification of lines– Short line, Medium Line and Long line– Equivalent circuits, Phasor diagrams, Transmission efficiency and voltage regulation. **UNIT – VI** **Distribution Systems:** Classification of distribution systems, design features of distribution systems, radial distribution, Ringmain distribution, Voltage drop calculation: DC distributors for following cases– Radial DC distributor fed at one end and at both ends, Ring main distributor.	

Text Books & Reference Books	**TEXT BOOKS:** 1. "Generation Distribution and Utilization of Electrical Energy", C L Wadhawa, New Age International (P) Limited, 2011. 2. "Renewable Energy Power for a Sustainable Future", Godfrey Boyle, Oxford University Press, 2nd Edition **REFERENCE BOOKS:** 1. "Elements of Power Station Design and Practice", M V Deshpande, Wheeler Publishing. 2. "Utilisation of Electrical Energy", E. Openshaw Taylor, Orient Longman, 2006 3. "Principles of Power Systems", V K Mehta and Rohit Mehta, S CHAND & Co. Ltd., New Delhi 2004. 4. "A Course in Power Systems". J B Gupta, S.K. Kataria & Sons, 11th Edition.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	2	-	-	2	-	2	2	-	-
CO2	3	2	2	2	-	2	-	-	2	-	2	2	-	-
CO3	3	2	2	2	-	3	-	-	2	-	3	2	-	-
CO4	3	3	3	3	-	2	-	-	2	-	2	2	-	-
CO5	3	2	2	2	-	2	-	-	2	-	2	2	-	-
CO6	3	2	2	2	-	2	-	-	2	-	2	2	-	-

20CS3202 - OPERATING SYSTEMS

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Knowledge about Fundamentals of Computer basics	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100
Objectives:	• Learn OS operations and supporting structures. • Knowledge about the different scheduling algorithms and their evaluation. • Obtain exposure on deadlock handling, protection and security mechanisms.		

Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Learn the Basics of Operating Systems and structures.
	CO2	Acquire knowledge about Inter process communication and Scheduling algorithms.
	CO3	Study Deadlock handling mechanisms.
	CO4	Understand various Memory management techniques.
	CO5	Gain insights of File system operations and implementation methods.
	CO6	Identify Disk Structures and various goals and principles of protection.

Course Content

UNIT-I

Introduction: What Operating Systems Do, OS Structure &Operations, Process Management, Memory and Storage Management, Protection and Security, Computing Environments, Open-Source Operating Systems.

System Structures: OS Services, User& OS Interface, System Calls, Types of System Calls, System Programs, OS Design and Implementation, Various structures of OS, System Boot

UNIT-II

Process Management: Process Concept, Process Control Block, Process Scheduling, Operations on Processes, Interprocess Communication, Examples of IPC systems.
Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Algorithm Evaluation.

UNIT-III

Synchronization: The Critical-Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Classic Problems of Synchronization-Reader/Writers Problem, Dining – Philosophers Problem, Monitors.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT-IV

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

	Virtual Memory Management: Background, Demand Paging, Copy on write, Page replacement, Frame allocation, Thrashing, Allocating Kernel Memory. **UNIT-V** **File System:** File Concept, Access Methods, Directory and Disk Structure, File Sharing, Protection. **Implementing File-System:** File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, and Recovery. **UNIT-VI** **Mass Storage Structure:** Overview, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, RAID Levels. **System Protection and Security:** Goals, Principles and Domain of protection, Security Problem, Program Threats, System and Network Threats.
Text Books & References Books	**TEXT BOOKS:** 1. "Operating System Concepts", Abraham Silberchatz, Peter B Galvin, Greg Gagne, 9th Edition, John Wiley & Sons Publication, 2016. **REFERENCE BOOKS:** 1. "Modern Operating Systems", Andrew S. Tanenbaum, Herbert Bos, 4th Edition, Pearson Education, 2016. 2. "Operating Systems – Internals and Design Principles", William Stallings, 9th Edition, Pearson Education, 2018.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	2	-	-	2	-	2	2	-	-
CO2	3	2	1	2	-	2	-	-	2	-	2	2	-	-
CO3	3	1	2	1	-	3	-	-	2	-	3	2	-	-
CO4	3	2	2	2	-	2	-	-	2	-	2	2	-	-
CO5	3	2	2	2	-	2	-	-	2	-	2	2	-	-
CO6	3	2	2	2	-	2	-	-	2	-	2	2	-	-

20CS3204 - ARTIFICIAL INTELLIGENCE

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Prerequisite:	Fundamentals of Networking, Analytical capabilities and logic orientations.	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100
Objectives:	• To apply knowledge of computing and mathematics appropriate to the discipline. • To analyze a problem, identify and define the computing requirements appropriate to its solution. • To design, implement, and evaluate a computer-based system, process, component, or program.		

Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the basics of AI and study different types of supporting agent characteristics
	CO2	Know various Problem-solving agents and their behavior in real-world environment
	CO3	Understand and apply the fundamentals of AI search algorithms
	CO4	Gain knowledge in Adversarial Search Methods
	CO5	Draw the Inferences based on logical reasoning
	CO6	Apply different Learning techniques for future implementation
Course Content	**UNIT-I** **Introduction**: What is Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. **UNIT-II** **Search:** Introduction to Search, Problem solving agents, toy problems, Real-world problems, Searching for solutions. **Uninformed Search strategies**: BFS, DFS, Depth-limited search. **UNIT-III** **Informed Search strategies**: GBFS, A* search, Local search algorithms: Hill-climbing. **Constraint Satisfaction Problems**: Constraint Satisfaction Problems, Backtracking Search for CSPs, Local search for CSPs. **UNIT-IV** **Adversarial Search**: Games, optimal decision in games, Alpha-Beta pruning, Imperfect, Real-Time Decisions. **Problem Solving:** Formulating problems, problem types, Solving Problems by Searching, heuristic search techniques, constraint satisfaction problems, stochastic search methods.	

	UNIT-V **Knowledge and reasoning**: Inference, Propositional Logic, Predicate Logic (first order logic), Logical Reasoning, Forward &Backward Chaining, Resolution. **UNIT-VI** **Learning:** Overview of different forms of learning, decision trees, rule-based learning, neural networks, reinforcement learning. **Game playing:** Perfect decision game, imperfect decision game, evaluation function, minimax, alpha-beta pruning.
Text Books & References Books	**TEXT BOOKS:** 1. Artificial Intelligence- A Modern Approach, Stuart Russell, Peter Norvig (Person Education), Third Edition. **REFERENCE BOOKS:** 1. Artificial Intelligence- Rich E & Knight K (TMH), 4th edition. 2. Artificial Intelligence Structures and Strategies complex problem Solving – George F. Lugar Pearson Education. 3. E Charniak and D McDermott, "Introduction to Artificial Intelligence", Pearson. 4. R.J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO2	3	3	1	2	-	2	-	-	2	-	2	2	-	-
CO3	3	3	2	2	-	3	-	-	2	-	3	2	-	-
CO4	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO5	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO6	3	3	2	2	-	2	-	-	2	-	2	2	-	-

20CEXX04 –DISASTER MANAGEMENT

Course Category:	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial - Practical**	3 - 0 - 0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Hazards and disasters and different approaches to disaster and their mitigation.
	CO2	Types of disasters, exogenous disasters and their effects.
	CO3	Endogenous disasters and their effects.
	CO4	Man induced disasters and their effects.
	CO5	Disaster management through engineering applications.
	CO6	Case study on disasters in national and international level.

Course Content

UNIT-I

ENVIRONMENTAL HAZARDS & DISASTERS: Meaning of Environmental hazards – Environmental Disasters Environmental stress – Concept of Environmental Hazards – Different approaches and relation with human Ecology - Landscape Approach –Ecosystem Approach – Perception approach – Human ecology & its application in geographical researches.

UNIT –II

TYPES OF ENVIRONMENTAL HAZARDS & DISASTERS: Natural hazards and Disasters – Man induced hazards & Disasters – Natural Hazards – Planetary Hazards/ Disasters – Extra Planetary Hazards/ disasters Planetary Hazards – Endogenous Hazards – Exogenous Hazards Endogenous Hazards.

Volcanic Eruption – Earthquakes – Landslides – Volcanic Hazards/ Disasters. Causes and distribution of Volcanoes – Environmental impacts of volcanic eruptions – Earthquake Hazards/ Disasters – Causes of Earthquakes – Distribution of earthquakes – Hazardous effects of earthquakes – Human adjustment – Perception & mitigation of earthquake.

UNIT –III

EXOGENOUS HAZARDS AND DISASTERS: Infrequent events – Cumulative atmospheric hazards/ disasters Infrequent events – Cyclones – Lightning – Hailstorms.

CYCLONES: Tropical cyclones & Local storms – Destruction by tropical cyclones & local storms – Causes – Distribution human adjustment – Perception & mitigation)Cumulative atmospheric hazards and disasters – Floods – Droughts – Cold waves – Heat waves. Floods: – Causes of floods – Flood control measures (Human adjustment – Perception & mitigation) – Droughts: – Impacts of droughts – Drought control measures – Extra Planetary Hazards/ Disasters.

UNIT –IV

SOIL EROSION: Mechanics & forms of Soil Erosion – Factors and causes of Soil Erosion – Conservation measures of Soil Erosion. Chemical hazards/ disasters – Release of toxic chemicals – nuclear explosion – Sedimentation processes. Sedimentation processes: – Global Sedimentation problems – Regional Sedimentation problems – Sedimentation and Environmental problems – Corrective measures of Erosion and Sedimentation. Biological hazards/ disasters: – Population Explosion.

	UNIT –V **EMERGING APPROACHES IN DISASTER MANAGEMENT:** Three Stages 1. Pre- disaster stage (preparedness). 2. Emergency Stage. 3. Post Disaster stage-Rehabilitation. **UNIT – VI** **CASE STUDIES:** 1. Bhuj Earthquake – Gujarat 2001. 2. Indian Ocean earthquake and Tsunami, 2004. 3. Chernobyl disaster, Ukraine 1986. 4. Bhopal Gas tragedy, 1984. 5. Kerala Floods, 2018.

Textbooks and References	**TEXTBOOKS:** 1. Tushar Bhattacharya, *Disaster Science and Management*, McGraw hill Publications, 1st Edition, 2017. 2. Donald Hyndman and David Hyndman, *Natural Hazards and Disasters*, Brooks/Cole, 5th Edition, 2016. 3. Rajib Shah, RR Krishna Murthy, *Disaster Management: Global Problems and Local Solutions*, CRC Press, 1st Edition, 2009. **REFERENCES:** 1. R B Singh, *Natural Hazards and Disaster Management: Vulnerability and Mitigation*, Rawat Publications, Reprint edition, 2006. 2. Pardeep and Sahni, *Disaster Mitigation: Experiences and Reflections*, Prentice Hall India Learning Private Limited, New title edition, 2001. 3. H.K. Gupta, *Disaster Management*, Universities Press, India, 2003.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO2	3	3	1	2	-	2	-	-	2	-	2	2	-	-
CO3	3	3	2	1	-	2	-	-	2	-	2	2	-	-
CO4	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO5	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO6	3	3	2	2	-	2	-	-	2	-	2	2	-	-

SOFT SKILLS

20IT32SC-MOBILE APP DEVELOPMENT

MANDATORY COURSE

20MC3201 - ENTREPRENEURSHIP

Course Category:	Mandatory Course	**Credits:**	0
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 -0- 0
Prerequisite:	General Business awareness	**Sessional Evaluation :** **External Exam Evaluation:** **Total Marks:** **External Exam Duration:**	40 60 100 3 hrs

Course Objectives	The students develop and can systematically apply an entrepreneurial way of thinking that will allow them to identify and createbusiness opportunities that may be commercialized successfully.	
Course Outcomes		Upon successful completion of the course , the students will able to:
	CO1	Understand/ Overview of Entrepreneurship
	CO2	Know the methods of generating ideas
	CO3	Understand the concept of Business planning
	CO4	Understand managing the new venture
	CO5	Know the production and marketing management
	CO6	Know the financial assistance to Enterprise
Course Content	**UNIT – I** **Introduction to Entrepreneurship**: Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur, Opportunities for Entrepreneurs in India and abroad, Woman as Entrepreneur, Role of Entrepreneurship in economic development. **UNIT – II** **Creating the Ideas and Starting the Venture**:Sources of new Ideas, Methods of generating ideas, creating problem solving.Features and evaluation of joint ventures, acquisitions, merges, franchising, Public issues, rights issues, and bonus issue sand stock splits. **UNIT – III** **Business planning process:** Meaning of business plan, Business plan process-Writing ,evaluation and implementation of business plan , advantages of business planning , Business model canvas **UNIT – IV** **Managing the new venture**: Sources of capital, venture capital, Record keeping, recruitment, motivating and leading teams,	

	UNIT – V **Production &Marketing management**: Thrust of production management, selection of production techniques, Marketing functions, market segmentation, market research. **UNIT – VI** **Organization Assistance:** Industrial Park (Meaning, features, & examples),Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies (SIDBI, DIC , NSTEDB, APPC etc.), MSME Act Small Scale Industries,
Assignment	All students (Maximum batch size 5) need to submit a business plan on any entity as per the norms of any financial agency
TEXT BOOKS:	1. Entrepreneurship : Robert Hisrich, & Michael Peters, 5th ed., TMH., 1986 2. Entrepreneurship : Dollinger, Pearson, 4th ed., 2004.
REFERENCES:	1. Dynamics of Entrepreneurial Development and Management, Vasant, 2009. 2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999. 3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004. 4. Essential of Entrepreneurship and small business management, Thomas W. Zimmerer& Norman M. Scarborough, 4th ed., PHI, 2005 5. Industrial Relations &Labour Laws, Srivastava, Vikas, 2005.
E-Resources	1.https://nptel.ac.in/courses 2.https://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO2	3	3	1	2	-	2	-	-	2	-	2	2	-	-
CO3	3	3	2	1	-	3	-	-	2	-	3	2	-	-
CO4	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO5	3	3	2	2	-	2	-	-	2	-	2	2	-	-
CO6	3	3	2	2	-	2	-	-	2	-	2	2	-	-

N.B.K.R. INSTITUTE OF SCIENCE & TECHNOLOGY

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COLLEGE WITH POTENTIAL FOR EXCELLENCE (CPE)
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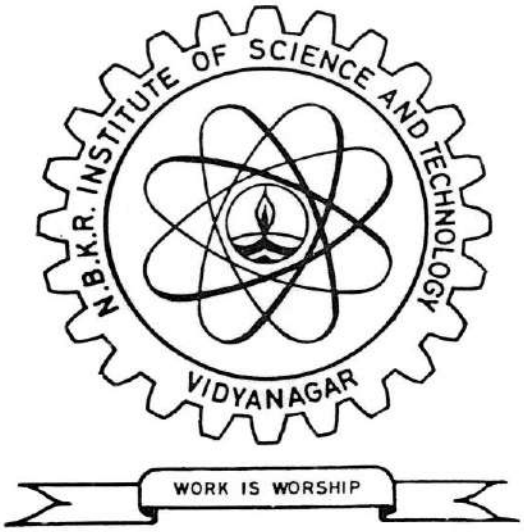
B.Tech. Courses Accredited by NBA under TIER-I



SYLLABUS

B.TECH. DEGREE COURSE

IV B.Tech

I & II Semesters

ELECTRONICS AND COMMUNICATION ENGINEERING

(With effect from the batch admitted in the academic year 2020-2021)

VIDYANAGAR - 524413
SPSR Nellore-Dist. Andhra Pradesh
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NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR

(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

IV YEAR OF FOUR-YEAR B.TECH DEGREE COURSE – I SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
							Sessional-I Marks			Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks		Duration In Hours	Max. Marks	100
1	20HS41EX	HSM-Elective	3	0	-	3	34	6	40	34	6	40	0.8*Best of two+0.2* least of two	3	60	100
2	20EC41EX	Program Elective	3	0	-	3	34	6	40	34	6	40		3	60	100
3	20EC41EX	Program Elective	2	1	-	3	34	6	40	34	6	40		3	60	100
4	20EC41EX	Program Elective	3	0	-	3	34	6	40	34	6	40		3	60	100
5	20XXXXXX	Open Elective	3	-	-	3	34	6	40	34	6	40		3	60	100
6	20EC41MC	MOOC	3	-	-	3	34	6	40	34	6	40		3	60	100
		PRACTICALS											Day to Day Evaluation and a test (40 Marks)			
7	20EC41IS	Summer Internship	-	-	-	3	-	-	-	-	-	40		-	60	100
		SOFT SKILLS														
8	20AD41SC	Data Representation and Analysis Using R Laboratory	1	-	2	2	-	-	-	-	-	40		3	60	100
		TOTAL	18	1	2	23	-	-	-	-	-	320	-	-	480	800

***** Common to ECE & EEE. **Common to ECE, CE, EEE & ME. # A for Assignment (continuous evaluation), $ Test (Descriptive & Objective) duration = 2 Hours

HUMAN SCIENCE MANAGEMENT ELECTIVES		
S.NO	**CODE**	**COURSE NAME**
1.	20SH41E1	Management Science
2.	20SH41E2	Customer Relationship Management
3.	20SH41E3	Strategic Management
4.	20SH41E4	Business Ethics and Corporate Governance

20SH41E1-MANAGEMENT SCIENCE

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to • Understand the functions of Management and evolution of management thought • Learn the application of the principles in an organization and aware of the social responsibilities of business. • Understand the principles of strategy formulation, implementation and control in organizations and fundamental concepts of marketing. • understand the role of HRM in an organization • Understand the concepts of production and operations management of an industrial undertaking. • Understand the mechanism of PERT and CPM.	
Course Outcomes	Upon successful completion of the course, the students will be	
	CO1	Able to explain the concepts of management.
	CO2	Able to apply the principles of management in designing the organization structure of an enterprise.
	CO3	Able to Identify core concepts of marketing and develop marketing strategies based on product, price, place and promotion objectives
	CO4	Demonstrate the role of HRM in an organization and able to manage human resources efficiently and effectively with best HR practices.
	CO5	Able to select appropriate location for establishing industrial plants and design plant and production layouts
	CO6	Able to determine activities' times and schedule the projects using the CPM and PERT.
Course Content	**UNIT – I** **Introduction to Management**: Concept of Management — Functions of Management, Evolution of Management Thought: Taylor's Scientific Management Theory, Fayal's Principles of Management- Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory Y - Hertzberg Two Factor Theory of Motivation - Leadership Styles. **UNIT – II** **Design of Organization:** principles of Organization –Organisation process- Types of organization: line, Staff or functional, line and staff, committee, matrix, virtual, cellular, team organization. Boundary less organization, inverted pyramid structure, lean and flat organization. Managerial objectives and social responsibilities. **UNIT-III** **Strategic Management**: Corporate planning – Vision, Mission, Goals Objectives, Policies, & programmes -SWOT analysis – Strategy formulation and implementation.	

	Marketing Management: Functions of Marketing-Marketing Mix - Marketing Strategies based on Product Life Cycle- Channels of distribution. **UNIT-IV** **Human Resources Management**: Manpower Planning-Recruitment & Selection-Training & Development- Job Evaluation- Performance Appraisal, Incentives. **UNIT-V** **Production and Operations management**: Plant Location and Plant Layout concepts-methods of production (Job, Batch & Mass)-Production Planning and control. Work study- Basic procedure involved in Method Study -Work Measurement. **UNIT-VI** **Project Management (PERT/ CPM):** Network Analysis- Programme Evaluation and Review Technique (PERT)- Critical Path Method (CPM) -Project Cost Analysis- Project Crashing (simple problems).
Text Books & Reference Books	**TEXT BOOKS:** 1.Management Science, A.R.Aryasri, Tata McGraw-Hill Education 2.Industrial Engineering and Management, O. P. Khanna (2004), Dhanpat Rai, New Delhi. **REFERENCE BOOKS:** 1.Business organizations and management, C.B.Gupta, Sultan Chand and Sons. **2.I**ndustrial Engineering and Management (Including Production Management) T.R.Banga, S.C.Sharma, Khanna Publishers. 3.Production and Operations Management, Panner Selvam (2004), Prentice Hall of India, New Delhi

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO2	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO3	3	-	-	-	-	3	3	3	2	2	2	2	-	-
CO4	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO5	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO6	3	-	-	-	-	3	3	2	2	2	2	2	-	-

20SH41E2-CUSTOMER RELATIONSHIP MANAGEMENT

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to • Understand the importance of CRM in the real business. • Know how do organizations implement CRM such that it benefits their business needs? • Understand how CRM helped define best practices and customer management methodology?	
Course Outcomes	On successful completion of this course, the students will be able to	
	CO1	Aware of the basics of customer relationship management
	CO2	Analyse the CRM link with the other aspects of marketing
	CO3	Know the CRM planning process.
	CO4	understand the Role of CRM in increasing the sales of the company
	CO5	Aware of the CRM practices in various markets and sectors
	CO6	Aware and analyse the different issues in CRM
Course Content	**Unit-I** **CRM Basics**: Meaning & Definition - Dimensions of CRM - Nature of CRM - Goals of CRM - Advantages of CRM **Unit II** **CRM Concepts:** Customer Value, Customer Expectation, Customer Satisfaction, Customer Centricity, Customer Acquisition, Customer Retention, Customer Loyalty, Customer Lifetime Value. Customer Experience Management, Customer Profitability, Enterprise Marketing Management, Customer Satisfaction Measurements, Web based Customer Support. **Unit III** **Planning for CRM:** Steps in Planning-Building Customer Centricity, Setting CRM Objectives, Defining Data Requirements, Planning Desired Outputs, Relevant issues while planning the Outputs, Elements of CRM plan. CRM Strategy: The Strategy Development Process, Customer Strategy Grid. **Unit IV** **CRM and Marketing Strategy:** CRM Marketing Initiatives, Sales Force Automation, Campaign Management, Call Centres.	

	Unit- V **Practice of CRM:** CRM in Consumer Markets, CRM in Services Sector, CRM in Mass Markets, CRM in Manufacturing Sector. **Unit VI** **CRM Planning and Implementation:** Issues and Problems in implementing CRM, Information Technology tools in CRM, Challenges of CRM Implementation. CRM Implementation Roadmap, Road Map (RM) Performance: Measuring CRM performance, CRM Metrics. .
Text Books & Reference Books	**TEXT BOOKS:** 1. Francis Buttle, Stan Maklan, Customer Relationship Management: Concepts and Technologies, 3rd edition, Routledge Publishers, 2015 2. Kumar, V., Reinartz, Werner Customer Relationship Management Concept, Strategy and Tools, 1st edition, Springer Texts, 2014 **REFERENCE BOOKS:** 1. Jagdish N.Sheth, Atul Parvatiyar & G.Shainesh, "Customer Relationship Management", Emerging Concepts, Tools and Application", 2010, TMH. 2. Dilip Soman & Sara N-Marandi," Managing Customer Value" 1st edition, 2014, Cambridge. 3. Alok Kumar Rai, "Customer Relationship Management: Concepts and Cases", 2008, PHI. 4. Ken Burnett, the Handbook of Key "Customer Relationship Management", 2010, PearsonEducation. 5. Mukesh Chaturvedi, Abinav Chaturvedi, "Customer Relationship Management- An Indian Perspective", 2010 Excel Books, 2nd edition

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO2	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO3	3	-	-	-	-	3	3	3	1	2	2	2	-	-
CO4	3	-	-	-	-	3	3	1	2	2	2	2	-	-
CO5	3	-	-	-	-	3	1	2	2	2	2	2	-	-
CO6	3	-	-	-	-	2	3	2	2	2	2	2	-	-

20SH41E3-STRATEGIC MANAGEMENT

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to • To expose students to various perspectives and concepts in the field of Strategic Management • The course would enable the students to understand the principles of strategy formulation, implementation and control in organizations. • To help students develop skills for applying these concepts to the solution of business problems • To help students master the analytical tools of strategic management	
Course Outcomes	Upon successful completion of the course the students will be	
	CO1	Students will be able to describe major theories, background work, concepts and research output in the field of strategic management.
	CO2	Students will able to prepare the mission statement for the operational efficiency
	CO3	Students will be able to analyse the environment through SWOT Analysis
	CO4	Able to understand organizational change
	CO5	Students will be able to demonstrate capability of making their own decisions in dynamic business landscape.
	CO6	Students will be able to develop their capacity to think and execute strategically.
Course Content	**UNIT – I** **Strategic Management:** An Introduction Strategic Thinking Vs Strategic Management Vs Strategic planning, Meaning of strategic management, concept of strategy, policy and strategy, strategy and tactic, Strategy and strategic plan, Nature of strategic plan, nature of strategic decisions, approaches to strategic decision making, levels of strategies, The strategic management process, strategic management: merits and demerits **UNIT – II** **Mission, Objectives, Goals and Ethics** What is mission, concept of goals, Integration of individual and organisation goals: A Challenge, How Objectives are pursued, how are mission and objectives are formulated, why do mission and objective change, vision mission, objectives, goals and Strategy: Mutual relationships, core of strategic management: vision A-must, ethics and strategy **UNIT-III** **External environment:** Analysis and appraisal Concept of environment, environmental analysis and appraisal, why environmental scanning and analysis, component of environment, SWOT: A tool of environment analysis, techniques of environmental search and analysis, ETOP: A technique of diagnosis, decision making on environmental information **UNIT-IV**	

	Organisational change and innovation: Planned and unplanned change, causes or forces of organisational change, managing planned change, choosing a change strategy, creativity and innovation in organisations, organizational creativity and innovation process, learning organisation **UNIT-V** **Generic competitive strategy:** Generic vs. competitive strategy, the five generic competitive strategy, competitive marketing strategy option, offensive vs. defensive strategy, corporate strategy**:** Concept of corporate strategy, offensive strategy, defensive strategy, scope and significance of corporate strategy **UNIT-VI** **Strategic evaluation and control:** Evaluation of strategy and strategic control, why strategy evaluating, criteria for evaluation and the evaluation process, strategic control process, types of external controls.
Text Books & Reference Books	**TEXT BOOKS:** 1. Strategic management: the Indian context 5th edition, kindle edition R srinivasan 2. Strategic management: Indian and Global Context, supriya singh **REFERENCE BOOKS:** 1.Dess, G. G., Lumpkin, G. T., Eisner, A. B., McNamara, G. 2013. Strategic Management: Creating Competitive Advantages, 7th Edition, McGraw-Hill International Edition, McGraw-Hill/Irwin.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	2	2	2	1	2	2	-	-
CO2	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO3	3	-	-	-	-	3	3	3	1	2	2	2	-	-
CO4	3	-	-	-	-	3	3	2	2	2	1	2	-	-
CO5	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO6	3	-	-	-	-	3	3	2	2	2	2	2	-	-

20SH41E4-CORPORATE GOVERNANCE AND BUSINESS ETHICS

Course Category:	Humanities	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	NIL	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to • Understand the Corporate Governance and regulatory mechanism in emerging economies. • Understand various corporate governance philosophies to explain how they contribute to world society. • Understand the corporate governance in Indian perspective • Understand the Corporate Governance in banking sector and in emerging economies. • Understand the importance of Business Ethics in day-to-day working environment. • Explore the implications of business ethics at international level.	
Course Outcomes	Upon successful completion of the course, the students will be able to	
	CO1	Comprehend Corporate Governance and regulatory mechanism in emerging economies.
	CO2	Compare various corporate governance philosophies to explain how they contribute to world society.
	CO3	Analyse the corporate governance in Indian perspective
	CO4	Contrast the Corporate Governance in banking sector with emerging economies.
	CO5	Understand the importance of Business Ethics in day-to-day working environment.
	CO6	Explore the implications of business ethics at international level.
Course Content	**Unit – I**	Corporate Governance – Concept of Corporate Governance (CG) – Aims and Objectives – Good Corporate Governance importance of CG — parties to CG – Issues in CG in Emerging Economies – corporate governance regulatory mechanisms in India.
	Unit – II	Corporate Governance in Global – Developments CG in USA and UK – The Cadbury Committee, the Green bury Committee, Global convergence in CG- the OECD principals- Sarbanes-Oxley act 2002
	Unit – III	CG in India – Need and Importance CG – History of CG – The CII Initiatives – Naresh Chandra Committee – Kumaramangalam Birala Committee – Narayana Murthy Committee – Clause 49 of Listing agreement.

	Unit – IV Corporate Governance in Banks - Why Corporate Governance in Banks – CG and the World Bank – Basel Committee on Corporate Governance – Ganguly Committee Recommendations - RBI Initiatives **Unit – V** An overview of Business Ethics- Definition and nature of Business Ethics- Types of business ethic issues -Need and benefit of Business Ethics- - History of the development of Business ethics- Arguments for and against Business Ethics- competitive Issues Legal and Regulatory Philanthropic Issues. **Unit-VI** Business Ethics in a Global Economy- Ethical perceptions and International Business- Global Values- Various Ethical Issues around the Globe- Cross cultural Issues.
Text Books & Reference Books	**TEXT BOOKS:** 1. Fernando A.C – Corporate Governance- Principles, Policies and Practices – Pearson Education- New Delhi-2006. 2. Subhash Chandra Das – Corporate Governance –Codes, Systems, Standards and Practices – PHI Learning-New Delhi -2009. 3. C.S.V. Murthy - Business Ethics and Corporate Governance- Himalaya Publishing House- Mumbai- 2009 4. Kesho Prasad - Corporate Governance - PHI Learning-New Delhi - 2009 5. Singh S - Corporate Governance- Global Concepts and Practices – Excel Books – New Delhi -2005. 6. Donald H. Chew Jr. and Staurt L. Gillan - Corporate Governance at Crossroads – Tata Mc Graw-Hill Co.Ltd., New Delhi- 2006.

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	1	2	2	2	2	-	-
CO2	3	-	-	-	-	3	3	2	2	2	1	2	-	-
CO3	3	-	-	-	-	3	3	3	2	2	2	2	-	-
CO4	3	-	-	-	-	3	1	2	2	1	2	2	-	-
CO5	3	-	-	-	-	3	3	2	2	2	2	2	-	-
CO6	3	-	-	-	-	3	3	2	2	1	2	2	-	-

PROGRAM ELECTIVES		
1.	**20EC41E1**	**VLSI Design**
2.	20EC41E2	Satellite Communication
3.	20EC41E3	Principles of modern radar systems
4.	20EC41E4	Adaptive Signal Processing
5.	**20EC41E5**	**Cellular & Mobile Communication**
6.	20EC41E6	VLSI Signal Processing
7.	20EC41E7	IC Fabrication Technology
8.	20EC41E8	Radar signal processing
9.	**20EC41E9**	**Digital Image Processing**
10.	20EC41EA	DSP Processors & Architectures
11.	20EC41EB	Low power VLSI
12.	20EC41EC	Digital IC Design

20EC41E1-VLSI DESIGN

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Electronic Devices & Circuits, Linear & Digital ICs and Basics of IC Fabrication	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To introduce the fundamental structures of VLSI Systems at the lowest levels of System abstraction. 2. To know the basic electrical properties of MOS & BI-CMOS circuits 3. To understand the Basic Circuit Concepts and design process of VLSI circuits and also, to introduce the fundamental principles of VLSI circuit design. 4. To know the Gate level design and physical design by considering portioning, floor Planning, Placement and Routing. 5. To bring both Circuits and System views on design together by considering circuit Subsystems and VLSI Design styles. 6. To have a profound understanding of the design of complex digital VLSI circuits, computer aided simulation and synthesis tool for hardware design	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Know the trends in semiconductor technology, and how it impacts scaling and performance.
	CO2	analyse the basic electrical characteristics of MOS & BI-CMOS circuits
	CO3	Learn Layout, stick diagrams, Fabrication steps, Static and Switching characteristics of inverters
	CO4	Estimate delay in circuits and knows routing techniques for clock and power
	CO5	Understand design styles in VLSI like full-custom, FPGA etc.
	CO6	Discriminate various faults in circuits and to develop fault-modelling synthesis.
	UNIT-I **INTRODUCTION:** IC fabrication - MOS, PMOS, NMOS, CMOS & Bi-CMOS Technologies - Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation, Probe testing, Integrated Resistors and capacitors. **UNIT-II** **BASIC ELECTRICAL PROPERTIES OF MOS & Bi-CMOS CIRCUITS:** I_{ds}-V_{ds} relationships, MOSFET threshold voltage, g_m, g_{ds}, ω_o, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design Bi-CMOS inverters. **UNIT-III** **BASIC CIRCUIT CONCEPTS:** Sheet Resistance R_s and its concepts to MOS, Area Capacitance calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-In and Fan-Out.	

Course Content	**VLSI CIRCUIT DESIGN PROCESSES:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm CMOS Design rules for wires, Contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and gates, Scaling of MOS circuits, Limitation of Scaling. **UNIT-IV** **GATE LEVEL DESIGN:** Logic gates and other Complex gates, Switch Logic, Alternate Gate circuits. **PHYSICAL DESIGN:** Floor- Planning, Placement, routing, Power delay estimation, Clock and Power routing. **UNIT-V** **SUBSYSTEM DESIGN:** Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters, High density Memory Elements. **VLSI DESIGN STYLES:** Full-custom, Standard Cells, Gate-arrays, FPGAs and CPLDs. **UNIT-VI** **VHDL Synthesis:** VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools. **TEST AND TESTABILITY:** Fault-modelling and simulation, test generation, design for testability, Built-in self-test.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Essentials of VLSI circuits and Systems", by Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005 Edition. 2. "CMOS VLSI Design: circuits and system perspective", by Weste and Harris, Pearson Education, 2015. 3. "Application Specific Integrated Circuits", by Michal Smith, pearson india, 1st edition, 2002. **REFERENCE BOOKS:** 1. "Linear Integrated circuits", by D. Roy Chowdhury, New Age International, 5th Edition, 2018. 2. "Modern VLSI Design" by Wayne Wolf, Pearson Education, 4th Edition 2015. 3. "Introduction to VLSI Circuits and Systems", by John. P. Uyemura, John Wiley, 2015. 4. "Digital Integrated Circuits" by John M. Rabaey, chandrakasan, nkolic,PHI, 2nd edition, 2016.
E-Resources	1. http://nptel.ac.in/courses 2. http://tocs.ulb.tu-darmstadt.de/35621702.pdf

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	-	-	2	2	2	2	3	3
CO2	3	3	2	-	2	2	-	-	-	-	-	2	3	3
CO3	3	3	3	1	1	1	-	-	-	-	-	2	3	3
CO4	3	3	2	-	2	2	-	-	-	-	2	2	3	3
CO5	3	3	2	-	-	2	-	-	-	-	2	2	3	3
CO6	3	3	2	2	1	1	-	-	-	-	1	2	3	3

20EC41E2 - SATELLITE COMMUNICATION

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Antenna and Wave Propagation, Radar Engineering	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. Understand the origin, brief history, current state and future trends of Satellite Communications. 2. Understand the principles, concepts and operation of satellite communication systems. 3. Calculate and interpret key geometric and timing parameters for a variety of common satellite orbits. 4. Understand different types of satellite subsystems. 5. Describe the concepts of signal propagation affects, link design, rain fading, link availability and perform interference calculations. 6. Understand different components of satellite Earth Stations.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand history, current state and future trends of Satellite Communications.
	CO2	Identify, formulate and solve engineering problems related to orbital aspects of satellite communication.
	CO3	Know about working of different subsystems in the satellite.
	CO4	Design satellite link budgets to account for channel losses, noise, and interference in satellite communications systems for specific communications requirements.
	CO5	Gain knowledge about different multiple access techniques.
	CO6	Acquire knowledge about of Earth Station components.
Course Content	**UNIT-I** **INTRODUCTION:** The Origin of Satellite Communications, A brief history of Satellite Communications, Frequency allocations for Satellite Services, Applications, Current State of Satellite Communications and Future trends of Satellite Communications. **UNIT-II** **ORBITAL ASPECTS OF SATELLITE COMMUNICATION:** Orbital Mechanics, Lock Angle determination, Orbital perturbations, Orbit determination, Launches and Launch Vehicles, Orbital effects in Communication Systems Performance. **UNIT-III** **SATELLITE SUBSYSTEMS:** Introduction, Attitude and Orbit Control System (AOCS), Telemetry, Tracking, Command and Monitoring (TTC&M), Power Systems, Communication Subsystems, Satellite Antennas, Equipment reliability and Space Qualification. **UNIT-IV** **SATELLITE LINK DESIGN:** Basic Transmission Theory, System Noise Temperature and G/T ratio, Design of Down Link, Up Link design, Design of Satellite links for specified C/N, System Design examples.	

Course Content	**UNIT-V** **MULTIPLE ACCESS:** Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Frame Structure and Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception. **UNIT-VI** **EARTH STATION:** Types of Earth Station, Earth Station Architecture, Earth Station Design Considerations, Earth Station Testing, Earth Station Hardware and Satellite Tracking.
Text Books and Reference Books	**TEXT BOOKS:** 1. Satellite Communication by Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003. 2. Satellite Communications by Anil K.Maini and Varsha Agarwal, Wiley India Pvt. Ltd., 2011. **REFERENCE BOOKS:** 1. Satellite Communication by D.C Agarwal, Khanna Publications, 7th Edition,1989. 2. Satellite Communications by Dennis Roddy, McGraw Hill, 4th Edition, 2017.
E-Resources	1. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-851-satellite-engineering-fall-2003/lecture-notes/

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	2	–	–
CO2	3	3	2	2	1	-	-	-	-	1	-	2	–	–
CO3	3	3	3	1	1	-	-	-	1	-	-	2	–	–
CO4	3	3	2	2	1	2	2	1	-	1	-	2	–	–
CO5	3	3	2	2	1	-	-	-	-	-	-	2	–	–
CO6	3	3	2	2	1	-	-	-	-	-	-	2	–	–

20EC41E3 - PRINCIPLES OF MODERN RADAR SYSTEMS

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Analog and digital communication systems, Microwave techniques and Radiating systems.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to:	
	1. Analyze the fundamentals of radar block diagram and range equation. 2. understand different components of radar system. 3. know types of radar systems. 4. illustrate Radar detection techniques. 5. learn special radars. 6. understand fundamentals ECM and ECCM.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the components of a radar system and their relationship to overall system and measure of performance.
	CO2	Analyse the performance of radar components.
	CO3	Familiarized in different radar systems.
	CO4	Develop skills in designing Radar systems in different noise environments.
	CO5	Demonstrate knowledge in special radars.
	CO6	Describe the fundamentals ECM and ECCM.
Course Content	**UNIT-I** **THE NATURE OF RADAR**: The simple form of the Radar equation, Radar block diagram and operation, Radar frequencies and Applications of Radar. Minimum Detectable signal, Receiver noise, Probability Density Functions, Signal to Noise Ratio, Integration of Radar pulses, Radar Cross Section of Targets, Cross section fluctuations, Pulse Repetition Frequency and Range Ambiguities. **UNIT-II** **RADAR COMPONENTS**: Klystron Power Amplifier, Travelling Wave Tube, Magnetron Oscillator, Cross Field Amplifier, Modulators, Mixers: Conversion Loss, Noise Figure, Balanced mixer, Image recovery mixer, Duplexers: Branch type, Balanced type and Solid State Duplexers, limiters, Displays: CRT Display, A,B,C,D Scopes, PPI and RHI. **UNIT-III** **RADAR SYSTEMS**: Doppler Effect, Simple CW Radar, FM-CW Radar, MTI Radar: Delay line Cancellers, Blind speeds, Range Gated Doppler Filters, Limitations and types of MTI radars. **TRACKING RADAR**: Sequential Lobbing, Conical Scanning and Monopulse Tracking, Tracking in Range.	

Course Content	**UNIT- IV** **RADAR DETECTION TECHNIQUES:** Coherent & Non-Coherent Detection – Matched Filters-Different methods of Integration of Pulse Trains – Detection of Fluctuating Targets – Fluctuation laws – Diversity gain – Binary Integration of Fluctuation Targets – Cumulative Integration of Fluctuating Targets – Sequential Detection with Rapid Confirmation – Constant False Alarm Rate Detection – Cell Averaging – Two Parameter Averaging & Non-Parametric Averaging. **UNIT-V** **SPECIAL RADARS:** Bi-Static Radar – Synthetic Aperture Radar – HF Over the Horizon Radar –Air Surveillance Radar– Height Finder & 3D radar. **UNIT-VI** **RADAR ELECTRONIC COUNTER MEASURES (ECM) AND ELECTRONIC COUNTER-COUNTER MEASURES (ECCM):** Noise Jamming of Surveillance Radar – Detection Range in Noise Jamming – ECCM Provisions for Surveillance Radar – Objective of ECM.
Text Books and Reference Books	**TEXT BOOKS:** 1.David. K. Barton-"Modern Radar Systems"- Artech House INC 1988. 2. Introduction to Radar Systems-Merrill. I. Skolnik, TMH, 2nd Edition, 2007. 3.Radar: Principles, Technology and Applications-Byron Edde, Pearson Education, 2004. **REFERENCE BOOKS:** 1. Microwave and Radar Engineering- M. Kulakarni, Umesh Publications, 4th Edition, 2012. 2. Hamish. D. Meikle- "Modern Radar Systems" - Artech House INC 1988. David. K. Barton-"Radar system Analysis & Modeling" - Artech House INC 2003.
E-Resources	1. https://www.ll.mit.edu/outreach/introduction-radar-systems 2. http://lej4learning.com.pk/videos-introduction-to-radar-systems-mit/

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	2	-	2	3	3
CO2	3	3	2	1	-	-	-	-	-	-	-	1	3	3
CO3	3	3	3	1	-	-	-	-	-	-	-	1	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	-	-	-	-	-	2	-	1	3	3
CO6	3	3	2	-	-	-	-	-	-	-	-	1	3	3

20EC41E4 - ADAPTIVE SIGNAL PROCESSING

Course Category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practical:**	3-0-0
Prerequisite:	Signals & Systems Digital Signal Processing	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The Definitions, Characteristics, Applications of adaptive systems 2. The Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution 3. The steepest descent algorithms, eigen values and vectors 4. The LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms 5. The Application of RLS algorithm on Adaptive Equalization. 6. The Variants of Kalman filtering, Extend Kalman filtering	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the concept of adaptive filter theory and develop a filter for any real time application.
	CO2	Know how to get desired response from a filter and various searching methods.
	CO3	Design a filter using Steepest Descent algorithm and LMS algorithm.
	CO4	Compare Eigen filters with LMS algorithm in any real time application.
	CO5	Apply RLS algorithm design an adaptive filter equalization and Kalman filtering.
	CO6	Develop an adaptive filter for target tracking using only DOA.

Course Content

UNIT I

INTRODUCTION TO ADAPTIVE SYSTEMS: Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner - Description, Weight Vectors, Desired Response Performance function, Gradient & Mean Square Error.

UNIT II

DEVELOPMENT OF ADAPTIVE FILTER THEORY AND SEARCHING METHODS: Introduction to Filtering, Smoothing and Prediction, Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance - Minimum Mean Square Error. Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution, Stability & Rate of convergence - Learning Curves.

UNIT III

STEEPEST DESCENT ALGORITHMS, EIGEN VALUES AND VECTORS: Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves. Eigen Value Problem, Properties of Eigen values and Eigen vectors, Eigen Filters, Eigen Value computations.

UNIT IV

LMS ALGORITHM & APPLICATIONS: Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic

Course Content	algorithms, Convergence of LMS algorithm, Noise cancellation, Cancellation of Echoes in long distance telephone circuits. **UNIT-V** **RLS ALGORITHM:** Matrix Inversion lemma, exponentially weighted recursive least square algorithm, update recursion for the sum of weighted error squares, convergence analysis of RLS Algorithm, Application of RLS algorithm on Adaptive Equalization. **UNIT-VI** **KALMAN FILTERING:** Statement of Kalman filtering problem, Filtering, Initial conditions, Variants of Kalman filtering, Extend Kalman filtering, Introduction to Recursive Mean Square Estimation Random variables, Target tracking using only DOA.
Text Books and Reference Books	**TEXT BOOKS:** 1. Adaptive signal processing- Bernard Widrow, Samuel D.Strearns, 2005, PE. 2. Adaptive Filter Theory - Simon Haykin-, 4th ed., 2002, PE Asia **REFERENCE BOOKS:** 1. Optimum signal processing: An introduction - Sophocles. J. Orfamadis, 2 ed., 1988, McGraw-Hill, New York 2. Adaptive signal processing-Theory and Applications, S.Thomas Alexander, 1986, Springer-Verilog.
E-Resources	https://nptel.ac.in/courses/117105075/

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	1	3	3
CO5	3	3	2	1	-	-	-	-	-	-	-	1	3	3
CO6	3	3	2	1	-	-	-	-	-	-	-	1	3	3

20EC41E5 - CELLULAR MOBILE COMMUNICATION

Course Category:	Program Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practical:**	2-2-0
Prerequisite:	Antenna and Wave Propagation, Radar Engineering	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The basic Cellular system 2. The elements of cellular radio system design. 3. The various Prediction models for cell coverage in terms of signal and traffic. 4. The interference problem and its reduction by designing proper antenna system. 5. Frequency spectrum utilization techniques channel & traffic management and evaluation of dropped call rate. 6. The need for digital mobile telephony and studying various mobile systems like GSM & CDMA.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand cellular communication system with cell splitting, consideration of cellular system, cell-site antennas like elements.
	CO2	Design elements for Analog and Digital cellular systems.
	CO3	Acquire knowledge about propagation mechanisms, Multipath fading, and channel modeling and co-channel interference.
	CO4	Know about different types of channel interferences with cell-site antenna heights and signals coverage cells
	CO5	Gain knowledge about Frequency management and Channel assignment and multiple access schemes
	CO6	Acquire knowledge about the evolution of GSM, TDMA & CDMA technologies for proper Frequency spectrum utilization.
Course Content	**UNIT-I** **INTRODUCTION TO CELLULAR MOBILE SYSTEM:** A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, Analog and Digital cellular systems. **UNIT-II** **ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN:** General description of the problem, concept of frequency reuse channels, channel interferences reduction factors, desired C/I from a normal case in an Omni-directional antenna system, cell splitting, consideration of cellular system, cell-site antennas & mobile antennas characteristics, antennas at cell-site, mobile antennas. **UNIT-III** **CELL COVERAGE FOR SIGNAL & TRAFFIC:** General introduction, obtaining the mobile point-to-point model, propagation over water or flat open area, foiling loss, propagation in near distance, long distance propagation, point-to-point prediction model characteristics, cell-site antenna heights and signals coverage cells, mobile propagation.	

Course Content	**UNIT-IV** **INTERFERENCE:** Introduction to co-channel interference, real time co-channel interference measurement, design of antenna system, diversity receiver, types of non-co-channel interference, interference between systems. **UNIT-V** **FREQUENCY MANAGEMENT & CHANNEL ASSIGNMENT:** Frequency spectrum utilization, setup channels, management & traffic channel assignment, Handoff & their characteristics, dropped call rates and their evaluations. Real-time co-channel interference measurement. **UNIT-VI** **DIGITAL CELLULAR SYSTEM:** Why digital, digital mobile telephony, practical multiple access schemes, Global System for Mobile (GSM), TDMA & CDMA, miscellaneous mobile systems.
Text Books and Reference Books	**TEXT BOOKS:** 1. Mobile Cellular Telecommunication – Analog and Digital Systems by Lee. W. C. Y, Mc Graw Hill, 2nd Edition, 2017. 2. Mobile communication by G.K. behere lopamudra das, SciTech publications, 2010. **REFERENCE BOOKS:** 1. Principles of communication systems by Taub & shilling, TMH, 4th Edition, 2017 2. Celullar mobile communications by Willium stallings, PHI, 1st Edition, 2001.
E-Resources	1. www.iitg.ernet.in/scifac/qip/public_html/cd_cell/EC632.pdf 2. www.morse.colorado.edu/~tlen5510/text/

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	2	2	2	2	3	3
CO2	3	3	2	2	2	2	1	2	-	-	-	2	3	3
CO3	3	3	3	1	1	1	2	2	-	-	-	2	3	3
CO4	3	3	2	2	2	2	2	2	-	-	2	2	3	3
CO5	3	3	2	2	2	2	2	2	-	-	2	2	3	3
CO6	3	3	2	2	1	1	1	2	-	-	1	2	3	3

20EC41E6 - VLSI SIGNAL PROCESSING

Course Category:	Program core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	2 - 2 – 0
Prerequisite:	VLSI Design, Digital Signal Processing algorithms, graph-theoretic concepts, and combinatorial algorithms.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. fundamentals of graph theory in VLSI signal processing 2. transformations for high-speed using pipelining, retiming, and parallel processing techniques 3. area reduction using folding techniques 4. mapping of algorithms on array structures, DSP systems, and FPGAs 5. low Power Design Techniques 6. VLSI systems for some typical signal processing applications	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand VLSI design methodology for signal processing systems in different signal processing application.
	CO2	Apply the concepts with VLSI algorithms for computing digital signal processing applications**.**
	CO3	Be familiar with architectures for DSP and its Properties.
	CO4	Design Families of Architectures for specified algorithm complexity and speed constraints for Systolic Array Design
	CO5	Design low power constrained systems with Power estimation approach.
	CO6	Describe signal processing computation and its relevance to some specific applications with proper power management.
Course Content	**UNIT-I** **INTRODUCTION FOR DSP ALGORITHMS:** VLSI Design flow, Mapping algorithms into Architectures: Graphical representation of DSP algorithms – signal flow graph (SFG), data flow graph (DFG), critical path, dependence graph (DG). Data path synthesis, control structures, Optimization at Logic Level and architectural Design, Loop bound and iteration bound, Algorithms for computing iteration bound, Iteration bound of Multi-rate data-flow graphs. **UNIT-II** **PARALLEL AND PIPELINE OF SIGNAL PROCESSING APPLICATION:** Architecture for real time systems, latency and throughput related issues, clocking strategy, power conscious structures, array architectures; Pipelining processing of Digital filter, Parallel processing, Parallel and pipelining for Low power design, Optimization with regard to speed, area and power, asynchronous and low power system design, ASIC and ASISP design. **UNIT-III** **SYSTOLIC ARRAY ARCHITECTURE:** Methodology of systolic array architecture, FIR based Systolic Array, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design, Systolic Design for Space Representations Containing Delays.	

Course Content	**UNIT-IV** **ARCHITECTURE OF DIFFERENT SIGNAL PROCESSING MODULES:** Convolution technique, Folding /Unfolding Transformation, CORDIC architecture, Retiming: Introduction, Definition and Properties, Solving System of Inequalities, Retiming Techniques. **UNIT-V** **LOW POWER DESIGN:** Theoretical background, Scaling v/s power consumption, power analysis, Power reduction techniques, Power estimation approach. **UNIT-VI** **APPLICATION IN COMMUNICATION AND SIGNAL PROCESSING SYSTEM:** Transformation architectures, source and channel coding structures, Motion Estimation and motion compensation for video, Speech processing algorithm.
Text Books and Reference Books	**TEXT BOOKS:** 1. VLSI Digital Signal Processing Systems: Design and Implementation By K.K. Parhi, John Wiley & Sons, 1tstEdition 1999 2. Digital Signal Processing in VLSI by Richard J. Higgins, Prentice Hall,1990. **REFERENCES BOOKS:** 1. VLSI Design Methodology for DSP Architectures by M.A. Bayoumi, Kluwer, 1994 2. U. Meyer – Baese, Digital Signal Processing with FPGAs, Springer, 4th Edition 2004
E-Resources	1. http://people.ece.umn.edu/users/parhi/SLIDES/

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	2	2	2	2	3	3
CO2	3	3	2	2	2	2	1	2	-	-	-	2	3	3
CO3	3	3	3	1	1	1	2	2	-	-	-	2	3	3
CO4	3	3	2	2	2	2	2	2	-	-	2	2	3	3
CO5	3	3	2	2	2	2	2	2	-	-	2	2	3	3
CO6	3	3	2	2	1	1	1	2	-	-	1	2	3	3

20EC41E7 - IC FABRICATION TECHNOLOGY

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Electronic Devices & Circuits, Switching Theory & Logic Design, Analog IC Applications, Digital Design, VLSI Design.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected to understand:	
	1. The fundamental process involved in IC fabrication and able to describe the CMOS and Bi-CMOS IC Fabrication Process 2. The modelling of resistor and capacitor in IC fabrication considering the parasitic effects and design rules 3. The gate structures, Network layout design and sequential machines 4. The gain adequate knowledge on subsystems and physical design 5. The floor planning, touting, distribution 6. The automatic test pattern generator and BIST.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the fundamental process involved in IC fabrication process and Model resistor and capacitor in IC fabrication and understand transistor parasitic, stick diagrams
	CO2	Describe the CMOS and BiCMOS IC Fabrication Process and SCMOS design rules.
	CO3	Understand the gate structures and sub systems
	CO4	Design sequential machines and 4-bit arithmetic processor.
	CO5	Gain adequate knowledge on floor planning and Testing and Testability
	CO6	Design channel distribution and BIST and ATPG
Course Content	**UNIT-I** **FUNDAMENTALS OF IC FABRICATION PROCESS:** Preparation of EGS, Crystal growing, Wafer preparation, Epitaxy, Oxidation, Photolithography, Diffusion, Metallization, CMOS fabrication-p-well process, n-well process, twin-tub process. Bi-CMOS fabrication. IC design techniques-Hierarchical design and design abstraction. **UNIT-II** **DEVICES AND LAYOUT:** Sheet resistance. Area capacitance. Delay unit τ. MOS Transistors - Structure of the transistor, Simple transistor model, Transistor parasitics, Wires and vias, Tub ties and latch up, Wire parasitics, Advanced characteristics, design rules- Fabrication errors, Scalable design rules, SCMOS design rules, Layout design and tools- Layouts for circuits, Stick diagrams, Hierarchical stick diagrams. **UNIT-III** **GATES, NETWORK AND SEQUENTIAL MACHINES:** Static complementary gates- Gate structures, Basic gate layouts, delay, Power consumption, Speed- power product, parasitic, Wires and delay. Network layout design- Single row layout, Standard	

Course Content	cell layout. Network delay- Fan-out, Path delay, Transistor sizing. Sequential machines- Latches and Flip-flops. **UNIT-IV** **SUBSYSTEMS:** Subsystems- Pipelining, Data paths, 4-bit arithmetic processor as example of subsystem design. **UNIT-V** **FLOOR PLANNING:** Floor planning methods – Block placement and channel distribution, Global routing, power distribution, Clock distribution. Off-chip connections- Packages, I/O Architecture, Pad design. **UNIT-VI** **TESTING AND TESTABILITY:** System partitioning, Design for testability, Fault models. ATPG, Testing combinational logic, Testing sequential logic, Scan design techniques BIST.
Text Books and Reference Books	**TEXT BOOKS:** 1. VLSI Technology by S.M. Sze, Mc Graw-Hill Int, 2nd Edition, 2017. 2. Modern VLSI design by Wayne Wolf, Pearson Education Asia, 4th Edition, 2008. **REFERENCE BOOKS:** 1. Basic VLSI design by Douglas A. Pucknell and Kamran Eshraghian, Prentice-Hall of India Pvt. Ltd, 3rd Edition, 1995. 2. Introduction to VLSI Circuits and Systems by John. P. Uyemura. John wiley, 2003. 3. Digital Integrated Circuits by John M.Rabaey, PHI, 2nd Edition, 2003.
E-Resources	1. www.iue.tuwien.ac.at/phd/ceric/node8.html 2. www.eecs.berkeley.edu/~hu/ChenmingHu_ch3.pdfwww.nptel.ac.in/courses/111310602/Lec22.pdf

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	1	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	3	3
CO4	3	3	2	2	1	1	1	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	1	-	-	-	2	3	3
CO6	3	3	2	2	1	1	-	1	-	2	-	2	3	3

20EC41E8 - RADAR SIGNAL PROCESSING

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0 – 0
Prerequisite:	Analog and digital communication systems, DSP, Basic Radar engineering.	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To learn the fundamentals of radar block diagram and range equation. 2. To understand the matched filter receiver. 3. To understand detection criteria of radar signals in noise environment. 4. To learn the Radar waveform design requirements. 5. To learn the Pulse compression techniques. 6. To understand fundamentals different phase coding techniques.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the components of a radar system and their relationship to overall system and measure of performance with and without noise.
	CO2	Analyse the radar performance and Frequency Response Characteristic of matched filter receiver with noise.
	CO3	Develop skills in designing Radar systems in different noise environments by choosing proper Waveform Design Requirements.
	CO4	Familiarized Detection Criteria of radar and ambiguity function and basic radar signals.
	CO5	Demonstrate knowledge in radar pulse compression techniques with coding techniques.
	CO6	Describe the different phase coding techniques in Decoding the received Waveforms.
Course Content	**UNIT-I** RADAR RANGE EQUATION: Introduction– Radar Frequencies, Radar Block Diagram, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance– General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, Bistatic Radar. **UNIT – II** MATCHED FILTER RECEIVER: Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and Cross-Correlation Receiver, Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise. **UNIT – III** DETECTION OF RADAR SIGNALS IN NOISE: Detection Criteria – Neyman-Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer, Detectors –Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection – CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in Radar. Radar Signal Management –Schematics, Component Parts, Resources and Constraints. **UNIT – IV** WAVEFORM SELECTION: Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave,	

Course Content	Periodic Pulse Train, Single Linear FM Pulse, Noise like Waveforms. Waveform Design Requirements. Radar clutter- Introduction, surface clutter, Land clutter, Detection of targets in Clutter. **UNIT – V** PULSE COMPRESSION IN RADAR SIGNALS: Introduction, Significance, Types. Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Side lobes, Stretch Techniques, Generation and Decoding of FM Waveforms – Block Schematic and Characteristics of Passive System, Digital Compression, SAW Pulse Compression. **UNIT-VI** PHASE CODING TECHNIQUES: Phase Coding Techniques: Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar. Poly Phase Codes: Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM), Side lobe Reduction for Phase Coded PC Signals, Complementary codes, Huffman codes, Limiting in Pulse Compression, Cross Correlation Properties, compatibility.
Text Books and Reference Books	**TEXT BOOKS:** 1. M.I. Skolnik, *"Introduction to Radar Systems",* TMH, 3rd Edition, 2001. " 2. Fred E. Nathanson, *"Radar Design Principles – Signal Processing and The Environment",* McGraw Hill, Inc, 2nd Edition,1991. 3. M.I. Skolnik, *Radar Handbook,* McGraw Hill, 2nd Edition, 1991. **REFERENCE BOOKS:** 1. Peyton Z. Peebles Jr., *Radar Principles,* Wiley India Pvt. Ltd., 1998. 2. R. Nit berg, *Radar Signal Processing and Adaptive Systems,* Artech House, 1999. 3. F.E. Nathanson, *Radar Design Principles, 1st* Edition, McGraw Hill, 1969
E-Resources	1. https://www.ll.mit.edu/outreach/introduction-radar-systems 2. https://ocw.mit.edu/resources/res-ll-001-introduction-to-radar-systems-spring-2007/ 3. http://lej4learning.com.p/videos-introduction-to-radar-systems-mit/

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	2	-	-	3	3
CO2	3	3	3	2	-	-	-	-	-	2	-	-	3	3
CO3	3	3	3	2	-	-	-	-	-	1	-	-	3	3
CO4	3	3	2	2	-	-	-	-	-	2	-	-	3	3
CO5	3	3	2	1	-	-	-	-	-	1	-	-	3	3
CO6	3	3	2	1	-	-	-	-	-	1	-	-	3	3

20EC41E9 - DIGITAL IMAGE PROCESSING

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Prerequisite:	Engineering Mathematics, Signals and Systems, Digital Signal Processing	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To learn the fundamentals of digital image processing and the relationship between pixels. 2. To understand transformations used in digital image processing algorithms. 3. To understand the spatial and frequency domain image processing 4. To learn the restoration techniques used in image enhancement. 5. To learn how to code and compress the images. 6. To understand fundamentals of color image processing.	
Course Outcomes	After completing the course, the student will be able to:	
	CO1	Describe how digital images are represented and how they are sampled and quantized and define the image processing system and basic relations among pixels.
	CO2	Analyse the need for image transforms, types and their properties.
	CO3	Study different techniques employed for the enhancement of images in both spatial and frequency domain.
	CO4	Explore causes for image degradation and various restoration techniques.
	CO5	Understand the techniques for image segmentation and define different image coding techniques and compression models.
	CO6	Describe the techniques of colour image processing.
Course Content	**UNIT-I** **DIGITAL IMAGE FUNDAMENTALS:** Digital Image Representation – Digital Image Processing System – Visual Perception – Sampling and quantization – Basic Relationship between pixels – Imaging geometry. **UNIT – II** **IMAGE TRANSFORMS:** Discrete Fourier Transform – Properties of 2-D Fourier transform – 2-D Fast Fourier Transform – Walsh Transform – Hadamard Transform – D.C.T. – Haar Transform – Slant Transform – Hotelling Transform. **UNIT – III** **IMAGE ENHANCEMENT:** Back ground enhancement by point processing – Histogram Processing – Spatial Filtering – Enhancement in frequency Domain – Image Smoothing – Image Sharpening. **UNIT – IV** **IMAGE RESTORATION:** Degradation model – Algebraic approach to restoration – Inverse filtering – Least Mean Square filters – Constrained Least Mean Square restoration – Inverse Restoration.	

Course Content	**IMAGE SEGMENTATION:** Detection of Discontinuities – Edge Linking – Boundary detection and Boundary Description – Thresholding – Region Oriented Segmentation. **UNIT – V** **IMAGE CODING & COMPRESSION:** Fidelity Criteria – Encoding Process – Transform Encoding – Redundancies and their removal methods – Image compression models and methods – Source coder and decoder – Error free compression – Lossy compression. **UNIT-VI** **COLOUR IMAGE PROCESSING:** Colour Image Processing – Colour Model, Pseudo colour image processing – Full colour image processing, Colour Image Filtering, Colour Image Segmentation
Text Books and Reference Books	**TEXT BOOKS:** 1. "Digital Image Processing" – Rafael C. Gonzalez, Richard E. Woods, 3rd Ed, Pearson. 2. "Fundamentals of Image Processing" – A. K. Jain, Prentice Hall India. **REFERENCE BOOKS:** 3. "Digital Image Processing" – William K. Pratt, John Wiley Publications 4. "Digital Image Processing" – K. R. Castleman, Pearson Publications **5.** "Fundamentals of Electronic Image Processing" – Weeks Jr, SRIC/IEEE series, PHI.
E-Resources	1. nptel.ac.in/courses/117105079/ 2. www.ee.columbia.edu/~xlx/courses/ee4830-sp08/notes/lect1-parta.pdf

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	-	-	-	-	-	1	2	-	3	3
CO3	3	3	3	1	1	2	-	-	-	1	2	-	3	3
CO4	3	3	3	1	2	1	-	-	-	1	1	-	3	3
CO5	3	3	2	2	1	1	-	-	-	2	2	2	3	3
CO6	3	3	2	2	2	2	-	-	-	2	2	2	3	3

20EC41EA - DSP PROCESSORS & ARCHITECTURES

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	2-2-0
Prerequisite:	Engineering Mathematics, Signals and Systems, Digital Signal Processing	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To learn the fundamentals of digital signal processing and Analysis and Design tool for DSP Systems MATLAB. 2. To understand the number formats for signals and coefficients in DSP systems 3. To learn the architectures for programmable DSP devices 4. To understand fundamentals of FIR Filters & IIR Filters 5. To learn the FFT Algorithm for DFT Computation.	
Course Outcomes	After completing the course, the student will be able to:	
	CO1	Comprehends the knowledge & concepts of digital signal processing techniques
	CO2	Acquire knowledge of DSP computational building blocks and knows how to Achieve speed in DSP architecture or processor.
	CO3	Develop basic DSP algorithms using DSP processors.
	CO4	Acquire knowledge about various addressing modes of DSP TMS320C54XX and are able to program DSP processor.
	CO5	Discuss about interfacing of serial and parallel communication devices.
	CO6	Describe the Programmed I/O, Interrupts and I/O and Direct memory access.
Course Content	**UNIT-I** **INTRODUCTION TO DIGITAL SIGNAL PROCESING**: Linear Time-Invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB. **UNIT – II** **COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS:** Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter. **UNIT – III** **ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES**: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing, Commercial Digital signal-processing Devices, Data Addressing modes, Memory space, instructions, Program Control of TMS320C54XX	

Course Content	Processors, and Programming On-Chip Peripherals, Interrupts, Pipeline Operation of TMS320C54XX Processors. **UNIT – IV** **IMPLEMENTATIONS OF BASIC DSP:** The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing. **UNIT – V** **FFT ALGORITHMS IMPLEMENTATIONS:** The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing. An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum. **UNIT-VI** **INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES:** Memory space ornization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.
Text Books and Reference Books	**TEXT BOOKS:** 1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004. 2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al.S. Chand & Co, 2000. **REFERENCE BOOKS:** 1. Digital Signal Processors, Architecture, Programming and Applications- B.Venkata Ramani and M. Bhaskar, TMH, 2004. 2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005
E-Resources	3. nptel.ac.in/courses/117105079/ 4. www.ee.columbia.edu/~xlx/courses/ee4830-sp08/notes/lect1-parta.pdf

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	-	-	-	-	2	2	-	3	3
CO2	3	3	3	-	1	-	-	-	-	2	2	-	3	3
CO3	3	3	2	-	2	-	-	-	-	2	2	2	3	3
CO4	3	3	2	-	1	-	-	-	-	1	2	2	3	3
CO5	3	3	3	-	1	-	-	-	-	2	2	-	3	3
CO6	3	3	3	-	2	-	-	-	-	3	2	-	3	3

20EC41EB - LOW POWER VLSI DESIGN

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Electronic Devices & Circuits, Linear & Digital ICs and Basics of IC Fabrication	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected: 1. To know the basic electrical properties of MOS & BI-CMOS circuits 2. To understand the low power design approaches 3. To learn the CMOS & BI-CMOS logic gates 4. To understand the concepts of low voltage low power adders 5. To understand the concepts of low voltage low power multipliers 6. To learn low power techniques used for memories	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	analyse the basic electrical characteristics of MOS & BI-CMOS circuits
	CO2	understand the low power design approaches
	CO3	Learn CMOS & BI-CMOS logic gates
	CO4	Design and analysis of different low voltage low power adders
	CO5	Design and analysis of different low voltage low power Multipliers
	CO6	Discriminate various low power techniques used for memories
Course Content	**UNIT-I** **MOS/BiCMOS PROCESSES:** Introduction to low voltage low power design, limitations, Silicon on insulator, CMOS process, BiCMOS process, Integration and Isolation considerations, Integrated Analog/Digital BiCMOS process. **UNIT-II** **LOW POWER DESIGN APPROACHES:** CMOS Inverter DC characteristics, sources of power dissipation, low power design approaches through voltage scaling, switched capacitance minimization approaches. **UNIT-III** **CMOS AND BiCMOS LOGIC GATES:** Conventional CMOS and BiCMOS logic gates, performance evaluation, low voltage BiCMOS applications. **UNIT-IV** **LOW VOLTAGE LOW POWER ADDERS:** Introduction, standard adder cells, CMOS adder's architectures: Ripple carry adder, carry look ahead adder, carry select adder, carry save adder, low	

	voltage low power design techniques: Trends of technology and power supply voltage, low voltage low power logic styles. **UNIT-V** **LOW VOLTAGE LOW POWER MULTIPLIERS:** Braun, Baugh, Booth multipliers and Introduction to Wallace tree multiplier. **UNIT-VI** **MEMORIES:** SRAM— Basics of SRAM, read-write operation, low power techniques. DRAM-- Basics of DRAM, read –write operation, low power techniques, self-refresh technique.
Text Books and Reference Books	**TEXT BOOKS:** 1. CMOS/Bi-CMOS ULSI low voltage, low power by Yeo Rofail/Gohl, Pearson Education Asia, 1st Indian reprint, 2002. 2. CMOS Digital Integrated Circuits-Analysis and Design by Sung-Mo Kang, Yusuf Leblebici, TMH, 4th Edition, 2014. 3. Low voltage, Low power VLSI subsystems by Kiat-Seng Yeo, Kaushik Roy, TMH professional Engineering, 2007. **REFERENCE BOOKS:** 1. Practical low power digital VLSI Design by Gary K. Yeap, KAP, 2012. 2. Digital Integrated Circuits by J. Rabaey, PH, 2nd Edition, 2003. 3. Low Power CMOS Design by Anantha chadrasekhran, IEEE press/ wiley International, 1st Edition 1998.
E-Resources	3. http://nptel.ac.in/courses 4. http://tocs.ulb.tu-darmstadt.de/35621702.pdf

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	-	-	-	-	-	2	3	3
CO2	3	3	2	2	1	1	-	-	-	-	-	2	3	3
CO3	3	3	3	2	1	-	-	-	-	-	-	2	3	3
CO4	3	3	2	2	1	1	-	-	-	-	-	2	3	3
CO5	3	3	2	2	1	-	-	-	-	-	-	2	3	3
CO6	3	3	2	2	1	1	-	-	-	2	-	2	3	3

20EC41EC - DIGITAL IC DESIGN

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Linear ICs and Basics of IC Fabrication	**Sessional Evaluation:** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives

Students undergoing this course are expected:

1. To understand the concept of MOS Design
2. To understand the concept Combinational MOS Logic
3. To understand the concept of Sequential MOS Logic Circuits
4. To learn dynamic logic circuits
5. To design and to develop the Digital Integrated Circuits for different Applications
6. To understand the concepts of Semiconductor Memories, Flash Memory, RAM array organization

Course Outcomes

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

CO1	Understand the concepts of MOS Design
CO2	Design and analysis of Combinational MOS Circuits
CO3	Design and analysis of Sequential MOS Circuits
CO4	Description of Dynamic Logic Circuits
CO5	Extend the Digital IC Design to Different Applications
CO6	Understand the Concepts of Semiconductor Memories, Flash Memory, RAM array organization

Course Content

UNIT-I

MOS Design: Pseudo NMOS Logic – Inverter, Inverter threshold voltage, Output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II

Combinational MOS Logic Circuits: MOS logic circuits with NMOS loads, Primitive CMOS logic gates – NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates, AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

UNIT-III

Sequential MOS Logic Circuits: Behaviour of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip- flop.

Course Content	**UNIT-IV** **Dynamic Logic Circuits**: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits. **UNIT-V** **Interconnect**: Capacitive Parasitics, Resistive Parasitics and Inductive Parasitics, Advanced Interconnect Techniques. **UNIT-VI** **Semiconductor Memories**: Memory Types, RAM array organization, DRAM – Types, Operation, Leakage currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory- NOR flash and NAND flash.
Text Books and Reference Books	**TEXT BOOKS:** 1. "Essentials of VLSI circuits and Systems", by Kamran Eshraghian, Eshraghian Douglas and A. Pucknell, PHI, 2005 Edition. 2. "CMOS VLSI Design: circuits and system perspective", by Weste and Harris, Pearson Education, 2015. **REFERENCE BOOKS:** 1. "Linear Integrated circuits", by D. Roy Chowdhury, New Age International, 5th Edition, 2018. 2. "Modern VLSI Design" by Wayne Wolf, Pearson Education, 4th Edition 2015. 3. "Introduction to VLSI Circuits and Systems", by John. P. Uyemura, John Wiley, 2015. 4. "Digital Integrated Circuits" by John M. Rabaey, chandrakasan, nkolic,PHI, 2nd edition, 2016.
E-Resources	http://nptel.ac.in/courses http://tocs.ulb.tu-darmstadt.de/35621702.pdf

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	-	-	2	2	2	2	3	3
CO2	3	3	2	-	2	2	-	-	-	-	-	2	3	3
CO3	3	3	3	1	1	1	-	-	-	-	-	2	3	3
CO4	3	3	2	-	2	2	-	-	-	-	2	2	3	3
CO5	3	3	2	-	-	2	-	-	-	-	2	2	3	3
CO6	3	3	2	2	1	1	-	-	-	-	1	2	3	3

R-20 OPEN ELECTIVES		
1.	20EE41O1	BASICS OF ELECTRICAL VEHICLE
2.	20CS41O1	R PROGRAMMING
3.	20CS41O3	MACHINE LEARNING
4.	20CE41O8	ENVIRONMENTAL POLLUTION AND CONTROL

20EE41O1-BASICS OF ELECTRICAL VEHICLE

Course Category:	Open elective	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practical:**	3-0-0
Pre-requisite:	Basics of physics and chemistry	**Sessional Evaluation:** **External Exam Evaluation:** **Total Marks:**	40 60 100

Course Objectives:	To make the student learn about: 1. The importance of electric vehicle systems 2. The basics of electric vehicle components and storage 3. The basics of battery technology 4. The various charging types and comfort 5. The electric propulsion units in electric vehicle 6. The energy management strategies.	
Course Outcomes:	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the importance of electric vehicle and IC engine systems dynamics
	CO2	Design and develop basic configuration of electric vehicles and hybrid electric vehicles
	CO3	Understand the basics of electric vehicle components and storage
	CO4	Understand the basics of battery technology
	CO5	Choose s suitable drive scheme for developing an electric hybrid vehicle depending on resources
	CO6	Understand the energy management strategies.
Course Content:	**UNIT –I** **Introduction to Hybrid Electric Vehicles:** history of modern transportation importance of different transportation development strategies to future oil supply, introduction to electric vehicles, history of hybrid and electric vehicles, social environmental importance and key challenges of hybrid and electric vehicles, **Conventional vehicles**: vehicle resistance, dynamic equation, power train effort and vehicle speed, vehicle power plant and transmission characteristics, vehicle performance. **UNIT-II** **Hybrid Electric Drive-trains:** Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. **Electric Drive-trains:** Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric Drive-train topologies, fuel efficiency analysis. **UNIT-III** **Energy storage:** Introduction to energy storage requirements in electric vehicles, battery based energy storage and its analysis, fuel cell based energy storage and its analysis, super capacitor based energy storage and its analysis, fly wheel (mechanical capacitor) based energy storage and its analysis	

	UNIT-IV **Battery technology:** Types of batteries, properties of batteries, working principle and construction of lead acid, nickel cadmium, nickel metal hydride, lithium-ion batteries, maintenance and charging of batteries, diagnosing lead acid battery faults **UNIT-V** **Electric propulsion unit:** Introduction to electrical components used in electric vehicles, configuration and control of induction motor drives, BLDC motor drive construction and principle, performance analysis and control **UNIT-VI** **Energy Management Strategies:** Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies
Text books & Reference books:	**Text books:** 1. "Modern electric, hybrid electric and fuel cell vehicles: fundamentals, theory, and design", by M. Ehsani, Y. Gao, and A. Emadi, 2nd Edition, CRC Press, Aug. 2009. 2. Iqbal Hussein, "Electric and Hybrid Vehicles": Design Fundamentals, by Iqbal Hussein, CRC Press, 2003 3."Advanced electric drive vehicles", by A. Emadi, CRC Press, 1st Edition Oct. 2014. 4. "Hybrid electric vehicles: principles and applications with practical perspectives", by Chris Mi, M. AbulMasrur, 2nd Edition,November 2017, John Wiley & Sons Ltd. **Reference books:** 1."Electric & hybrid vehicles – design fundamentals", by Iqbal Hussain, 2nd Edition, CRC Press, 2011. 2."Electric vehicle technology explained", by James Larminie, John Wiley & Sons, 2003. 3."Smart Grid: technology and applications", by JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons inc, 2012.
e-Resources:	http://nptel.ac.in/courses http://iete-elan.ac.in http://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	2	-	2	2	-	-	-	-	-	2	-	-
CO2	3	3	2	-	2	1	-	-	-	-	-	2	-	-
CO3	3	3	1	2	2	1	-	-	-	-	-	2	-	-
CO4	3	3	2	1	2	1	-	-	-	-	-	2	-	-
CO5	3	3	1	1	2	1	-	-	-	-	-	2	-	-
CO6	3	3	2	1	2	-	2	-	-	-	-	2	-	-

20CS41O1 - R PROGRAMMING

<table>
<tr><td>Course Category:</td><td colspan="2">Open Elective</td><td>Credits:</td><td>3</td></tr>
<tr><td>Course Type:</td><td colspan="2">Theory</td><td>Lecture-Tutorial-Practical:</td><td>3-0-0</td></tr>
<tr><td>Prerequisite:</td><td colspan="2">Require fundamental knowledge in any programming language, mathematics and statistical techniques.</td><td>Sessional Evaluation:
Univ. Exam Evaluation:
Total Marks:</td><td>40
60
100</td></tr>
<tr><td>Objectives:</td><td colspan="4">• Gain a foundational understanding of R Programming basics
• Master the R programming and understand how various constructs are implemented in complex problems and applications</td></tr>
<tr><td rowspan="7">Course Outcomes</td><td colspan="4">Upon successful completion of the course, the students will be able to:</td></tr>
<tr><td>CO1</td><td colspan="3">Know the benefits of R, as well as its unique features and quirks, R editing options, Starting R, writing first R script, and finding the R environment</td></tr>
<tr><td>CO2</td><td colspan="3">Using functions and arguments, Making code clear and legible, Extending R with user packages, Using R as a fancy calculator, Constructing and working with vectors.</td></tr>
<tr><td>CO3</td><td colspan="3">Working with vectors, Representing textual data with character vectors, Working with text, and Creating, converting, and working with factors.</td></tr>
<tr><td>CO4</td><td colspan="3">Working with dates in R, Understanding the different ways of representing dates, Throwing time into the mix, Formatting dates and times for pretty printing, Operating on dates and times, Creating matrices, Getting values in and out of a matrix, Using row and column names in a matrix, Performing matrix calculations, and Working with multidimensional arrays.</td></tr>
<tr><td>CO5</td><td colspan="3">Putting data in a data frame, Getting data in and out of a data frame, Working with lists, work with functions, Playing with arguments, Finding objects within the functions, and Working with methods.</td></tr>
<tr><td>CO6</td><td colspan="3">Making choices based on conditions, Looping over different values, Applying functions row-wise and column-wise, Applying functions over values, variables, and list components, Discovering warnings, Reading errors correctly, Finding the bugs, and Optimizing debugging strategies</td></tr>
<tr><td>Course Content</td><td colspan="4"><u>UNIT-I</u>
Introduction to R programming: History of R programming, Reserved words of R, Variables and constants of R, Operators of R, precedence and association of R, data types in R, Decision making statements in R programming, Iterative statements, functions, strings, arrays, vectors, lists, matrices, factors, data frames, data reshaping and data interfacing.
<u>UNIT-II</u>
R-command packages: Standard Command Packages, How to Get Extra Packages of R Commands, How to Install Extra Packages for Windows Users, Running and Manipulating Packages, Loading Packages, Windows-Specific Package Commands.
<u>UNIT-III</u>
Some Simple Math: Use R Like a Calculator, Storing the Results of Calculations.
Reading and Getting Data into R: Using the combine Command for Making Data, Entering Numerical Items as Data, Entering Text Items as Data, Using the scan Command for Making Data, Entering Text as Data, Using the Clipboard to Make Data and Reading a File of Data from a Disk.
Reading Bigger Data Files: The read.csv () Command, Alternative Commands for Reading Data in R, Missing Values in Data Files.</td></tr>
</table>

	UNIT-IV **Viewing Named Objects:** Viewing Previously Loaded Named-Objects, Viewing All Objects, Viewing Only Matching Names and Removing Objects from R. **Manipulating Objects:** Manipulating Vectors, Manipulating Matrix and Data Frames, Manipulating Lists. **Constructing Data Objects:** Making Lists, Making Data Frames, Making Matrix Objects. **Forms of Data Objects:** Testing and Converting, Testing to See What Type of Object You Have, Converting from One Object Form to Another, Convert a Matrix to a Data Frame, Convert a Data Frame into a Matrix, Convert a Data Frame into a List and Convert a Matrix into a list. **UNIT-V** **Simple Hypothesis Testing:** Using the Student's t-test, Two-Sample t-Test with Unequal Variance, Two-Sample t-Test with Equal Variance, One-Sample t-Testing, Using Directional Hypothesis Formula, Syntax and Sub setting Samples in the T-Test. **The Wilcoxon U-Test (Mann-Whitney):** Two-Sample U-Test, One-Sample U-Test, Using Directional Hypotheses, and Formula Syntax and Sub setting Samples in the U-test. **Paired t- and U-Tests:** Correlation and Covariance, Simple Correlation, Covariance, Significance Testing in Correlation Tests and Formula Syntax. **UNIT-VI** Introduction to Graphical Analysis: **Box-whisker Plots:** Basic Box plots, Customizing Box plots, Horizontal Box plots, **Scatter Plots:** 2 Basic Scatter Plots, Adding Axis Labels, www. Plotting Symbols, Setting Axis Limits, Using Formula Syntax, Adding Lines of Best-Fit to Scatter Plots. **Pairs Plots:** (Multiple Correlation Plots) Line Charts, Line Charts Using Numeric Data, Line Charts Using Categorical Data, Pie Charts, Cleveland Dot Charts. Bar Charts: Single-Category Bar Charts and Multiple Category Bar Charts.
Text Books & References Books	**TEXT BOOKS:** 1. Beginning R, the statistical programming language by Dr Mark Gardener. **REFERENCE BOOKS:** 1. "R Programming for Beginners: Fast and Easy Learning" by Steven Keller, Kindle Edition. 2. "A Handbook of Statistical Analyses Using R" by Brian Everitt and Torsten Hothorn
E-Resources	1. https://nptel.ac.in/courses 2. https://freevideolectures.com/university/iitm

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	2	-	2	-	-	-	-	-	-	1	-	-
CO2	3	3	3	2	1	-	-	-	-	-	-	1	-	-
CO3	3	3	2	2	2	-	-	-	-	-	-	1	-	-
CO4	3	3	2	2	2	-	-	-	-	-	-	1	-	-
CO5	3	3	2	2	2	-	-	-	-	-	-	1	-	-
CO6	3	3	2	2	1	-	-	-	-	-	-	1	-	-

20CS41O3 - MACHINE LEARNING

Course category:	Program Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practical:**	3 - 0- 0
Prerequisite:	Probability Theory and Linear Algebra.	**Sessional Evaluation :** **External Evaluation:** **Total Marks:**	40 60 100

Course Objectives	Students undergoing this course are expected:	
	1. To introduce fundamental concepts in machine learning and popular machine learning algorithms. 2. To become familiar with the fundamentals of Supervised Learning techniques 3. To understand & analyze various Unsupervised Learning techniques. 4. To acquire knowledge on principles and techniques of Artificial Neural Networks. 5. To understand different types of Perceptron. 6. To have a profound understanding of Computational Learning Theory.	
Course Outcomes	Upon successful completion of the course, the students will be able to:	
	CO1	Understand the fundamental principles, techniques and applications of Machine Learning.
	CO2	Design and implement machine-learning solutions to classification, regression and clustering problems.
	CO3	Evaluate and interpret the results of the Unsupervised Learning techniques.
	CO4	Design the neural network to meet the needs of control systems and pattern classification issues.
	CO5	Recognize and implement various ways of selecting suitable model parameters for different Machine Learning techniques.
	CO6	Gain the knowledge of Computational Learning Theory.
Course Content	**UNIT – I** **MACHINE LEARNING**: Introduction, Review of Probability Theory and Linear Algebra, Basic definitions of machine learning, types and applications of machine learning, hypothesis space and inductive bias, evaluation, cross-validation. **UNIT - II** **SUPERVISED LEARNING:** Introduction, Linear methods for classification, Linear methods for regression, Support Vector Machine, SVM- the dual formulation, SVM- the maximum margin with noise, Decision trees, over fitting. **UNIT – III** **UNSUPERVISED LEARNING:** Introduction, Instance based learning: K- Nearest neighbour, Feature selection, Feature Extraction, Collaborative filtering-based recommendation, Bayesian learning, Naïve Bayes, Bayesian network, Kernel functions, Non-linear SVM with kernel function. **UNIT – IV** **NEURAL NETWORKS:** Introduction, Biological neurons, Artificial neurons, Mc.Culloch-Pitts model, Neuron Modelling for artificial neural systems, Feed forward network, Feedback network, Types of neural networks. **UNIT – V** **PERCEPTRON:** Introduction, Exclusive OR problem, Single layer perceptron network, Multilayer feed forward networks, Pattern classification, Delta learning rule for multilayer perceptron, Error back propagation algorithm.	

Course Content	**UNIT - VI** **COMPUTATIONAL LEARNING THEORY:** Introduction, PAC learning model, Sample complexity, VC Dimension, Ensemble learning, Introduction to Clustering, k-means clustering, adaptive hierarchical clustering.
Text Books and Reference Books	**TEXT BOOKS:** 1. Mitchell Tom, Machine Learning, McGraw Hill, 1997. 2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer 2006. 3. Jacek M. Zurada, Introduction to Artificial Neural Systems, Jaico Publications. **REFERENCE BOOKS:** 1. Richard O. Duda, Peter E. Hart, David G. Stork. Pattern classification (2nd edition). Wiley, New York, 2001. 2. Nikola K.Kasabov, Foundations of Neural Networks, Fuzzy Systems and Knowled Engineering (The MIT Press)
E-Resources	1. https://onlinecourses.nptel.ac.in/noc18_cs40 2. http://nptel.ac.in/courses/108104049/13

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	3	2	2	-	-	-	**1**	-	-	-	2	2	2
CO2	3	3	3	2	-	-	-	1	-	-	-	2	2	2
CO3	3	3	2	1	-	-	-	1	-	-	-	2	2	2
CO4	3	3	3	2	-	-	-	1	-	-	-	2	2	2
CO5	3	3	3	2	-	-	-	1	-	-	-	2	2	2
CO6	3	3	3	3	-	-	-	1	-	-	-	2	2	2

20CE41O8 - ENVIRONMENTAL POLLUTION AND CONTROL

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**Lecture - Tutorial – Practical**	3-0-0
Prerequisite	None	**Sessional Evaluation**	40
		Semester End Exam Evaluation	60
		Total Marks	100

Course Outcomes	CO1	Understand the nature, significance and effects of pollution.
	CO2	Understand the effects of air pollution and various controlling parameters.
	CO3	Understand the effects of water pollution and various controlling parameters.
	CO4	Understand the various methods for solid and hazardous waste disposal.
	CO5	Understand the environmental legislation acts for industrial pollution control.
	CO6	Understanding the characteristics and effects of noise pollution.

Course Content

UNIT – I

THE NATURE OF POLLUTION:
Air pollution and its effects on living and non-living things. Water pollution and its effects on living and non-living things, solid wastes and land pollution.

UNIT – II

AIR POLLUTION CONTROL:
Influence of meteorological parameters, physical principles, dry systems, fabric collectors, wet scrubbers, electrostatic precipitations, fume incineration tall sacks. Physical separation systems gravity setting chambers, inertial separators, cyclones, fabric collectors, wet scrubbers, electrostatic precipitators, fume incineration.

UNIT – III

WATER POLLUTION CONTROL:
Routine methods for removal of suspended and dissolved impurities, advance methods like chemical oxidation, membrane separation process, and biological process for removal of phosphorous and nitrogen. Land treatment, eutrophication control.

UNIT – IV

SOLD WASTE MANAGEMENT:

Quantities and characterizations of municipal solid wastes, recovery of materials and energy, sanitary land filling. Disposal of hazardous wastes.

	UNIT – V **ENVIRONMENTAL LEGISLATION AND INDUSTRIAL POLLUTION CONTROL:** Legislation conserving water pollution air pollution and hazards wastes. Caste studies of pollution control in cement industries, paper, & pulp industries, brewing. **UNIT – VI** **NOISE POLLUTION CONTROL:** Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; Sources of Noise, typical range of noise levels, types of noise pollution, Characteristics of noise, Effects of noise on the human health, Reactions to noise, psychological effects.
Textbooks and Reference books	**TEXT BOOKS:** 1. CS Rao, *Environmental Pollution Control Engineering*, New Age International Private Limited; 4th edition, October 2021. 2. P. R. Trivedi, *Environmental Pollution and Control*, APH Publishing Corporation, December 2004. 3. J. Jeffrey Peirce, P Aarne Vesilind, Ruth Weiner, *Environmental Pollution and Control*, Butterworth-Heinemann publishers, 4th edition , January 1998. **REFERENCE BOOKS:** 1. Howard Peavy, Donald Rowe, George Tchobanoglous, *Environmental Engineering*, McGraw Hill Education publishers, First edition, July 2017 2. S.C. Bhatia, *Noise Pollution and its control*, Atlantic Publication, 2007. 3. P.A Vesilind, J.J. Peirce, *Environmental pollution and control*, Butterworth-Heinemann publishers, 4th edition, November 1997.

Contribution of Course Outcomes towards achievement of Program Outcomes															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1		3	-	-	-	3	**3**	-	-	-	-	2	-	**3**	-
CO2	3	3	3	2	2	1	2	-	-	-	-	2	-	**3**	3
CO3	3	3	2	2	1	1	2	-	-	-	-	2	-	**3**	3
CO4	3	3	2	2	2	2	2	-	-	-	-	2	-	**3**	3
CO5	3	3	2	2	2	1	2	-	-	-	-	2	-	**3**	3
CO6	-	3	-	-	2	2	2	-	-	-	-	2	-	**3**	3

20AD41SC - DATA REPRESENTATION AND ANALYSIS USING R LABORATORY
(COMMON TO CSE, IT, AI&DS, ECE, AND EEE)

Course Category:	Skill Oriented	**Credits:**	2
Course Type:	Practical	**Lecture-Tutorial-Practical:**	1-0-2
Prerequisite:	Basic Knowledge of Data Analysis and R Programming Fundamentals	**Sessional Evaluation:** **Univ. Exam Evaluation:** **Total Marks:**	40 60 100
Objectives:	• To strengthen the ability to identify and apply the suitable R functions for the given Datasets. • To develop skills to Analyse and Visualize the Data.		

Course Outcomes	After the completion of this Course, the students will be able to Analyze and Visualize the Data.
Course Content	**Session-I:** Download and install R-Programming Environment and install basic packages using install. Packages() command in R. **Session-II:** Learn the R Basic Syntax, Datatypes, variables and Reserved words. **Session-III:** Learn the operators, R statements, Loops and R functions. **Session-IV: R objects and Manipulation on R objects:** Vector, List, Array **Session-V: R objects and Manipulation on R objects:** Data frame, Matrix, Factors. **Session-VI:** Conversion of one form of object to another form, Classes and objects in R, Data Reshaping in R, R Debugging. **Session-VII: Data Interfacing:** Reading file from Disk into R, Read CSV files into R, Using Clip Board for Making Data in R, Read the Binary files into R, Handling Missing values in R. **Session-VIII:** Collect the Datasets for Performing Manipulations, Mathematical operations in R, Solving Linear Equations Using R. **Session-IX: R Regression:** Linear Regression, Logistic Regression, Multiple Regression, Poisson Regression. **Session-X: R Statistics:** Normal Distribution, Binominal Distribution, R classification, Time Series Analysis, R Random Forest, Hypothesis, U-test, Chi-square test in R, Analysis of Correlation and Covariance in R.

	Session-XI: Data Visualization using R: visualization packages in R, Pie Charts, Bar Charts, Box Plots, Histograms, Line Graphs, Scatter Plots. **Session-XII** • Collect Dataset and Perform Statistical Analysis on the Collected data. • Collect Dataset and Perform Regression Analysis on the Collected data. **Session-XIII** • Collect Dataset and Perform Data Visualization on the Collected data. • Collect Dataset and Perform Sentiment Analysis on the Collected data.
Text Books & References Books	**TEXT BOOKS:** 1. Beginning R, the statistical programming language by Dr Mark Gardener. **REFERENCE BOOKS:** 1. "R Programming for Beginners: Fast and Easy Learning" by Steven Keller, Kindle Edition. 2. "A Handbook of Statistical Analyses Using R" by Brian Everitt and Torsten Hothorn. 3. "R Graphics Cookbook" by Winston Chang.
E-Resources	1. https://www.rstudio.com/ 2. https://www.w3schools.com/ 3. https://www.r-project.org/

SUMMER INTERNSHIP

Credits	Sessional Marks	End Examination Marks	Maximum Total Marks
3	40	60	100

NBKR INSTITUTE OF SCIENCE & TECHNOLOGY: VIDYANAGAR

(AUTONOMOUS)

(AFFILIATED TO JNTU ANANTAPUR: ANANTHAPURAMU)

SPSR NELLORE DIST

IV YEAR OF FOUR-YEAR B. TECH DEGREE COURSE – II SEMESTER

ELECTRONICS AND COMMUNICATION ENGINEERING

SCHEME OF INSTRUCTION AND EVALUATION

(With effect from the academic year 2020-2021)

(For the batch admitted in the academic year 2020-2021)

S.No	Course Code	Course Title	Instruction Hours/Week			Credits	Evaluation									
			Sessional-I Marks							Sessional-II Marks			Total Sessional Marks(40)	End Semester Examination		Maximum Total Marks
		THEORY	L	T	D/P		Test$^{\$}$-I	A$^{\#}$-I	Max. Marks	Test$^{\$}$-II	A$^{\#}$-II	Max. Marks	Internal Seminars/ Reviews (40 Marks)	Duration In Hours	Max. Marks	100
1	20EC42PR	Project Work & Summer Internship	-	-	-	12	-	-	-	-	-	40		-	60	100
		TOTAL	-	-	-	12	-	-	-	-	-	40	-	-	60	100

***** Common to ECE & EEE. **Common to ECE, CE, EEE & ME.

A for Assignment (continuous evaluation),

$ Test (Descriptive & Objective) duration = 2 Hours

PROJECT WORK & SUMMER INTERNSHIP

Credits	Sessional Marks	End Examination Marks	Maximum Total Marks
12	40	60	100