PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY

PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
think • innovate • transform

Criterion 1 – Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.3	Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by Electronics and Communication Engineering

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

1. List of courses for the programmes in order of

S. No.	Programme Name
i.	Bachelor of Technology(Electronics and Communication Engineering)
ii.	Master of Technology (Wireless Communications) (Full Time)

2. Syllabus of the courses as per the list.

Legend : Words highlighted with **Blue Color** - Entrepreneurship
Words highlighted with **Red Color** - Employability
Words highlighted with **Purple Color** - Skill Development

1. List of Courses

Sl.No.	Name of the course	Course Code	Year of Introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
2020-21				
1.	Calculus and Linear Algebra	XMA101	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
2.	Programming for Problem Solving	XCP102	2018-19	**Employability**- Test,Assignment, Seminar,Poster Presentation
3.	English	XGS103	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
4.	Applied Chemistry for Engineers	XAC104	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
5.	Workshop Practices	XWP105	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
6.	Calculus, Ordinary Differential Equations and Complex Variable	XMA201	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
7.	Electrical and Electronics Engineering Systems	XBE203	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
8.	Applied Physics for Engineers	XAP204	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
9.	Engineering Graphics	XEG205	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
10.	Transforms and Partial Differential Equations	XMA301	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
11.	Electronic Devices	XEC302	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
12.	Digital System Design	XEC303	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
13.	Signals and Systems	XEC304	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
14.	Entrepreneurship Development	XUM305	2014-15	**Entrepreneurship**- Test,Assignment, Seminar

15.	Constitution of India*#	XUM306	2019-20	**Entrepreneurship**- Test,Assignment, Seminar
16.	Network Theory	XEC307	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
17.	Electronics Devices and Networks Lab	XEC308	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
18.	Digital System Design Lab	XEC309	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
19.	In Plant Training – 1	XEC310	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
20.	Probability Theory and Stochastic Processes	XMA401	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
21.	Total Quality Management	XUM402	2014-15	**Entrepreneurship**- Test,Assignment, Seminar
22.	Human ethics, values, rights and gender equality*#	XUM403	2014-15	**Entrepreneurship**- Test,Assignment, Seminar
23.	Transmission Lines and Waveguides	XEC405	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
24.	Analog Communication	XEC406	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
25.	Electronic Circuits	XEC407	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
26.	Microprocessors and Microcontrollers	XEC408	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
27.	Electronic Circuits Lab	XEC409	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
28.	Microprocessors and Microcontrollers Lab	XEC410	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
29.	Analog Integrated Circuits	XEC501	2013-14	**Employability**- Test,Assignment, Seminar,Poster Presentation
30.	Digital Communication	XEC502	2017-18	**Employability**- Test,Assignment, Seminar,Poster Presentation
31.	Computer Architecture and Organisation	XEC503	2013-14	**Employability**- Test,Assignment, Seminar,Poster Presentation

32.	Digital Signal Processing	XEC504	2013-14	**Employability**- Test,Assignment, Seminar,Poster Presentation
33.	Effective Technical Communication	XGS507	2008-09	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
34.	Analog Integrated Circuits Lab	XEC508	2017-18	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
35.	Analog and Digital Communication Lab	XEC509	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
36.	Digital Signal Processing Lab	XEC510	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
37.	In Plant Training – 2	XEC511	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
38.	PCB Design through ULTIBOARD*#	XECM01	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
39.	Economics for Engineers	XUM601	2013-14	**Employability**- Test,Assignment, Seminar,Poster Presentation
40.	VLSI Design and Embedded Systems	XEC607	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
41.	VLSI Design and Embedded Systems Lab	XEC608	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
42.	Mini Project	XEC609	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
43.	PLC and Sensorics*#	XECM02	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
44.	Embedded Systems and VLSI Design	XEC702	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
45.	Microwave Engineering and Optical Communication	XEC703	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
46.	Professional Elective - III	XEC704*	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
47.	Project Phase – I	XEC707	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion

48.	Career Development Skills	XGS708	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
49.	In-plant Training – III	XEC 709	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
50.	Matlab For Wireless Communication	XEC710	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
51.	Project Phase – II	XEC804	2014-15	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
52.	Wireless Communication	YWC102	2012-13	**Employability**- Test,Assignment, Seminar,Poster Presentation
53.	Wireless Networks	YWC103	2012-13	**Employability**- Test,Assignment, Seminar,Poster Presentation
54.	Digital Communication Lab	YWC106	2012-13	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
55.	Research Methodology and IPR	YRM107	2012-13	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
56.	English for Research Paper Writing	YEGOE1	2012-13	**Employability**- Test,Assignment, Seminar,Poster Presentation
57.	Wireless Networks Lab	YWC109	2012-13	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
58.	AdvancedRadiationSystems	YWC203	2014-15	**Employability**- Test,Assignment, Seminar,Poster Presentation
59.	Radio Frequency Systems lab	YWC206	2012-13	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
60.	MiniProject	YWC207	2012-13	**Skill Developement**- Quiz, Test, Assignment,Seminar, Group Discussion
61.	Constitution of India	YPSOE1	2012-13	**Entrepreneurship**- Test,Assignment, Seminar

COURSE CODE			XMA101	L	T	P	C
COURSE NAME			CALCULUS AND LINEAR ALGEBRA	3	1	0	4
C	P	A		L	T	P	H
3	0.5	0.5		3	1	0	4

PREREQUISITE: Differentiation and Integration

Course Outcomes		Domain	Level
CO1	**Apply** orthogonal transformation to reduce quadratic form to canonical forms.	Cognitive	Remembering Applying
CO2	**Apply** power series to tests the convergence of the sequences and series. Half range Fourier sine and cosine series.	Cognitive Psychomotor	Applying Remembering Guided Response
CO3	**Find** the derivative of composite functions and implicit functions. Euler's theorem and Jacobian	Cognitive Psychomotor	Remembering Guided Response
CO4	**Explain** the functions of two variables by Taylorsexpansion, by finding maxima and minima with and without constraints using Lagrangian Method. Directional derivatives, Gradient, Curl andDivergence.	Cognitive Affective	Remembering Understanding Receiving
CO5	**Apply** Differential and Integral calculus to notions of Curvature and to improper integrals.	Cognitive	Applying

UNITI -MATRICES	**15 Hours**
Linear Transformation - Eigen values and Eigen vectors -Properties of Eigen values and Eigen vectors - Cayley-Hamilton Theorem – Diagonalisation of Matrices – Real Matrices: Symmetric - Skew-Symmetric and Orthogonal Quadratic form – canonical form - Nature of Quadratic form and Transformation of Quadratic form to Canonical form (Orthogonal only).	
UNIT2 -SEQUENCES AND SERIES	**15 Hours**
Sequences: Definition and examples-Series: Types and convergence- Series of positive terms – Tests of convergence: comparison test, Integral test and D'Alembert's ratio test-. Fourier series: Half range sine and cosine series- Parseval's Theorem.	
UNIT 3 -MULTIVARIABLE CALCULUS: PARTIAL DIFFERENTIATION	**15 Hours**
Limits and continuity –Partial differentiation – Total Derivative – Partial differentiation of Composite Functions: Change of Variables – Differentiation of an Implicit Function - Euler's Theorem- Jacobian.	
UNIT 4 - MULTIVARIABLE CALCULUS: MAXIMA AND MINIMA AND VECTOR CALCULUS	**15 Hours**
Taylor's theorem for function of Two variables- Maxima, Minima of functions of two variables:	

with and without constraints - Lagrange's Method of Undetermined Multipliers – Directional Derivatives - Gradient, Divergence and Curl.
UNIT 5 - DIFFERENTIAL AND INTEGRAL CALCULUS **15 Hours**
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

	LECTURE	TUTORIAL	TOTAL
	60	15	75

TEXT BOOKS

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11th Reprint, 2015**. (Unit-1, Unit-3 and Unit-4).**
2. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2014. **(Unit-2).**
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2010. **(Unit-5).**

REFERENCE BOOKS

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson, Reprint, 2002.
2. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
3. D. Poole, "Linear Algebra: A Modern Introduction", 2nd Edition, Brooks/Cole, 2005.
4. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

Table 1: Mapping of Cos with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	2			2					1		2
CO 2	3	1								1		1
CO 3	3	1								1		1
CO 4	3	2								1		1
CO 5	3	2			1					1		2
	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		

1 – 5 → 1, 6 – 10 → 2, 11 – 15 → 3

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

COURSE CODE	XCP102	L	T	P	C
COURSE NAME	PROGRAMMINGFORPROBLEMSOLVING	3	0	2	5
PREREQUISITES		L	T	P	H
C:P:A		3	0	4	7

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Define***programmingfundamentalsand***Solve***simpleprogramsusingI/O statements	Cognitive Psychomotor	Remember Understand Apply
CO2	***Define***syntaxand ***writesimpleprograms***using control structures and arrays	Cognitive Psychomotor	Remember Understand Apply
CO3	***Explain***and ***writesimpleprograms***usingfunctionsand pointers	Cognitive Psychomotor	Understand Apply
CO4	***Explain***and ***writesimpleprograms***usingstructures and unions	Cognitive Psychomotor	Understand Apply Analyze
CO5	***Explain***and ***writesimpleprograms***usingfiles and ***Build***simple projects	Cognitive Psychomotor	Remember Understand Create

UNIT I - PROGRAMMINGFUNDAMENTALSAND INPUT/OUTPUTSTATEMENTS — **9+6 Hours**

Theory

Introductiontocomponentsofacomputersystem,Program–Flowchart– Pseudocode–Software– IntroductiontoClanguage–Character set–Tokens: Identifiers,Keywords,Constants,andOperators–sampleprogramstructure-Header files – Data Types-Variables- Output statements –Input statements. **Practical**

1.Program to displayasimple pictureusingdots.
2.Program for addition of two numbers
3.Program to swap two numbers
4.Program to solve anymathematical formula.

UNIT II- CONTROLSTRUCTUREANDARRAYS — **9+6 Hours**

Theory

ControlStructures–ConditionalControlstatements:Branching,Looping-Unconditionalcontrolstructures:switch,break,continue,gotostatements–Arrays:OneDimensionalArray–Declaration–Initialization–Accessing ArrayElements–Searching–Sorting–TwoDimensionalarrays-Declaration –Initialization– Matrix Operations –MultiDimensional Arrays-Declaration– Initialization.Storageclasses:auto–extern–static.Strings:Basicoperations on strings.

Practical

1. Program to find greatest of 3 numbers using BranchingStatements
2. Program to displaydivisible numbers between n1and n2 usinglooping Statement
3. Program to remove duplicate element in an array.
4. Program to perform stringoperations.
5. Performingbasic sorting algorithms.

UNIT III- FUNCTIONSANDPOINTERS	9+6 Hours

Theory

Functions:Builtinfunctions–UserDefinedFunctions-Parameterpassing methods-Passingarraystofunctions–Recursion-Programsusingarraysand functions.Pointers-Pointerdeclaration-Addressoperator-Pointer expressions&pointerarithmetic-Pointersandfunction-Callbyvalue-Call byReference-Pointertoarrays-UseofPointersinself-referentialstructures-Notion of linked list(no implementation).

Practical

1.Program to find factorial of a given number using four function types.
2.Programs usingRecursion such asFindingFactorial, Fibonacci series,Ackermanfunction etc.Quick sort orMerge sort
3.Programs usingPointers

UNIT IV -STRUCTURESANDUNIONS	9+6 Hours

Theory

Structures andUnions -Givingvalues to members-Initializingstructure-Functions and structures- Passingstructure to elements to functions- Passing entire function to functions-Arrays of structure -Structurewithin a structure and Union.

Practical

1.Program to readand displaystudent mark sheet Structureswith variables
2.Program to readand displaystudent marks of a class usingStructures with arrays
3.Program to create linkedlist usingStructures with pointers

UNIT V - FILES	9+6 Hours

Theory

FilemanagementinC-FileoperationfunctionsinC-Definingandopeninga file-Closingafile-Thegetwandputwfunctions-Thefprintf&fscanf functions - fseek function– Files andStructures.

Practical

1.Program for copying contents of one file to another file.
2.Program usingfiles usingstructure with pointer

HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	0	30	75

TEXT BOOKS/ REFERENCES

1.ByronGottfried,"ProgrammingwithC",IIIEdition,(IndianAdaptedEdition),TMHpublications, 2010
2. YeshwantKanethker,“Let us C”, BPBPublications, 2008.
3. Brian W. Kernighan and Dennis M. Ritchie,"The C Programming Language", Pearson EducationInc. 2005.
4. Behrouz A.Forouzanand Richard. F. Gilberg,"A Structured ProgrammingApproachUsingC",II Edition, Brooks–Cole ThomsonLearningPublications, 2001
5. Johnson baugh R. and Kalin M., “ApplicationsProgrammingin ANSIC”,IIIEdition, Pearson

EducationIndia, 2003.
6. E. Balaguruswamy, Programmingin ANSIC,Tata McGraw-Hill.

Table 1: COs Versus POs Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			3						2	3	2	
CO2	3	2			2						2	3	2	
CO3	2	2	1	2	2						2	2	2	
CO4	2	2	1	2	2						2	2	2	
CO5	2	2	1		2			1		2	2	2	2	
Total	**12**	**10**	**3**	**4**	**11**			**1**		**2**	**10**	**12**	**10**	
Scaled Value	3	2	1	1	3			**1**		1	2	3	2	

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

COURSE CODE			**XGS103**	**L**	**T**	**P**	**C**
COURSE NAME			**ENGLISH**	**3**	**0**	**0**	**3**
PREREQUISITES				**L**	**T**	**P**	**H**
C	**P**	**A**		**3**	**0**	**0**	**3**
2.6	**0.4**	**0**					

COURSE OUTCOMES:		**Domain**	**Level**
CO1	***Ability*** to recall the meaning for proper usage	Cognitive	Remember
CO2	***Apply*** the techniques in sentence patterns	Cognitive	Apply
CO3	***Identify***the common errors in sentences	Cognitive	Remember
CO4	***Construct*** the Nature and Style of sensible Writing	Cognitive	Create
CO5	***Practicing***thewriting skills	Psychomotor	Guided Response
CO6	***Grasping*** the techniques in learning sounds and etiquettes	Psychomotor	Adapting

UNITI - VOCABULARY BUILDING	9 Hours
1.1 The concept of Word Formation 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations.	
UNIT II - BASIC WRITING SKILLS	**9 Hours**
2.1 Sentence Structures 2.2 Use of phrases and clauses in sentences 2.3 Importance of proper punctuation 2.4 Creating coherence 2.5 Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely	
UNIT III - IDENTIFYING COMMON ERRORS IN WRITING	**9 Hours**
3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés	
UNIT IV - NATURE AND STYLE OF SENSIBLE WRITING	**9 Hours**
4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion	
UNIT V - WRITING PRACTICES	**9 Hours**
5.1 Comprehension 5.2 Précis Writing 5.3 Essay Writing	
UNIT VI - ORAL COMMUNICATION	
(This unit involves interactive practice sessions in Language Lab) - Listening Comprehension - Pronunciation, Intonation, Stress and Rhythm	

- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) Practical English Usage. Michael Swan. OUP. 1995
(ii)Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Table 1: Mapping of Cos with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO2	2	0	0	0	0	0	2	0	1	0	0	0	0	0
CO3	1	0	0	0	0	0	1	0	1	0	0	0	0	0
CO4	2	0	0	0	0	0	1	0	1	0	0	0	0	0
CO5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	7	0	0	0	0	0	6	0	4	0	0	0	0	0
Scaled Value	2	0	0	0	0	0	2	0	1	0	0	0	0	0
	1	0	0	0	0	0	1	0	1	0	0	0	0	0

1-5= 1, 6-10 = 2, 11-15= 3

0-No Relation, 1- Low Relation, 2 - Medium Relation, 3- High

COURSE CODE			XAC104	L	T	P	C
COURSE NAME			APPLIED CHEMISTRY FOR ENGINEERS	3	1	1	5
PREREQUISITES			Nil	L	T	P	H
C	P	A		3	1	2	6
3.5	1.0	0.5					

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Identify***the periodic properties such as ionization energy, electron affinity, oxidation states and electro negativity. ***Describe*** the various water quality parameters like hardness and alkalinity.	Cognitive Psychomotor	Remember Perception
CO2	***Explain*** *and****Measure*** microscopic chemistry in terms of atomic, molecular orbitals and intermolecular forces.	Cognitive Psychomotor	Understand Set
CO3	***Interpret*** bulk properties and processes using thermodynamic and kinetic considerations.	Cognitive Psychomotor Affective	Apply Mechanism Receive
CO4	***Describe, Illustrate*** *and* ***Discuss*** the chemical reactions that are used in the synthesis of molecules.	Cognitive Psychomotor Affective	Remember Analyze Perception Respond
CO5	***Apply, Measure*** and ***Distinguish*** the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques	Cognitive Psychomotor	Remember Apply Mechanism

UNIT I -PERIODIC PROPERTIES AND WATER CHEMISTRY	8+3+6

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries. **Water Chemistry**-Water quality parameters-Definition and explanation of hardness, determination of hardness by EDTA method-Introduction to alkalinity.

UNIT II- USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA	12+3+6

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Corrosion-Types, factors affecting corrosion rate and Control methods. Use of free energy considerations in metallurgy through Ellingham diagrams. Advantages of electroless plating, electroless plating of nickel and copper on Printed Circuit Board (PCB).

UNITIII - ATOMIC AND MOLECULAR STRUCTURE	10+3+6

Schrodinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles.. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic molecules. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Intermolecular forces and potential energy surfaces

Ionic, dipolar and Vander waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

UNIT IV - SPECTROSCOPIC TECHNIQUES AND APPLICATIONS	7+3+6

Principles of spectroscopy and selection rules. Electronic spectroscopy-chromophore, auxochromes, types of electronic transition and application. Fluorescence and its applications in medicine. Vibrational spectroscopy-types of vibrations, Instrumentation and applications. Rotational spectroscopy of diatomic molecules. Nuclear magnetic resonance spectroscopy-concept of chemical shift and applications-magnetic resonance imaging. Diffraction and scattering.

UNITV - STEREOCHEMISTRY AND ORGANIC REACTIONS	8+3+6

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization reactions and ring opening reactions. Synthesis of a commonly used drug molecule-Aspirin and paracetamol.

HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	15	30	90

TEXT BOOKS

1. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rdition), New Delhi, Shoban Lal Nagin Chand & Co., 1993
2. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science, 2006.
3. Trapp. C, Cady, M. Giunta. C, Atkins's Physical Chemistry, 10th Edition, Oxford publishers, 2014.
4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd, 1983.
5. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., 1976.
6. Banwell. C.N, Fundamentals of Molecular Spectroscopy, (3th Edition), McGraw-Hill Book Company, Europe 1983.
7. Bahl B.S. and ArunBahl, Advanced Organic Chemistry, (4th edition), S./ Chand & Company Ltd. New Delhi, 1977.
8. P. S. Kalsi, Stereochemistry: Conformation and mechanism, (9th Edition), New Age International Publishers, 2017.

REFERENCE BOOKS

1. Puri B R Sharma L R and Madan S Pathania, " Principles of Physical Chemistry", Vishal publishing Co., Edition 2004
2. Kuriocose, J C and Rajaram, J, "Engineering Chemistry", Volume I/II, Tata McGraw-Hill Publishing Co. Ltd. New Delhi, 2000

E Resources - MOOCs:

1. http://www.mooc-list.com/course/chemistry-minor-saylororg
2. https://www.canvas.net/courses/exploring-chemistry
3. http://freevideolectures.com/Course/2263/Engineering-Chemistry-I
4. http://freevideolectures.com/Course/3001/Chemistry-I
5. http://freevideolectures.com/Course/3167/Chemistry-II
6. http://ocw.mit.edu/courses/chemistry/

Laboratory Part **30 hrs**

Experiments :

1. Determination of chloride ion present in the water sample by Argentometric method.	**CO1**
2. Determination of total, temporary and permanent hardness of water sample by EDTA method.	**CO1**
3. Determination of cell constant and conductance of solutions.	**CO2**
4. Potentiometry - determination of redox potentials and emfs.	**CO2**
5. Determination of surface tension and viscosity.	**CO3**
6. Adsorption of acetic acid by charcoal.	**CO3**
7. Determination of the rate constant of a reaction.	**CO4**
8. Estimation of iron by colorimetric method.	**CO4**
9. Synthesis of a polymer/drug.	**CO5**
10. Saponification/acid value of an oil.	**CO5**

REFERENCE BOOKS

1. Mendham, Denney R.C,. Barnes J.D and Thomas N.J.K., "Vogel's Textbook of Quantitative Chemical Analysis", 6th Edition, Pearson Education, 2004.
2. Garland, C. W.; Nibler, J. W.; Shoemaker, D. P. "Experiments in Physical Chemistry", 8th Ed.; McGraw-Hill: New York, 2003.

E Resources -MOOCs:

1.http://freevideolectures.com/Course/2380/Chemistry-Laboratory-Techniques
2. http://freevideolectures.com/Course/2941/Chemistry-1A-General-Chemistry-Fall-2011
3.http://ocw.mit.edu/courses/chemistry/5-301-chemistry-laboratory-techniques

Table 1 : Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	0	0	0	0	0	2	3	3
CO2	2	0	0	0	0	0	1	2	2
CO3	3	0	0	0	0	0	2	3	3
CO4	8	0	0	0	0	0	3	3	3
CO5	3	0	0	0	0	0	2	2	3

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

0-No Relation, 1- Low Relation, 2-Medium Relation, 3-High Relation

SUB CODE			**XWP105**	**L**	**T**	**P**	**C**
SUB NAME			**WORKSHOP PRACTICES**	**1**	**0**	**2**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
1	**2**	**0**		**1**	**0**	**4**	**5**

PREREQUISITE:

Course outcomes		**Domain**	**Level**
CO1	***Summarize*** the machining methods and ***Practice*** machining operation.	Cognitive Psychomotor	Understanding Guided response
CO2	***Defining***metal casting process, moulding methods and **relates**Casting and Smithy applications.	Cognitive Psychomotor	Remembering Perception
CO3	***Plan*** basic carpentry and fitting operation and ***Practice*** carpentry and fitting operations.	Cognitive Psychomotor	Applying Guided response
CO4	***Summarize*** metal joining operation and ***Practice*** welding operation.	Cognitive Psychomotor	Understanding Guided response
CO5	***Illustrate*** the, electrical and electronics basics and ***Makes*** appropriate connections**.**	Cognitive Psychomotor	Understanding Origination

COURSE CONTENT

EXP. NO	**TITLE**	**CO RELATION**
1	Introduction to Machining Process	CO1
2	Plain Turining using Lathe Operation	CO1
3	Introduction to CNC	CO1
4	Demonstration of Plain Turning using CNC	CO1
5	Study of Metal Casting Operation	CO2
6	Demonstration of Molding Process	CO2
7	Study of Smithy Operation	CO2
8	Study of Carpentry Tools	CO3
9	Half lap joint – Carpentry	CO3
10	Mortise and Tenon joint – Carpentry	CO3

11	Study of fitting tools	CO3
12	Square fitting	CO3
13	Triangular fitting	CO3
14	Study of Welding Tools	CO4
15	Square butt joint - welding	CO4
16	Tee joint – Welding	CO4
17	Introduction to house wiring	CO5
18	One lamp controlled by one switch	CO5
19	Two lamps controlled by single switch	CO5
20	Staircase wiring	CO5

TEXT BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay
2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

REFERENCES

1. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.
2. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi
3. Workshop Technology by B.S. Raghuwanshi, DhanpatRai and Co., New Delhi.
4. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

E RESOURCES

1. **http://nptel.ac.in/courses/112107145/**

Mapping of CO's with PO'S:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	2	2	1			1	1		1	2
CO2	2	1	2	2	1			1	1		1	2
CO3	2	1	2	2	1			1	1		1	2
CO4	2	1	2	2	1			1	1		1	2
CO5	2	1	2	2	1			1	1		1	2
Total												
Scaled												

0- No relation 1- Low relation 2- Medium relation 3- High relation

COURSE CODE			XMA201	L	T	P	C
COURSE NAME			CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE	3	1	0	4
C	P	A		L	T	P	H
3	0.5	0.5		3	1	0	4

PREREQUISITE:Mathematics I (Calculus and Linear Algebra)

Course Outcomes		Domain	Level
CO1	**Find** double and triple integrals and to find line, surface and volume of an integral by **Applying** Greens, Gauss divergence and Stokes theorem.	Cognitive	Applying Remembering
CO2	**Solve** first order differential equations of different types which are solvable for p, y, x and Clairaut's type.	Cognitive	Applying
CO3	**Solve** Second order ordinary differential equations with variable coefficients using various methods.	Cognitive	Applying
CO4	**Use** CR equations to verify analytic functions and to find harmonic functions and harmonic conjugate. Conformal mapping of translation and rotation. Mobius transformation.	Cognitive Psychomotor	Remembering Applying Guided Response
CO5	**Apply** Cauchy residue theorem to evaluate contour integrals involving sine and cosine function and to state Cauchy integral formula, Liouvilles theorem. Taylor's series, zeros of analytic functions, singularities, Laurent's series.	Cognitive Affective	Applying Receiving

UNIT - I MULTIVARIABLE CALCULUS (Integration)	**12 Hours**

Multiple Integration: Double integrals (Cartesian) - change of order of integration in double integrals - Change of variables (Cartesian to polar) - Triple integrals (Cartesian), Scalar line integrals - vector line integrals - scalar surface integrals - vector surface integrals - Theorems of Green, Gauss and Stokes.

UNIT - IIFIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS	**12 Hours**

Exact - linear and Bernoulli's equations - Euler's equations - Equations not of first degree: equations solvable for p - equations solvable for y- equations solvable for x and Clairaut's type.

UNIT - III ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS	**12 Hours**

Second order linear differential equations with variable coefficients- method of variation of parameters - Cauchy-Euler equation- Power series solutions- Legendre polynomials- Bessel functions of the first kind and their properties.

UNIT - IV COMPLEX VARIABLE – DIFFERENTIATION	**12 Hours**

Differentiation-Cauchy-Riemann equations- analytic functions-harmonic functions-finding harmonic conjugate- elementary analytic functions (exponential, trigonometric, logarithm) and their properties- Conformal mappings- Mobius transformations and their properties.

UNIT - V COMPLEX VARIABLE - INTEGRATION	**12 Hours**

Contour integrals - Cauchy-Goursat theorem (without proof) - Cauchy Integral formula (without proof)-Liouville's theorem (without proof)- Taylor's series- zeros of analytic functions- singularities- Laurent's series – Residues- Cauchy Residue theorem (without proof)- Evaluation of definite integral involving sine and cosine- Evaluation of certain improper integrals using the Bromwich contour.

HOURS	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOK

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40thth Edition, 2008.

REFERENCE BOOKS

1.G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9th Edition, Pearson,Reprint, 2002.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3.W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", 9thEdn. Wiley India, 2009.
4. S. L. Ross, "Differential Equations", 3rd Ed., Wiley India, 1984.
5.E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
6. E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
7.J. W. Brown and R. V. Churchill, "Complex Variables and Applications", 7th Ed., McGrawHill, 2004.
8. N.P. Bali andManish Goyal, "A text book of Engineering Mathematics", LaxmiPublications, Reprint, 2008.

Table 1: Mapping of Cos with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3	2			2					1		2
CO 2	3	1								1		1
CO 3	3	1								1		1
CO 4	3	2								1		1
CO 5	3	2			1					1		2
	15	8	0	0	3	0	0	0	0	5	0	7
Scaled Value	3	2			1					1		

$1 – 5 \rightarrow 1$, $6 – 10 \rightarrow 2$, $11 – 15 \rightarrow 3$

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

COURSE CODE	XBE203	L	T	P	C
COURSE NAME	ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS	3	1	1	5

PREREQUISITES			Physics	L	T	P	H
C	P	A		3	1	2	6
3	1	0					

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Define, Relate,*** the fundamentals of electrical parameters and***build***and ***explain***AC, DC circuits by Using measuring devices	Cognitive Psychomotor	Remember Understand Mechanism set
CO2	***Define and Explain*** the of operation of DCand AC machines.	Cognitive	Remember Understand
CO3	***Recall, Illustrate,***varioussemiconductor Devices and their applications and displays the input output characteristics of basic semiconductor devices.	Cognitive Psychomotor	Remember Understand Mechanism
CO4	***Relate Explain,*** the number systems and logic gates. ***Construc***t the different digital circuit.	Cognitive Psychomotor	Remember Understand Orgination
CO5	***Label, Outline*** different types of microprocessors and their applications.	Cognitive	Remember Understand

UNIT -I FUNDAMENTAL OF DC AND AC CIRCUITS, MEASUREMENTS	**9+6+12**

Fundamentals of DC– Ohm's Law – Kirchoff's Laws - Sources - Voltage and Current relations – Star/Delta Transformation - Fundamentals of AC – Average Value, RMS Value, Form Factor - AC power and Power Factor, Phasor Representation of sinusoidal quantities - Simple Series, Parallel, Series Parallel Circuit - Operating Principles of Moving coil and Moving Iron Instruments (Ammeter, Voltmeter) and Dynamometer type meters (Watt meter and Energy meter).

UNIT -II ELECTRICAL MACHINES	**9 + 3+0**

Construction, Principle of Operation, Basic Equations, Types and Application of DC Generators, DC motors - Basics of Single Phase Induction Motor and Three Phase Induction Motor- Construction, Principle of Operation of Single Phase Transformer, Three phase transformers, Auto transformer.

UNIT - III SEMICONDUCTOR DEVICES	**9 + 0+8**

Classification of Semiconductors, Construction, Operation and Characteristics: PN Junction Diode – Zener Diode, PNP, NPN Transistors, Field Effect Transistors and Silicon Controlled Rectifier – Applications.

UNIT - IV DIGITAL ELECTRONICS	**9 + 3+10**

Basic of Concepts of Number Systems, Logic Gates, Boolean Algebra, Adders, Subractors, multiplexer, demultiplexer, encoder, decoder, Flipflops, Up/Down counters, Shift Registers.

UNIT - V MICROPROCESSORS	**9+ 3+0**

Architecture, 8085, 8086 - Interfacing Basics: Data transfer concepts – Simple Programming concepts.

LIST OF EXPERIMENTS :

1.	Study of Electrical Symbols, Tools and Safety Precautions, Power Supplies.
2.	Study of Active and Passive elements – Resistors, Inductors and Capacitors, Bread Board.
3.	Verification of AC Voltage, Current and Power in Series and Parallel connection.
4.	Testing of DC Voltage and Current in series and parallel resistors which are connected in breadboard by using Voltmeter, Ammeter and Multimeter.
5.	Fluorescent lamp connection with choke.
6.	Staircase Wiring.
7.	Forward and Reverse bias characteristics of PN junction diode.
8.	Forward and Reverse bias characteristics of zener diode.
9.	Input and Output Characteristics of NPN transistor.
10.	Construction and verification of simple Logic Gates.
11.	Construction and verification of adders.
12.	Construction and verification of subtractor.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	**45**	**15**	**30**	**90**

TEXT BOOKS

1. Metha V.K., 2008. Principles of Electronics. Chand and Company.
2. Malvino, A. P., 2006. Electronics Principles. 7th ed. New Delhi: Tata McGraw-Hill.
3. Rajakamal, 2007. Digital System-Principle & Design. 2nd ed. Pearson education.
4. Morris Mano, 1999. Digital Design. Prentice Hall of India.
5. Ramesh, S. Gaonkar, 2000. Microprocessor Architecture, Programming and its Applications with the 8085. 4th ed. India: Penram International Publications.

REFERENCE BOOKS

1. Corton,H.,2004. Electrical Technology. CBS Publishers & Distributors.
2. Syed, A. Nasar, 1998, Electrical Circuits. Schaum Series.
3. Jacob Millman and Christos, C. Halkias, 1967. Electronics Devices.New Delhi: McGraw-Hill.
4. Millman, J. andHalkias, C. C., 1972. Integrated Electronics: Analog and Digital Circuits and Systems. Tokyo: McGraw-Hill, Kogakusha Ltd.
5. Mohammed Rafiquzzaman, 1999. Microprocessors - Theory and Applications: Intel and Motorola. Prentice Hall International.

E-REFERENCES

1. NTPEL, Basic Electrical Technology (Web Course), Prof. N. K. De, Prof. T. K. Bhattacharya and Prof. G. D. Roy, IIT Kharagpur.
2. Prof.L.Umanand, http://freevideolectures.com/Course/2335/Basic-Electrical-Technology#, IISc Bangalore.

3. http://nptel.ac.in/Onlinecourses/Nagendra/, Dr. NagendraKrishnapura , IIT Madras.
4. Dr.LUmanand , http://www.nptelvideos.in/2012/11/basic-electrical-technology.html, IISC Bangalore

Table: 1 Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	1	1			1	1	1			
CO 2	3	3	1	1	1	1			1	1	1			
CO 3	2	2	2	1	2	2	1	1	1	1	1			
CO 4	2	2	1	1	1	1	1	1	1	1	1			
CO 5	2	2	1	1	1	1	1	1	1	1	1			
Total	12	12	6	5	6	6	3	3	5	5	5			
Scaled value	3	3	2	1	2	2	1	1	1	1	1			

1-5 → 1, 6-10 → 2, 11-15 → 3

0 – No relation, 1 – Low relation, 2 – Medium relation, 3 – High relation

COURSE CODE			**XAP204**	**L**	**T**	**P**	**C**
COURSE NAME			**APPLIED PHYSICS FOR ENGINEERS**	**3**	**1**	**2**	**6**
PREREQUISITE			**Basic Physics in HSC level**	**L**	**T**	**P**	**H**
C	**P**	**A**		**3**	**1**	**3**	**7**
2.8	**0.8**	**0.4**					

COURSE OUTCOMES		**Domain**	**Level**
CO1	***Identify*** the basics of mechanics, ***explain*** the principles of elasticity and ***determine*** its significance in engineering systems and technological advances.	Cognitive Psychomotor	Remember, Understand Mechanism
CO2	***Illustrate*** the laws of electrostatics, magneto-statics and electromagnetic induction; ***use*** and ***locate*** basic applications of electromagnetic induction to technology.	Cognitive Psychomotor Affective	Remember, Analyze, Mechanism Respond
CO3	***Understand*** the fundamental phenomena in optics by measurement and ***describe*** the working principle and application of various lasers and fibre optics.	Cognitive Psychomotor Affective	Understand, Apply Mechanism Receive
CO4	***Analyse*** energy bands in solids, ***discuss*** and ***use*** physics principles of latest technology using semiconductor devices.	Cognitive Psychomotor Affective	Understand, Analyze Mechanism

			Receive
CO5	***Develop*** Knowledge on particle duality and ***solve***Schrodinger equation for simple potential.	Cognitive:	Understand, Apply

UNIT - I MECHANICS OF SOLIDS	**9+3+9**

Mechanics: Force - Newton's laws of motion - work and energy - impulse and momentum - torque - law of conservation of energy and momentum - Friction.
Elasticity: Stress - Strain - Hooke's law - Stress strain diagram - Classification of elastic modulus - Moment, couple and torque - Torsion pendulum - Applications of torsion pendulum - Bending of beams - Experimental determination of Young's modulus: Uniform bending and non-uniform bending.

UNIT -II ELECTROMAGNETIC THEORY	**9+3+3**

Laws of electrostatics - Electrostatic field and potential of a dipole; Dielectric Polarisation, Dielectric constant, internal field - ClausiusMossotti Equation - Laws of magnetism - Ampere's Faraday's law; Lenz's law - Maxwell's equation - Plane electromagnetic waves; their transverse nature - expression for plane, circularly and elliptically polarized light - quarter and half wave plates - production and detection of plane, circularly and elliptically polarized light.

UNIT –III OPTICS, LASERS AND FIBRE OPTICS	**9+3+12**

Optics: Dispersion- Optical instrument: Spectrometer - Determination of refractive index and dispersive power of a prism- Interference of light in thin films: air wedge - Diffraction: grating.
LASER: Introduction - Population inversion -Pumping - Laser action - Nd-YAG laser - CO_2 laser - Applications
Fibre Optics: Principle and propagation of light in optical fibre - Numerical aperture and acceptance angle - Types of optical fibre - Fibre optic communication system (Block diagram).

UNIT - IV SEMICONDUCTOR PHYSICS	**9+3+6**

Semiconductors: Energy bands in solids - Energy band diagram of good conductors, insulators and semiconductors - Concept of Fermi level - Intrinsic semiconductors - Concept of holes - doping - Extrinsic semiconductors - P type and N type semiconductors - Hall effect.
Diodes and Transistors: P-N junction diode - Forward bias and reverse bias - Rectification action of diode - Working of full wave rectifier using P N junction diodes - PNP and NPN transistors - Three different configurations - Advantages of common emitter configuration - working of NPN transistor as an amplifier in common emitter configuration.

UNIT -V QUANTUM PHYSICS	**9+3+0**

Introduction to quantum physics, black body radiation, Compton effect, de Broglie hypothesis, wave – particle duality, uncertainty principle, Schrodinger wave equation (Time dependent and Time independent), particle in a box, Extension to three dimension - Degeneracy.

TEXT BOOKS

1. Gaur R. K. and Gupta S. L., "Engineering Physics", DhanpatRai Publications, 2009.
2. Avadhanulu M. N. "Engineering Physics" (Volume I and II), S. Chand & Company Ltd., New Delhi, 2010.

REFERENCE BOOKS

1. Palanisamy P. K., "Engineering Physics", Scitech Publications (India) Pvt. Ltd, Chennai.
2. Arumugam M., "Engineering Physics" (Volume I and II), Anuradha Publishers, 2010.
3. Senthil Kumar G., " Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2011.
4. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2007.

E RESOURCES

1. NPTEL , Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.

LABORATORY

1.	Torsional Pendulum - determination of moment of inertia and rigidity modulus of the given material of the wire.
2.	Uniform Bending - Determination of the Young's Modulus of the material of the beam.
3.	Non-Uniform Bending - Determination of the Young's Modulus of the material of the beam.
4.	Meter Bridge - Determination of specific resistance of the material of the wire.
5.	Spectrometer - Determination of dispersive power of the give prism.
6.	Spectrometer - Determination of wavelength of various colours in Hg source using grating.
7.	Air wedge - Determination of thickness of a given thin wire.
8.	Laser - Determination of wavelength of given laser source and size of the given micro particle using Laser grating.
9.	Post office Box - Determination of band gap of a given semiconductor.
10.	PN Junction Diode - Determination of V-I characteristics of the given diode.

REFERENCE BOOKS

1. Samir Kumar Ghosh, "A text book of Advanced Practical Physics", New Central Agency (P) Ltd, 2008.
2. Arora C.L., "Practical Physics", S. Chand & Company Ltd., New Delhi, 2013.
3. UmayalSundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	15	30	90

Table 1: Mapping of CO's with PO:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS1	PS2
CO1	3	2	2	2	1	-	-	-	1	-	-	1		
CO2	3		1		1	-	-	-		-	-	1		
CO3	3	2	2	2	1	-	-	-	1	-	-	1		
CO4	3	2	2	2	1	-	-	-	1	-	-	1		
CO5	3		2			-	-	-		-	-	1		

Total	**15**	**6**	**9**	**6**	**4**				**3**			**5**		
Scaled to 0,1,2,3 scale	**3**	**2**	**2**	**2**	**1**				**1**			**1**		

1 – 5 →1, 6 – 10→ 2, 11 – 15→ 3

0-No Relation, 1- Low Relation, 2-Medium Relation, 3-High Relation

SUB CODE			**XEG205**	**L**	**T**	**P**	**C**
SUB NAME			**ENGINEERING GRAPHICS AND DESIGN**	**2**	**0**	**1**	**3**
C	**P**	**A**		**L**	**T**	**P**	**H**
1.75	**1**	**0.25**		**2**	**0**	**2**	**4**

PREREQUISITE: NIL

Course outcomes:		**Domain**	**Level**
CO1	*Apply* the national and international standards, *construct* and *practice* various curves	Cognitive, Psychomotor and Affective	Applying, Guided response and Responds to Phenomena
CO2	*Interpret*, *construct* and *practice* orthographic projections of points, straight lines and planes.	Cognitive, Psychomotor and Affective	Understanding, Mechanism and Responds to Phenomena
CO3	*Construct Sketch* and *Practice* projection of solids in various positions and true shape of sectioned solids.	Cognitive, Psychomotor and Affective	Applying, Complex Overt Response and Responds to Phenomena
CO4	*Interpret*, *Sketch* and *Practice* the development of lateral surfaces of simple and truncated solids, intersection of solids.	Cognitive, Psychomotor and Affective	Understanding, Complex Overt Response and Responds to Phenomena
CO5	*Construct sketch* and *practice* isometric and perspective views of simple and truncated solids.	Cognitive, Psychomotor and Affective	Applying, Complex Overt Response and Responds to Phenomena

UNIT-IINTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE	**12+6**

Importance of graphics in engineering applications – use of drafting instruments – BIS specifications and conventions as per SP 46-2003.

Pictorial representation of engineering objects – representation of three dimensional objects in two dimensional media – need for multiple views – developing visualization skills through free hand sketching of three dimensional objects.

Polygons & curves used in engineering practice – methods of construction – construction of ellipse, parabola and hyperbola by eccentricity method – cycloidal and involute curves – construction – drawing of tangents to the above curves. Practice on basic tools of CAD

UNIT - IIPROJECTION OF POINTS, LINES AND PLANE SURFACES	**12+6**

General principles of orthographic projection – first angle projection – layout of views –

projections of points, straight lines located in the first quadrant – determination of true lengths of lines and their inclinations to the planes of projection – traces – projection of polygonal surfaces and circular lamina inclined to both the planes of projection-CAD practice on points and lines

UNIT-IIIPROJECTION OF SOLIDS AND SECTIONS OF SOLIDS	**12+6**

Projection of simple solids like prism, pyramid, cylinder and cone when the axis is inclined to one plane of projection – change of position & auxiliary projection methods – sectioning of above solids in simple vertical positions by cutting plane inclined to one reference plane and perpendicular to the other and above solids in inclined position with cutting planes parallel to one reference plane – true shapes of sections-CAD practice on solid models

UNIT - IVDEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS	**12+6**

Need for development of surfaces – development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders and cones – development of lateral surfaces of the above solids with square and circular cutouts perpendicular to their axes – intersection of solids and curves of intersection –prism with cylinder, cylinder & cylinder, cone & cylinder with normal intersection of axes and with no offset-CAD practice on intersection of solids.

UNIT - VISOMETRIC AND PERSPECTIVE PROJECTIONS	**12+6**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones – principles of perspective projections – projection of prisms, pyramids and cylinders by visual ray and vanishing point methods-CAD practice on isometric view

	THEORY	**PRACTICAL**	**TOTAL**
	30	**60**	**90**

TEXT BOOKS

1. Bhatt,N.D, “Engineering Drawing”, Charotar Publishing House, 46th Edition-2003.
2. Natarajan,K.V, “ A Textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2006 .
3. Dr. P.K. Srividhya, P. Pandiyaraj, “Engineering Graphics”, PMU Publications, Vallam, 2013

REFERENCES

1. Luzadder and Duff, “Fundamentals of Engineering Drawing” Prentice Hall of India PvtLtd, XI Edition - 2001.
2. Venugopal,K. and Prabhu Raja, V., “Engineering Graphics”, New Age International(P) Ltd., 2008.
3. Gopalakrishnan.K.R,. “Engineering Drawing I & II”, Subhas Publications, 1998.
4. Shah,M.B and Rana,B.C.,”Engineering Drawing”, Pearson Education,2005.

E RESOURCES

1. http://periyarnet/Econtent
2. http://nptel.ac.in/courses/112103019/

Table 1: Mapping of CO's with PO'S:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3	2	3	1	1	2	3	3	3	-
CO2	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO3	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO4	3	3	3	1	3	1	3	1	1	1	2	3	3	-
CO5	3	3	3	1	3	1	3	1	1	1	2	3	3	-
Total	15	15	15	6	15	6	15	5	5	6	11	3	3	-
Scaled	3	3	3	2	3	2	3	1	1	2	3	3	3	-

0 - No relation 1- Low relation 2- Medium relation 3- High relation

1-5 → 1, 6-10→ 2, 11-15 → 3

COURSE CODE			XMA301	L	T	P	C
COURSE NAME			TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4
C	P	A		L	T	P	H
3	0.5	0.5		3	1	0	4
PREREQUISITE			Nil				

Learning Objectives

- Introduction of methods to solve linear partial differential equations of second order and higher order.
- Find the solutions of pde's are determined by conditions at the boundaries of the spatial domain and initial conditions at time zero.
- Provide sufficient knowledge to engineering students in the specific mathematical tools and techniques such as Fourier series, Fourier transform and Z transform.
- To enable students to use Fourier series method both in the solution of pde and other wider context.

COURSE OUTCOMES:

Course outcomes:		Domain	Level
CO1:	**Solve** standard types of first order and second order partial differential equations with constantcoefficients. Elimination of arbitrary constants and functions.	Cognitive Psychomotor	Apply Imitation
CO2	***State*** Dirichlet's condition. **Explain** general Fourierseries of the curve y = f(x) in the interval (0,2π) (-π, π), (0, 2ℓ), (-ℓ,ℓ) and (0, π). Perform harmonic analysis	Cognitive Psychomotor	Remembering Understanding Imitation
CO3	***Solve*** the standard Partial Differential Equations, arising in engineeringProblems, like one dimensional Wave equation and Heat flow equation by Fourier series method in Cartesian coordinates. Classify second order quasi pde.	Cognitive Affective	Apply Receiving
CO4	**Find** the Fourier transform and Fourier sine and cosinetransforms of simple functions using definition and its properties.	Cognitive	Remembering Apply
CO5	***Apply*** the properties of Z transform to ***Find*** theZtransform and inverse Z transform of sequence and functions, and to solve the difference equation usingthem.	Cognitive	Remembering Apply

Unit - I PARTIAL DIFFERENTIAL EQUATIONS	**12 Hours**
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients.	
Unit - II FOURIER SERIES	**12 Hours**
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series –Parseval's identity – Harmonic Analysis.	
Unit - III APPLICATIONS OF BOUNDARY VALUE PROBLEMS	**12 Hours**
Classification of second order quasi linear partial differential equations – Solutions of one dimensional wave equation – One dimensional heat equation – Steady state solution of two dimensional heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates**.**	
Unit - IV FOURIER TRANSFORM	**12 Hours**
Fourier integral theorem (without proof) – Fourier transform pairs – Fourier Sine and Cosine transforms – properties – Transforms of simple functions – Convolution theorem – Parseval's identity.	
Unit - V Z TRANSFORM AND DIFFERENCE EQUATIONS	**12 Hours**
Z-transform – Elementary properties – Inverse Z – transform – Convolution theorem – Initial and Final value theorems - Formation of difference equations – Solution of difference equations. using Z-transform.	

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**45**	**15**	**60**

TEXT BOOKS

1.Grewal, B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi (2015).

2.Veerarajan. T., "Engineering Mathematics Volume III", Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.

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1. Churchill, R.V. and Brown, J.W., "Fourier Series and Boundary Value Problems", Fourth Edition, McGraw Hill Book Co., Singapore (1987).
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Engineering Mathematics Volume III", S. Chand & Company Ltd., New Delhi (1996).
3. Bali N.P. and Manish Goyal, "A Text Book of Engineering Mathematics" 7th Edition Lakshmi Publications (P) Limited, New Delhi (2007).
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
6. Narayanan, S., ManicavachagomPillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volume: II and III, S.Viswanathan (Printers and Publishers) Pvt. Ltd., Chennai (2002).

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1. **nptel**: Advanced Engineering Mathematics, Prof. Jitendra Kumar, Department of Mathematics, Indian Institute of Technology, Kharagpur, India.

Table 1: CO Vs GA Mapping

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3									1		1
CO 2	3									1		1
CO 3	3	2								1	1	2
CO 4	3	2			1					1	1	1
CO 5	3	2			1					1	1	1
	15	6	0	0	2	0	0	0	0	5	3	6
Scaled Value	3	2			2					1	1	2

$1 - 5 \rightarrow 1$, $6 - 10 \rightarrow 2$, $11 - 15 \rightarrow 3$

0 - No Relation, 1 - Low Relation, 2- Medium Relation, 3- High Relation

COURSE CODE			XEC302	L	T	P	C
COURSE NAME			ELECTRONIC DEVICES	3	0	0	3
PREREQUISITES				L	T	P	H
C	P	A		3	0	0	3
3	0	0					

LEARNING OBJECTIVES

- To introduce the operation of different types of semiconductor devices.
- To familiarize the integrated circuits technology.
- To provide knowledge on the characteristics of opto electronic devices

COURSE OUTCOMES:		Domain	Level
CO1	***Define*** the principles of semiconductor physics.	Cognitive	Remembering
CO2	***Describe*** *the operation and characteristics of* semiconductor diodes.	Cognitive	Understanding
CO3	***Understand*** the operation and Characteristics of BJT and FET	Cognitive	Understanding
CO4	***Discuss*** the operation and characteristics of power electronic and optoelectronic diodes	Cognitive	Understanding
CO5	***Illustrate*** the Integrated Circuit fabrication processes**.**	Cognitive	Understanding

UNIT - I Introduction To Semiconductor Technology — **9 Hours**

ReviewofQuantumMechanics,ElectronsinperiodicLattices,E-kdiagrams.Energybandsinintrinsicandextrinsicsilicon;Carriertransport:diffusioncurrent,driftcurrent,mobilityandresistivity;sheetresistance,designofresistors.

UNIT - II Junction Diodes And Applications — **9 Hours**

Generationandrecombinationofcarriers;PoissonandcontinuityequationP-Njunctioncharacteristics,I-V characteristics,andsmallsignalswitchingmodels;Avalanchebreakdown,Zenerdiode , Half wave Rectifier, Full wave Rectifier, Bridge Rectifier and Voltage Regulators.

UNIT - III Transistors And Applications — **9 Hours**

BipolarJunctionTransistor,I-Vcharacteristics, NPN and PNP Transistors ,Ebers-MollModel, MOScapacitor,C-Vcharacteristics, Junction Field Transistor, VI Characteristics, MOSFET,I-Vcharacteristics,andsmallsignalmodelsofMOStransistor.

UNIT - IV Special Electronic Devices — **6 Hours**

SCR, DIAC, TRIAC , LED, LDR,LCD, Photodiode, Photo Transistorandsolarcell.

UNIT - V Introduction To Integrated Circuit Technology — **6+6Hours**

Integratedcircuitfabricationprocess:oxidation,diffusion,ionimplantation,photolithography,etching,chemicalvapordeposition,sputtering,twin-tubCMOSprocess.

HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45		0	45

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky , "Electronics devices and Circuit Theory" 11th Edition, UBS Publishers, New Delhi, 2013.
2. G.Streetman,andS.K.Banerjee,"SolidStateElectronicDevices,"7thedition,Pearson,2014.
3. D.Neamen,D.Biswas"SemiconductorPhysicsandDevices,"McGraw-HillEducationJacob
4. Millman and Christos C.Halkias, "Electronic Devices and Circuits" 3rd Edition, Tata McGraw Hill,New Delhi, 2010.

REFERENCES

1.C.T.Sah,"Fundamentalsofsolidstateelectronics,"WorldScientificpublishingCo.Inc,1991.
2. S.M.SzeandK.N.Kwok,"PhysicsofSemiconductorDevices,"3rdedition, John Wiley&Sons,2006.
3. Y.TsividisandM.Colin,"OperationandModelingoftheMOSTransistor,"OxfordUniversity .Press,2011.
4. David A. Bell ,"Electronic devices and circuits", Prentice Hall of India, 2004.
5. S.Salivahanan, "Electronics devices and circuits". 2nd Edition, Tata McGraw Hill, 2008.

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1. http://www.rtna.ac.th/departments/elect/Data/EE304/Electronic%20Devices%20and%20Circuit%20Theory.pdf
2. http://nptel.ac.in/courses/117103063/ (Prof. ChitralekhaMahanta, NPTEL, Basic Electronics, IIT-Guwahati)
3. http://nptel.ac.in/video.php?subjectId=117103063 (Prof. Gautam Barua, NPTEL, Basic Electronics, IIT-Guwahati)
4. http://nptel.ac.in/courses/117101106/ (Prof. A N chandorkar, NPTEL, Analog Electronics, IIT-Bombay)

Table 1 :Mapping of COs with Pos

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	1	1	1	1				1
CO 2	3	2	1	1	1	1	1	1				1
CO 3	3	2	1	1	1	1	1	1				1
CO 4	3	2	1	1	1	1	1	1				1
CO 5	3	2	1	1	1	1	1	1				1
CO6	3	2	1	1	1	1	1	1				1
Total	18	12	6	6	6	6	6	6				6
Scaled Value	4	3	2	2	2	2	2	2				2

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSECODE			XEC303	L	T	P	C
COURSE NAME			DIGITALSYSTEMDESIGN	3	0	0	3
PREREQUISITE							
C	P	A		L	T	P	H
3	0	0		3	0	0	3

LEARNING OBJECTIVES

- To introduce basic postulates of Boolean Algebra, methods for simplification of Boolean expression and Code conversion.
- To outline the design of combinational logic circuits.
- To understand the design of sequential logic circuits.
- To introduce the function of logic families and Programmable Logic Devices.
- To implement logic gates, combinational and sequential circuits using VHDL.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Understand*** the fundamental concepts and Karnaugh map techniques used in digital electronics.	Cognitive	Understanding
CO2	***Understand*** the fundamental concepts of combinational logic circuits	Cognitive	Understanding
CO3	***Understand***the fundamental concepts of Sequential logic circuits	Cognitive	Understanding
CO4	Explain the function of LogicFamilies, Memories and Programmable Logic Devices	Cognitive	Understanding
CO5	***Use***VHDLtosimulate combinational and sequential logic circuits.	Cognitive	Understanding

UNIT -I LOGIC SIMPLIFICATION **9 Hours**

Logic Simplification :Review of Boolean Algebra and DeMorgan's Theorem, SOP &POS forms, Canonical forms, Karnaughmaps upto 6 variables, Binary codes, Code Conversion.

UNIT - IICOMBINATIONAL LOGIC CIRCUITS **9 Hours**

MSI devices : Comparator, Multiplexer, Demultiplexer, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

UNIT - III SEQUENTIAL LOGIC CIRCUITS DESIGN **9 Hours**

Sequential Logic Design : Building blocks S-R, J KandMaster-Slave JKFF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite State Machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits :Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.

UNIT -IV LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES **9 Hours**

Logic Families and Semiconductor Memories : TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory

elements, Concept of Programmable logic devices : FPGA. Logic implementation using Programmable Devices.

UNIT - V VERY HIGHSPEED INTEGRATED CIRCUIT HARDWARE DESCRIPTION LANGUAGE(VHDL)	**9 Hours**

VLSIDesignflow:Designentry:Schematic,FSM&HDL,differentmodelingstylesinVHDL,Datatypes andobjects,Dataflow,BehavioralandStructuralModeling,Synthesis andSimulationVHDLconstructsandcodesforcombinationalandsequentialcircuits.

HOURS	**LECTURE**	**TUTORIAL**	**TOTAL**
	45	**0**	**45**

TEXT BOOKS

1. R.P.Jain,"ModerndigitalElectronics",TataMcGrawHill,4thedition, 2009.
2. DouglasPerry,"VHDL",TataMcGrawHill,4thedition,2002.
3.W.H.Gothmann,"DigitalElectronics – Anintroductiontotheoryandpractice",PHI,2nd edition,2006.
4. D.V.Hall,"DigitalCircuitsandSystems",TataMcGrawHill,1989
5. CharlesRoth,"DigitalSystemDesignusingVHDL",TataMcGrawHill2nd edition 2012.

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1.M. Morris Mano, and Michael D.Ciletti "Digital Design: with an Introduction to Verilog HDL", VHDL, and SystemVerilog (6thEdition) 6th Edition, Pearson/Prentice Hall of India Pvt. Ltd., New Delhi, 2017.
2.Thomas L. Floyd, "Digital Fundamentals, 11thEdition, Pearson Education", Inc, NewDelhi, 2014.

E REFERENCES

1.Lecture series on Digital Circuits & Systems by Prof.S.Srinivasan, Department of Electrical Engineering, IIT Madras.For more details on NPTEL visit http://nptel.ac.in
2.**http://nptel.ac.in/courses/117106114/**
3.http://nptel.ac.in/courses/117106086/1

Table 1 : CO Vs PO Mapping

	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	3	3	2	2	2	1	1				2
CO 2	3	3	3	2	2	2	1	1				2
CO 3	3	3	3	2	2	2	1	1				2
CO 4	3	3	3	2	2	2	1	1				2
CO 5	3	3	3	2	2	2	1	1				2
CO6	3	2	2	1	3	1	1	1				2
Total	**18**	**17**	**17**	**11**	**13**	**11**	**6**	**6**				**6**
Scaled Value	**4**	**4**	**4**	**3**	**3**	**3**	**1**	**1**				**1**

0 - No Relation 1 - Low Relation , 2 - Medium Relation, 3- High Relation

COURSECODE			XEC304	L	T	P	C
COURSE NAME			SIGNALS AND SYSTEMS	3	0	0	3
PREREQUISITE							
C	P	A		L	T	P	H
3	0	0		3	0	0	3

LEARNING OBJECTIVES

- To introduce students the concept and theory of signals and systems needed in electronics and telecommunication engineering fields.
- To introduce students to the basic idea of signal and system analysis and its characterization in time and frequency domain

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Describe*** and **C*lassify*** the signals & systems	Cognitive	Remembering Understanding
CO2	***Find*** and ***Apply*** FT and DFTand ***Analyze*** the properties of LSI systems.	Cognitive	Applying Analyzing
CO3	***Find*** and ***solve*** Laplace Transform to study the response of LSI systems	Cognitive	Remembering Applying
CO4	***Find*** and ***solve*** Z transform to study the performance of Discrete Time Signals	Cognitive	Remembering Applying
CO5	***Interpret*** the relation between the continuous and discrete time signals bySampling and Reconstruction.	Cognitive	Remembering Understanding

UNIT - I INTRODUCTION TO SIGNALS AND SYSTEMS — **9 Hours**

An Introduction to Signals and Systems: Energyandpowersignals,continuousanddiscretetimesignals,continuousanddiscreteamplitudesignals.Systemproperties:linearity, additivityandhomogeneity,shift-invariance,causality,stability,realizability.

UNIT- II LINEARSHIFT INVARIANT(LSI)SYSTEMS — **9 Hours**

LinearShift Invariant(LSI)systems,impulseresponseandstepresponse,convolution,input-outputbehaviorwithaperiodicconvergentinputs.Characterizationofcausalityandstabilityoflinearshift-invariantsystems.Systemrepresentationthroughdifferentialequationsanddifferenceequations.

UNIT – III FOURIERTRANSFORM — **9 Hours**

Periodicandsemi-periodicinputstoanLSIsystem,thenotionofafrequency responseanditsrelationtotheimpulseresponse,Fourierseriesrepresentation,theFourierTransform,convolution/multiplicationandtheireffectinthefrequencydomain,magnitudeandphaseresponse,Fourierdomainduality.TheDiscrete-TimeFourierTransform(DTFT)andtheDiscreteFourierTransform(DFT).Parseval'sTheorem. Theideaofsignalspaceandorthogonalbases.

UNIT - IVLAPLACETRANSFORM	9 Hours

TheLaplaceTransform,notionof EigenfunctionsofLSIsystems,abasisof Eigenfunctions,regionofconvergence,polesandzerosofsystem,Laplacedomainanalysis,solutionto differentialequationsandsystembehavior.

Thez-Transformfordiscretetimesignalsandsystems-eigenfunctions,regionofconvergence,z-domainanalysis.

UNIT - VSAMPLINGTHEOREMAND RECONSTRUCTION	9 Hours

State-spaceanalysisandmulti-input,multi-outputrepresentation.Thestate-transitionmatrixanditsrole.TheSamplingTheoremanditsimplications-Spectraofsampledsignals.Reconstruction:idealinterpolator,zero-orderhold,first-orderhold,andsoon.Aliasinganditseffects.Relationbetweencontinuousanddiscretetimesystems.

HOURS	LECTURE	TUTORIAL	TOTAL
	45	0	45

TEXT BOOKS

1. A.V.Oppenheim,A.S.WillskyandI.T.Young,"SignalsandSystems",PrenticeHall,1983.
2. R.F.Ziemer,W.H.TranterandD.R.Fannin,"SignalsandSystems-ContinuousandDiscrete",4thedition,PrenticeHall,1998.
3. Papoulis,"CircuitsandSystems:AModernApproach",HRW,1980.
4. B.P.Lathi,"SignalProcessingandLinearSystems",OxfordUniversityPress,c1998.
5.DouglasK.Lindner,"IntroductiontoSignalsandSystems",McGrawHillInternationalEdition:c1999.
6.SimonHaykin,BarryvanVeen,"SignalsandSystems",JohnWileyandSons(Asia)PrivateLimited,c1998.
7.RobertA.Gabel,RichardA.Roberts,"SignalsandLinearSystems",JohnWileyandSons,1995.
8.M.J.Roberts,"SignalsandSystems-AnalysisusingTransformmethodsandMATLAB",TMH,2003.
9.J.Nagrath,S.N.Sharan,R.Ranjan,S.Kumar,"SignalsandSystems",TMHNewDelhi,2001.
10.AshokAmbardar,"AnalogandDigitalSignalProcessing",2ndEdition,Brooks/ColePublishingCompany(AninternationalThomsonPublishingCompany),1999.

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1.JohnG.ProakisandD.G.Manolakis,DigitalSignalProcessing:Principles,AlgorithmsAndApplications,PrenticeHall,1997.
2.D.J.DeFatta,J.G.Lucasand W.S.Hodgkiss,DigitalSignalProcessing,JohnWiley&Sons,1988

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https://onlinecourses.nptel.ac.in /noc18_ee02/preview

Mapping of COs with POs:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	1	1	1	1				1
CO 2	3	3	2	1	1	1	1	1				1
CO 3	3	3	2	1	1	1	1	1				1
CO 4	3	3	2	1	1	1	1	1				1
CO 5	3	3	2	1	1	1	1	1				1
CO 6	3	3	2	1	1	1	1	1				1
	18	**18**	**12**	**6**	**6**	**6**	**6**	**6**				**6**

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSE CODE			XUM305	L	T	P	C
COURSE NAME			ENTREPRENEURSHIP DEVELOPMENT	2	0	0	2
PREREQUISITE:			Nil	L	T	P	H
C	P	A		2	0	0	2
2.7	0	0.3					

COURSE OUTCOMES		Domain	Level
CO1	***Recognise*** and ***describe*** the personal traits of an entrepreneur.	Affective Cognitive	Receiving Understanding
CO2	***Determine*** the new venture ideas and ***analyse*** the feasibility report.	Cognitive	Understanding Analysing
CO3	***Develop*** the business plan and ***analyse*** the plan as an individual or in team.	Affective Cognitive	Receiving Analysing
CO4	***Describe*** various parameters to be taken into consideration for launching and managing small business.	Cognitive	Understanding
CO5	***Explain the*** technological management and Intellectual Property Rights	Cognitive	Understanding

UNIT - IENTREPRENEURIAL TRAITS AND FUNCTIONS	**9 Hours**
Definition of Entrepreneurship; competencies and traits of an entrepreneur; factors affecting Entrepreneurship Development; Role of Family and Society ; Achievement Motivation; Entrepreneurship as a career and national development;	
UNIT - IINEW PRODUCT DEVELOPMENT AND VENTURE CREATION	**9 Hours**
Ideation to Concept development; Sources and Criteria for Selection of Product; market assessment ; Feasibility Report ;Project Profile; processes involved in starting a new venture; legal formalities; Ownership; Case Study.	
UNIT - IIIENTREPRENEURIAL FINANCE	**9 Hours**
Financial forecasting for a new venture; Finance mobilization; Business plan preparation; Sources of Financing, Angel Investors and Venture Capital; Government support in startup promotion.	
UNIT - IVLAUNCHING OF SMALL BUSINESS AND ITS MANGEMENT	**9 Hours**
Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units.	
UNIT - VTECHNOLOGY MANAGEMENT, IPR PORTFOLIO FOR NEW PRODUCT VENTURE	**9 Hours**
Technology management; Impact of technology on society and business; Role of Government in supporting Technology Development and IPR protection; Entrepreneurship Development Training and Other Support Services.	

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	0	0	45

TEXT BOOKS

1. Hisrich, 2016, *Entrepreneurship*, Tata McGraw Hill, New Delhi.
2. S.S.Khanka, 2013, *Entrepreneurial Development*, S.Chand and Company Limited, New Delhi.

REFERENCES

1. Mathew Manimala, 2005, *Entrepreneurship Theory at the Crossroads, Paradigms & Praxis*, Biztrantra ,2nd Edition.
2. Prasanna Chandra, 2009, *Projects – Planning, Analysis, Selection, Implementation and Reviews*, Tata McGraw-Hill.
3. P.Saravanavel, 1997, *Entrepreneurial Development*, Ess Pee kay Publishing House, Chennai.
4. Arya Kumar,2012, *Entrepreneurship: Creating and Leading an Entrepreneurial Organisation*, Pearson Education India.
5. Donald F Kuratko, T.V Rao, 2012, *Entrepreneurship: A South Asian perspective*, Cengage Learning India.
6. Dinesh Awasthi, Raman Jaggi, V.Padmanand, *Suggested Reading / Reference Material for Entrepreneurship Development Programmes* (EDP/WEDP/TEDP), EDI Publication, Entrepreneurship Development Institute of India, Ahmedabad. Available from: http://www.ediindia.org/doc/EDP-TEDP.pdf

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1. Jeff Hawkins, " Characteristics of a successful entrepreneur", ALISON Online entrepreneurship courses, "https://alison.com/learn/entrepreneurial-skills
2. Jeff Cornwall, "Entrepreneurship -- From Idea to Launch", Udemy online Education, https://www.udemy.com/entrepreneurship-from-idea-to-launch/

Table 1: COs Vs GA Mapping

CO/GA	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO1	0	0	0	0	0	1	0	0	3	3	0	1
CO2	0	0	1	2	3	2	1	3	1	2	3	0
CO3	0	0	0	0	0	0	0	0	3	3	3	2
CO4	0	0	0	0	0	1	1	2	3	0	3	3
CO5	0	0	0	0	0	1	1	3	0	0	0	3
Original	0	0	1	2	3	5	3	8	10	8	9	9
Scaled	0	0	1	1	1	1	1	2	3	2	2	2

1-5→1, 6-10 →2, 11-15→3

0 – No Relation, 1- Low Relation, 2- Medium Relation, 3- High Relation

COURSE CODE	XUM306	L	T	P	C
COURSE NAME	CONSTITUTION OF INDIA	0	0	0	0
PREREQUISITE:	NIL	L	T	P	H
C:P:A	0:0:0	3	0	0	3

COURSE OUTCOMES		Domain	Level
CO1	***Understand*** theConstitutional History	Cognitive	Understanding
CO2	***Understand*** the Powers and Functions	Cognitive	Understanding
CO3	***Understand*** the Legislature	Affective	Remembering
CO4	***Understand*** the Judiciary	Affective	Remembering
CO5	***Understand*** the Centre State relations	Cognitive	Understanding

UNIT - I	**08 Hours**

Constitutional History- The Constitutional Rights- Preamble- Fundamental Rights- Fundamental Duties- Directive principles of State Policy.

UNIT - II	**09 Hours**

The Union Executive- The President of India (powers and functions)- Vice-President of India- The Council of Ministers-Prime Minister- Powers and Functions.

UNIT - III	**10 Hours**

Union Legislature- Structure and Functions of Lok Sabha- Structure and Functions of Rajya Sabha- Legislative Procedure in India- Important Committes of LokSabha- Speaker of the Lok Sabha.

UNIT - IV	**09 Hours**

The Union Judiciary- Powers of the Supreme Court- Original Jurisdiction- Appelete jurisdictions- Advisory Jurisdiction- Judicial review.

UNIT - V	**09 Hours**

Centre State relations- Political Parties- Role of governor, powers and functions of Chief Minister-Legislative Assembly- State Judiciary- Powers and Functions of the High Courts.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	0	0	45

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1. W.H.Morris Shores- Government and politics of India, NewDelhi,B.1.Publishers,1974.
2. M.V.Pylee- Constitutional Government in India, Bombay, Asia Publishing House, 1977.
3. R.Thanker- The Government and politics of India, London:Macmillon, 1995.
4. A.C.Kapur- Select Constitutions S,Chand& Co.,NewDelhi, 1995
5. V.D.Mahajan- Select Modern Governments,S,Chand&Co, NewDelhi,1995.
6. B.C.Rout- Democractic Constitution of India.
7. GopalK.Puri- Constitution of India, India 2005.

Table 1: Mapping of COs with POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO 1	2			1					
CO 2	2			1					
CO 3	2			1					1
CO 4	2			1				1	1
CO 5	2	2		1				1	1
Total	10	2		5				2	3
Scaled to 0,1,2,3	2	1		1				1	1

1-5 →1, 6-10 →2, 11-15 →3

0 – No Relation, 1- Low Relation, 2- Medium Relation, 3- High Relation

COURSE CODE			XEC307	L	T	P	C
COURSE NAME			NETWORKTHEORY	3	0	0	3
PREREQUISITES			Mathematics	L	T	P	H
C	P	A		3	0	0	3
3	0	0					

LEARNING OBJECTIVES

- To make the students to understand the basic laws and theorems of AC and DC electrical circuits.
- To familiarize the transient and steady state behaviour of networks.
- To impart the knowledge on the frequency response characteristics of RLC and filter circuits.

COURSE OUTCOMES:		Domain	Level
CO1	***Describe and Understand*** the concepts of nodal, mesh analysis and network theorems.	Cognitive	Remembering Understanding
CO2	Recognize and Distinguish the response of a network	Cognitive	Remembering Understanding
CO3	***Distinguish*** RL, RC and RLC networks and ***Analyze*** their characteristics	Cognitive	Understanding Analyzing
CO4	***Understand*** the various functions of network and the stability of network.	Cognitive	Understanding
CO5	***Classify*** and ***Explain*** *the* different types of filters	Cognitive	Understanding Understanding

UNIT - I DC CIRCUIT ANALYSIS AND NETWORK THEOREMS — **9 Hours**

NodeandMeshAnalysis,matrixapproachofnetworkcontainingvoltageandcurrentsources,andreactance,sourcetransformationandduality.
Networktheorems:Superposition,reciprocity,Thevenin's,Norton's,MaximumpowerTransfer,compensationandTallegen'stheorem

UNIT - II TRIGONOMETRIC AND EXPONENTIAL FOURIER SERIES — **9 Hours**

Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

UNIT - III TRANSIENT ANALYSIS — **9 Hours**

Laplacetransformsandproperties:Partialfractions,singularityfunctions,waveformsynthesis,analysisofRC,RL,andRLCnetworkswithandwithoutinitialconditionswithLaplacetransformsevaluationofinitialconditions.

UNIT - IV NETWORK FUNCTIONS: POLES AND ZEROS — **9 Hours**

Transientbehavior,conceptofcomplexfrequency,Drivingpointsandtransferfunctionspolesandzerosofadmittancefunction,theirproperties,sinusoidalresponsefrompole-zerolocations,convolutiontheorem

UNIT - VRESONANCE IN RLC CIRCUITS AND FILTERS				6+6
Twofourportnetworkandinterconnections,Behaviorsofseriesandparallelresonantcircuits,Introductiontolowpass,highpass,bandpassandbandrejectfilters.				
	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
HOURS	**45**		**0**	**45**

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky , "Electronics devices and Circuit Theory" 11th Edition, UBS Publishers, New Delhi, 2013.
2. G.Streetman,andS.K.Banerjee,"SolidStateElectronicDevices,"7thedition,Pearson,2014.
3. D.Neamen,D.Biswas"SemiconductorPhysicsandDevices,"McGraw-HillEducationJacob
4. Millman and Christos C.Halkias, "Electronic Devices and Circuits" 3rd Edition, Tata McGraw Hill,New Delhi, 2010.

REFERENCES

1.C.T.Sah,"Fundamentalsofsolidstateelectronics,"WorldScientificpublishingCo.Inc,1991.
2. S.M.SzeandK.N.Kwok,"PhysicsofSemiconductorDevices,"3rdedition, John Wiley&Sons,2006.
3. Y.TsividisandM.Colin,"OperationandModelingoftheMOSTransistor,"OxfordUniversity .Press,2011.
4. David A. Bell ,"Electronic devices and circuits", Prentice Hall of India, 2004.
5. S.Salivahanan, "Electronics devices and circuits". 2nd Edition, Tata McGraw Hill, 2008.

E-REFERENCES

1. http://www.rtna.ac.th/departments/elect/Data/EE304/Electronic%20Devices%20and%20Circuit%20Theory.pdf
2. http://nptel.ac.in/courses/117103063/ (Prof. ChitralekhaMahanta, NPTEL, Basic Electronics, IIT-Guwahati)
3. http://nptel.ac.in/video.php?subjectId=117103063 (Prof. Gautam Barua, NPTEL, Basic Electronics, IIT-Guwahati)
4. http://nptel.ac.in/courses/117101106/ (Prof. A N chandorkar, NPTEL, Analog Electronics, IIT-Bombay)

Table1:Mapping of COs with POs:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	1	1	1	1				1
CO 2	3	2	1	1	1	1	1	1				1
CO 3	3	2	1	1	1	1	1	1				1
CO 4	3	2	1	1	1	1	1	1				1
CO 5	3	2	1	1	1	1	1	1				1
CO6	3	2	1	1	1	1	1	1				1
Total	18	12	6	6	6	6	6	6				6
Scaled Value	4	3	2	2	2	2	2	2				2

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSECODE			XEC308	L	T	P	C
COURSE NAME			ELECTRONIC DEVICES AND NETWORKS LAB	0	0	1	1
PREREQUISITE							
C	P	A		L	T	P	H
2.8	0.1	0.1		0	0	2	2

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Construct*** and ***Verify*** the characteristics ofsemiconductor diodes.	Psychomotor Affective	Perception Receiving Phenomena
CO2	***Construct*** and ***Verify*** the characteristics of Transistors	Psychomotor Affective	Perception Receiving Phenomena
CO3	***Construct*** and studythe characteristics of Opto electronic diodes	Psychomotor	Perception
CO4	***Construct*** and studythe output of Rectifiers	Psychomotor	Perception
CO5	***Construct andVerify*** the characteristics of Network theorems, filters and resonance circuits.	Psychomotor Affective	Perception Receiving Phenomena

LIST OF EXPERIMENTS

1. V-I characteristics of PN junction diode and Zener diode.
2. V-I characteristics of Input and Output characteristics of Common base configuration of BJT.
3. Input and Output characteristics of Common emitter configuration of BJT.
4. Drain and Transfer characteristics of JFET.
5. Characteristics of LED and LDR.
6. Design and implementation of Half wave and full wave rectifiers.
7. Verification of Reciprocity and Superposition Theorem.
8. Frequency response of low pass and high pass filter
9. Frequency response of series resonance circuit
10. Frequency response of parallel resonance circuit

	PRACTICAL	TOTAL
HOURS	45	45

CO Vs PO Mapping

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	2	2	1	2	2	1	2
CO 2	3	3	3	3	2	2	2	1	2	2	1	2
CO 3	3	3	3	3	2	2	2	1	2	2	1	2
CO 4	3	3	3	3	2	2	2	1	2	2	1	2
CO 5	3	3	3	3	2	2	2	1	2	2	1	2
CO6	3	3	3	3	2	2	2	1	2	2	1	2
Total	**18**	**18**	**18**	**18**	**12**	**12**	**12**	**6**	**12**	**12**	**6**	**12**
Scaled Value	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**

COURSECODE			**XEC309**	**L**	**T**	**P**	**C**
COURSE NAME			**DIGITALSYSTEMDESIGNLAB**	**0**	**0**	**1**	**1**
PREREQUISITE							
C	**P**	**A**		**L**	**T**	**P**	**H**
2.8	**0.1**	**0.1**		**0**	**0**	**2**	**2**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Choose***the logic gatesand***Use*** them for various applications	Psychomotor Affective	Perception
CO2	***Assemble*** Combinational logic circuits and***Verify*** their operation	Psychomotor Affective	Response Internalizing values
CO3	***Assemble*** Sequential logic circuits and ***Verify*** their operation	Psychomotor	Response
CO4	***Design*** Counters and Shift Registers and ***Demonstrate*** their output	Psychomotor	Origination
CO5	***Create*** digital circuits and ***display*** the results using VHDL	Psychomotor Affective	Origination Valuing

LIST OF EXPERIMENTS:

1. Study of logic gates.
2. Design and implementation of code converters using logic gates
3. Design and implementation of Adders using logic gates.
4. Design and implementation Subtractor using logic gates.
5. Design and implementation of Magnitude Comparators.
6. Design and implementation of encoder and decoder.

7. Design and implementation of Multiplexer and De-multiplexer. 8. Implementation of Flip- flops. 9. Construction and verification of counter . 10. Construction and verification of shift register. 11. Logic gates using VHDL. 12. Adder and subtractor using VHDL		
HOURS	**PRACTICAL**	**TOTAL**
	45	**45**

Table 1 :CO Vs PO Mapping

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2	2	2	1	2	2	1	2
CO 2	3	3	3	3	2	2	2	1	2	2	1	2
CO 3	3	3	3	3	2	2	2	1	2	2	1	2
CO 4	3	3	3	3	2	2	2	1	2	2	1	2
CO 5	3	3	3	3	2	2	2	1	2	2	1	2
CO6	3	3	3	3	2	2	2	1	2	2	1	2
Total	**18**	**18**	**18**	**18**	**12**	**12**	**12**	**6**	**12**	**12**	**6**	**12**
Scaled Value	**4**	**4**	**4**	**4**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**

COURSE CODE			XEC401	L	T	P	C
COURSE NAME			PROBABILITY THEORY AND STOCHASTIC PROCESSES	3	1	0	4
C	P	A		L	T	P	H
3.5	0.25	0.25		3	1	0	4

PREREQUISITE:Nil

Learning Objectives:

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of correlation and spectral densities and to understand the significance of linear systems with random inputs.

Course Outcomes		Domain	Level
CO1	**Describe** sets, its operation and basics of probability by examples and **solve** problems associated.	Cognitive	Remembering Applying
CO2	**Describe** and **Demonstrate** PMF, PDF, CDF of discrete and continues random variable	Cognitive	Remembering Understanding
CO3	**Describe** Joint distributions and **apply** them to communication systems problems	Cognitive	Remembering Applying
CO4	**Describe** random sequences and limit theorems and **solve** problems	Cognitive	Remembering Applying
CO5	**Describe** stochastic and **solve** problems related to communication system which involves stochastic process.	Cognitive	Remember Applying

UNIT - I	**12 Hours**
Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models. Requirements for a random process to be stationary. Rayleigh and Rician distribution in detail. Axioms of probability -Conditional probability -Bayes rule, statistically independent Random variable -CDF - Probability density function-Statistical averages-Moments.	
UNIT - II	**12 Hours**
Discrete random variables, probability mass function, example random variables and distributions; Cumulative Distribution Function (CDF), Averages, and Expected Value of a Derived Random Variable, Variance and Standard Deviation; Continuous random variables, probability density function, probability distribution function, example distributions; Gaussian Random Variables, Delta Functions, Mixed Random Variables, Probability Models of Derived Random Variables.	
UNIT - III	**12 Hours**

Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds.

UNIT - IV	**12 Hours**

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT - V	**12 Hours**

Stochastic Processes - Definitions and Examples- Types of Stochastic Processes- Random Variables from Random Processes- Independent Identically Distributed Random Sequences -The Poisson Process - Properties of the Poisson Process - The Brownian Motion Process - Expected Value and Correlation - Stationary Processes - Wide Sense Stationary Stochastic Processes -Cross-Correlation - Gaussian Processes.

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**45**	**15**	**60**

TEXTBOOKS

1. Roy D. Yates and David J.“Goodman, "Probability and Stochastic Processes", 3rd Edition, John Wiley & Sons, Inc., 2014.
2. H. Stark and J.W.Woods, "Probability and Random Processes with Applications to Signal Processing", Third Edition, Pearson Education, 2002.

REFERENCES

1. A.Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes", Fourth Edition, McGraw Hill., 2002
2. Scott Miller and Donald Childers, "Probability and Random Processes, : With Applications to Signal Processing and Communications', 2nd edition, Academic Pres, 2018.
3. Leon-Garcia, Alberto, "Probability, statistics, and random processes for electrical engineering”, Pearson Education, Inc.,Upper Saddle River, NJ 07458, 2008.

E REFERENCE

Nptel: Prof. Dr. S. Dharmaraja, "Stochastic Processes", Department of Mathematics, Indian Institute of Technology, Delhi, http://nptel.ac.in/courses/111102014/

TABLE 1: CO VS GA Mapping

	GA1	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**

CO 1	3	2	1						1	1		1
CO 2	3	2	1						1	1		1
CO 3	3	2	1	1					1	1		1
CO 4	3	2	1	1	1	1			1	1	1	1
CO 5	3	2	1	1	1	1	1		1	1	1	1
Total	15	10	5	3	2	2	1		5	5	2	5
Scaled value	3	2	1	1	1	1	1		1	1	1	1

1-5→1, 6-10 → 2, 11-15 → 3

0 – No Relation, 1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE			**XUM402**	**L**	**T**	**P**	**C**
COURSE NAME			**TOTAL QUALITY MANAGEMENT**	**2**	**0**	**0**	**2**
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**2**	**0**	**0**	**2**

LEARNING OBJECTIVES

- To basic concepts of total quality concepts and its limitations.
- To expose the students on Customer satisfaction, Employee involvement, supplier selection and appraise the performance by TQM principle
- To familiarize the Statistical Process Control Tools
- To enhance the fundamental knowledge on the different TQM tools and their significance
- To instill the knowledge of students on the importance aspects of different quality systems

COURSE OUTCOMES		**Domain**	**Level**
CO1	***List*** and ***Explain*** the basic concepts of total quality concepts and its limitations.	Cognitive	Remembering Understanding
CO2	***Analyze*** and ***Explain*** the Customer satisfaction, Employee involvement, supplier selection and appraise the performance by TQM principle	Cognitive	Analyzing, Evaluating
CO 3	***Explain*** and ***Apply*** the Statistical Process Control Tools	Cognitive	Understanding, Appling
CO4	***Select*** and ***Explain*** the different TQM tools and their significance	Cognitive	Remembering, Understanding
CO5	***Explain*** the importance aspects of different quality systems.	Cognitive	Understanding

UNIT - IINTRODUCTION **9 Hours**

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of Total Quality Management – Historical review –Principles of TQM – Leadership – Concepts – Role of senior management – Quality Council –Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation

UNIT - II TQM PRINCIPLES	9 Hours
Customer satisfaction – Customer perception of quality – Customer complaints – Service quality – Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.	
UNIT - III STATISTICAL PROCESS CONTROL (SPC)	**9 Hours**
The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.	
UNIT - IV TQM TOOLS	**9 Hours**
Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.	
UNIT - V QUALITY SYSTEMS	**9**
Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements – Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 – Concept, requirements and benefits.	

HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	-	-	45

TEXT BOOKS

1.Dale H. Besterfiled, et. Al. "Total Quality Management", New Delhi, Pearson Education, Inc.2007.

2.James R. Evans and William M. Lidsay, "The Management and Control of Quality", 5th Edition, South-Western, 2002.

REFERENCES

1. Feigenbaum, A.V., "Total Quality Management", McGraw Hill, 1991.
2. Oakland, J.S., "Total Quality Management", Butterworth Heineman, 1989.
3. Narayana V. and Sreenivasan, N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.
4. Zeiri, "Total Quality Management for Engineers", Wood Head Publishers, 1991.

E- REFERENCES

1. http://nptel.ac.in/faq/110101010/Prof.IndrajitMukherjee,IIT,Bombay and Prof.TapanP.Bagchi, IIT, Kharagpur.

COs Vs GA mapping

	CO1	CO2	CO3	CO4	CO5	Total	Scaled total
GA1	2	1	2	1	1	7	2

GA4	1	1	2	2	1	7	2
GA5	1	1	2	2	1	7	2
GA6	1	1	2	1	2	7	2
GA7	1	1	1	1	1	5	1
GA8	1	1	1	2	2	7	2
GA9	1	1	1	-	1	4	1
GA10	1	1	1	2	2	7	2
GA12	1	1	-	-	2	4	1

COURSE CODE			**XUM403**	**L**	**T**	**P**	**C**
COURSE NAME			**HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY**	**0**	**0**	**0**	**0**
C	**P**	**A**		**L**	**T**	**P**	**H**
2.7	**0**	**0.3**		**3**	**0**	**0**	**3**

LEARNING OUTCOMES

- To impart the knowledge on the human ethics and human relationships
- To familiarize gender issues, equality and violence against women
- To expose the students on women issues and challenges
- To introduce human rights and report on violations.
- To emphasis the students on family values, universal brotherhood, fight against corruption by common man and good governance.

COURSE OUTCOMES		**Domain**	**Level**
CO1	***Relate*** and ***Interpret*** the human ethics and human relationships	Cognitive	Remembering, Understanding
CO2	***Explain*** and ***Apply*** gender issues, equality and violence against women	Cognitive	Understanding, Applying
CO3	***Classify*** and ***Develop*** the identify women issues and challenges	Cognitive & Affective	Analyzing Receiving
CO4	***Classify*** and ***Dissect*** human rights and report on violations.	Cognitive	Understanding, Analyzing
CO5	***List*** and **respond** to family values, universal brotherhood, fight against corruption by common man and good governance.	Cognitive & Affective	Remembering, (Respond)

UNIT - I HUMAN ETHICS AND VALUES	**7 Hours**

Human Ethics and values - Understanding of oneself and others- motives and needs- Social service, Social Justice, Dignity and worth, Harmony in human relationship: Family and Society, Integrity

and Competence, Caring and Sharing, Honesty and Courage, WHO's holistic development - Valuing Time, Co-operation, Commitment, Sympathy and Empathy, Self respect, Self-Confidence, character building and Personality.

UNIT - IIGENDER EQUALITY	**9 Hours**

Gender Equality - Gender Vs Sex, Concepts, definition, Gender equity, equality, and empowerment. Status of Women in India Social, Economical, Education, Health, Employment, HDI, GDI, GEM. Contributions of Dr.B.R. Ambethkar, ThanthaiPeriyar and Phule to Women Empowerment.

UNIT - IIIWOMEN ISSUES AND CHALLENGES	**9 Hours**

Women Issues and Challenges- Female Infanticide, Female feticide, Violence against women, Domestic violence, Sexual Harassment, Trafficking, Access to education, Marriage. Remedial Measures – Acts related to women: Political Right, Property Rights, and Rights to Education, Medical Termination of Pregnancy Act, and Dowry Prohibition Act.

UNIT - IV HUMAN RIGHTS	**9 Hours**

Human Rights Movement in India – The preamble to the Constitution of India, Human Rights and Duties, Universal Declaration of Human Rights (UDHR), Civil, Political, Economical, Social and Cultural Rights, Rights against torture, Discrimination and forced Labour, Rights and protection of children and elderly. National Human Rights Commission and other statutory Commissions, Creation of Human Rights Literacy and Awareness. - Intellectual Property Rights (IPR). National Policy on occupational safety, occupational health and working environment.

UNIT - V GOOD GOVERNANCE AND ADDRESSING SOCIAL ISSUES	**11 Hours**

Good Governance - Democracy, People's Participation, Transparency in governance and audit, Corruption, Impact of corruption on society, whom to make corruption complaints, fight against corruption and related issues, Fairness in criminal justice administration, Government system of Redressal. Creation of People friendly environment and universal brotherhood.

HOURS	**LECTURE**	**SELF STUDY**	**TOTAL**
	45	**-**	**45**

REFERENCES

1. Aftab A, (Ed.), Human Rights in India: Issues and Challenges, (New Delhi: Raj Publications, 2012).
2. Bajwa, G.S. and Bajwa, D.K. Human Rights in India: Implementation and Violations (New Delhi: D.K. Publications, 1996).
3. Chatrath, K. J. S., (ed.), Education for Human Rights and Democracy (Shimala: Indian Institute of Advanced Studies, 1998).
4. Jagadeesan. P. Marriage and Social legislations in Tamil Nadu, Chennai: Elachiapen Publications, 1990).
5. Kaushal, Rachna, Women and Human Rights in India (New Delhi: Kaveri Books, 2000)
6. Mani. V. S., Human Rights in India: An Overview (New Delhi: Institute for the World Congress on Human Rights, 1998).
7. Singh, B. P. Sehgal, (ed) Human Rights in India: Problems and Perspectives (New Delhi: Deep and Deep, 1999).

8. Veeramani, K. (ed) Periyar on Women Right, (Chennai: Emerald Publishers, 1996)
9. Veeramani, K. (ed) Periyar Feminism, (PeriyarManiammai University, Vallam, Thanjavur: 2010).
11.Planning Commission report on Occupational Health and Safety http://planningcommission.nic.in/aboutus/committee/wrkgrp12/wg_occup_safety.p
11. Central Vigilance Commission (Gov. of India) website: http://cvc.nic.in/welcome.html.
12. Weblink of Transparency International: https://www.transparency.org/
13. Weblink Status report: https://www.hrw.org/world-report/2015/country-chapters/india

Table 1 : Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								2						
CO2								3	1					
CO3								2						
CO4								3		2				
CO5								3	2	2		2		
Total		2						13	3	4		2		
Scaled Value		1						3	1	1		1		

1 – 5 → 1, 6-10 → 2, 11 – 15→ 3

0 – No relation, 1 – Low relation, 2 – Medium relation, 3 – High relation

COURSECODE			**XEC405**	**L**	**T**	**P**	**C**
COURSE NAME			**TRANSMISSION LINES AND WAVEGUIDES**	**3**	**0**	**0**	**3**
PREREQUISITE							
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**0**	**0**	**3**

LEARNING OBJECTIVES

- To introduce the various types of transmission lines and its characteristics

- To give thorough understanding about high frequency line, power and impedancemeasurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce passive filters and basic knowledge of active RF components
- To get acquaintance with RF system transceiver design

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Explain***the various types of transmission lines and its characteristics	Cognitive	Understanding
CO2	***Understand***the high frequency line, power and impedance measurements	Cognitive	Understanding
CO3	***Analyze*** the characteristics of TE and TM waves	Cognitive	Understanding
CO4	***Analyze*** impedance matching using smith chart	Cognitive	Understanding
CO5	***Understand*** passive filters and basic knowledge of active RF components	Cognitive	Understanding
CO6	***Design*** RF system transceiver design	Cognitive	Understanding

UNIT - ITRANSMISSION LINE THEORY	**9 Hours**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT - IIHIGH FREQUENCY TRANSMISSION LINES	**9 Hours**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT - IIIIMPEDANCE MATCHING IN HIGH FREQUENCY LINES	**9 Hours**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNIT -IVWAVEGUIDES	**9 Hours**

General Wave behavior along uniform guiding structures – Transverse Electromagnetic Waves,

Transverse Magnetic Waves, Transverse Electric Waves – TM and TE Waves between parallel plates. Field Equations in rectangular waveguides, TM and TE waves in rectangular waveguides, Bessel Functions, TM and TE waves in Circular waveguides.

UNIT - VRF SYSTEM DESIGN CONCEPTS	**9 Hours**

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors Basic concepts of RF design, Mixers, Low noise amplifiers, voltage control oscillators, Power amplifiers, transducer power gain and stability considerations.

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**45**	**0**	**45**

TEXT BOOKS

1. John D Ryder, ―Networks, lines and fields‖, 2nd Edition, Prentice Hall India, 2015.
2. Mathew M. Radmanesh, ―Radio Frequency &Microwave Electronics‖, Pearson Education Asia, Second Edition,2002.

REFERENCE BOOKS

1. Reinhold Ludwig and Powel Bretchko,‖ RF Circuit Design – Theory and Applications‖,Pearson Education Asia, First Edition,2001.
2. D. K. Misra, ―Radio Frequency and Microwave Communication Circuits- Analysis and Design‖, John Wiley & Sons, 2004.
3. E.C.Jordan and K.G. Balmain, ―Electromagnetic Waves and Radiating Systems Prentice Hall of India, 2006.
4. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines Pearson Education, First edition 2005.

CO Vs PO Mapping

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

CO 2	3	3	2	2	1	1	1	1				1
CO 3	3	3	2	1	1	1	1	1				1
CO 4	3	3	2	1	1	1	1	1				1
CO 5	3	3	2	2	1	1	1	1				1
CO6	3	3	2	1	1	1	1	1				1
Total	**18**	**18**	**12**	**9**	**6**	**6**	**6**	**6**				**6**
Scaled Value	**4**	**4**	**3**	**2**	**2**	**2**	**2**	**2**				**2**

COURSECODE			**XEC406**	**L**	**T**	**P**	**C**
COURSE NAME			**ANALOG COMMUNICATION**	**3**	**0**	**0**	**3**
PREREQUISITE							
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**0**	**0**	**3**

LEARNING OBJECTIVES

- To introduce the concepts of various analog modulations and their spectral characteristics
- To impart the knowledge of effect of Noise in various communications
- To enhance the fundamental knowledge on pulsemodulationsystemand*Differentiate*theirsystemperformance
- To emphasis the students with FDM and TDM techniques

	COURSE OUTCOMES	**DOMAIN**	**LEVEL**
CO1	***Understand***the basics of communication system and analog modulation techniques	Cognitive	Understanding
CO2	***Apply*** the basic knowledge of signals and systems and ***Understand***the concept of Frequency modulation	Cognitive	Understanding Applying
CO3	***Apply*** the basic knowledge of electronic circuits and ***Understand*** the effect of Noise in communication system and noise performance of AM system	Cognitive	Applying Understanding
CO4	***Understand***the effect of noise performance of FM system.	Cognitive	Understanding
CO5	***Construct***pulsemodulationsystemand*Differentiate*theirsystemperformance	Cognitive	Understanding analyzing
CO6	***Understand*** FDM and TDM techniques	Cognitive	Understanding

UNIT – I	**9 Hours**
Basic blocks of Communication System. Amplitude (Linear) Modulation – AM, DSB-SC, SSB-SC and VSB-SC. Methods of generation and detection. FDM. Super Heterodyne Receivers.	
UNIT - II	**9 Hours**

Angle (Non-Linear) Modulation - Frequency and Phase modulation. Transmission Bandwidth of FM signals, Methods of generation and detection. FM Stereo Multiplexing.	
UNIT – III	**9 Hours**
Noise - Internal and External Noise, Noise Calculation, Noise Figure. Noise in linear and nonlinear AM receivers, Threshold effect.	
UNIT – IV	**9 Hours**
Noise in FM receivers, Threshold effect, Capture effect, FM Threshold reduction, Pre-emphasis and De-emphasis.	
UNIT - V	**9 Hours**
Pulse Modulation techniques – Sampling Process, PAM, PWM and PPM concepts, Methods of generation and detection. TDM. Noise performance.	

HOURS	**LECTURE**	**TUTORIAL**	**TOTAL**
	45	**0**	**45**

TEXT BOOKS

1. S.Haykins, Communication Systems , Wiley, (4/e), Reprint 2009.
2. Kennedy, Davis, Electronic Communication Systems (4/e), McGraw Hill, Reprint 2008.

REFERENCE BOOKS

1. B.Carlson, Introduction to Communication Systems, McGraw-Hill, (4/e), 2009.
2. J.Smith, Modern Communication Circuits (2/e), McGraw Hill, 1997.
3. J.S.Beasley&G.M.Miler, Modern Electronic Communication (9/e), Prentice-Hall, 2008.

E REFERENCES

1.http://nptel.ac.in /courses/ NPTEL, Communication Engineering ,Prof.Surendra Prasad, Department of Electrical Engineering , Indian Institute of Technology, New Delhi

2.http://freevideolectures.com/course/2311/Digital Communication (NPTEL, DigitalCommunication ,Prof.Bikash Kumar Dey, IIT Bombay.

3. http://www.nptel.ac.in/syllabus/117105077, IIT Kharagpur.

CO Vs PO Mapping

	PO1	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	3	2	2	1	1	1	1				1
CO 2	3	3	2	2	1	1	1	1				1

CO 3	3	3	2	1	1	1	1	1				1
CO 4	3	3	2	1	1	1	1	1				1
CO 5	3	3	2	2	1	1	1	1				1
CO6	3	3	2	1	1	1	1	1				1
Total	**18**	**18**	**12**	**9**	**6**	**6**	**6**	**6**				**6**
Scaled Value	**4**	**4**	**3**	**2**	**2**	**2**	**2**	**2**				**2**

COURSECODE			**XEC407**	**L**	**T**	**P**	**C**
COURSE NAME			**ELECTRONIC CIRCUITS**	**3**	**0**	**0**	**3**
PREREQUISITE							
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**0**	**0**	**3**

LEARNING OUTCOMES

- To give a comprehensive exposure to all types of amplifiers and oscillators constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To impart the knowledge on feedback amplifiers and oscillators principles
- To design oscillators.
- To expose the students about turned amplifier.
- To enhance the knowledge on the analysis and design of LC and RC oscillators, amplifiers, multi vibrators, power amplifiers and DC convertors.

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Design*** and ***analyze*** feedback amplifiers	Cognitive	Understanding Analyzing
CO2	***Design*** Oscillator circuits	Cognitive	Understanding
CO3	***Illustrate*** the frequency response of tuned amplifiers	Cognitive	Understanding
CO4	***Discuss*** wave shaping circuits and multivibrators .	Cognitive	Understanding
CO5	***Tell*** the working principle of power amplifiers	Cognitive	Understanding
CO6	***Explain*** about DC converters	Cognitive	Understanding analyzing

UNIT – IFEEDBACK AMPLIFIERS AND STABILITY **9 Hours**

Feedback Concepts – gain with feedback – effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers – analysis of series-series, shunt-shunt and shunt-series feedback amplifiers-stability problem-Gain and Phase-margins-Frequency compensation.

UNIT – II OSCILLATORS	9 Hours
Barkhausen criterion for oscillation – phase shift, Wien bridge - Hartley &Colpitt's oscillators – Clapp oscillator-Ring oscillators and crystal oscillators – oscillator amplitude stabilization.	
UNIT – IIITUNED AMPLIFIERS	**9 Hours**
Coil losses, unloaded and loaded Q of tank circuits, small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier – double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.	
UNIT – IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS	**9 Hours**
Pulse circuits – attenuators – RC integrator and differentiator circuits – diode clampers and clippers – Multivibrators - Schmitt Trigger- UJT Oscillator.	
UNIT – V POWER AMPLIFIERS AND DC CONVERTERS	**9 Hours**
Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design	

HOURS	LECTURE	TUTORIAL	TOTAL
	45	0	45

TEXT BOOKS

1.Sedra and Smith, ―Micro Electronic Circuits‖; Sixth Edition, Oxford University Press,2011.
2.Jacob Millman, _Microelectronics', McGraw Hill, 2nd Edition, Reprinted, 2009.

REFERENCE BOOKS

1.Robert L. Boylestad and Louis Nasheresky, ―Electronic Devices and Circuit Theory‖, 10th Edition, Pearson Education / PHI, 2008
2.David A. Bell, ―Electronic Devices and Circuits‖, Fifth Edition, Oxford University Press, 2008.
3.Millman J. and Taub H., ―Pulse Digital and Switching Waveforms‖, TMH, 2000.
4.Millman and Halkias. C., Integrated Electronics, TMH, 2007.

CO Vs PO Mapping

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	1	1	1	1				1
CO 2	3	3	2	2	1	1	1	1				1

CO 3	3	3	2	1	1	1	1	1				1
CO 4	3	3	2	1	1	1	1	1				1
CO 5	3	3	2	2	1	1	1	1				1
CO6	3	3	2	1	1	1	1	1				1
Total	**18**	**18**	**12**	**9**	**6**	**6**	**6**	**6**				**6**
Scaled Value	**4**	**4**	**3**	**2**	**2**	**2**	**2**	**2**				**2**

COURSECODE			**XEC408**	**L**	**T**	**P**	**C**
COURSE NAME			**MICROPROCESSORS AND MICROCONTROLLERS**	**3**	**0**	**0**	**3**
PREREQUISITE							
C	**P**	**A**		**L**	**T**	**P**	**H**
3	**0**	**0**		**3**	**0**	**0**	**3**

LEARNING OBJECTIVES

- To make the students understand the Architecture of 8086 microprocessor.
- To educate the students the design aspects of I/O and Memory Interfacing circuits.
- To impart the knowledge to the students to interface microprocessors with supporting chips.
- To give insight into the Architecture of 8051 microcontroller.
- To emphasize the students to design a microcontroller based system

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Understand*** the architecture and function of8086 microprocessor	Cognitive	Understanding
CO2	***Understand*** and execute programs based on 8086 microprocessor.	Cognitive	Understanding
CO3	***Illustrate***8086 System Bus Structure	Cognitive	Understanding
CO4	***Explain*** I/O interfacing	Cognitive	Understanding
CO5	***Illustrate*** the architecture of 8051	Cognitive	Understanding
CO6	***Design*** and ***implement*** 8051 microcontroller based systems	Cognitive	Applying

UNIT - ITHE 8086 MICROPROCESSOR	**9 Hours**

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

UNIT - II 8086 SYSTEM BUS STRUCTURE	**9 Hours**

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT - IIII/O INTERFACING	**9 Hours**

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT - IVMICROCONTROLLER	**9 Hours**

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.

UNIT - VINTERFACING MICROCONTROLLER	**9 Hours**

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

	LECTURE	**TUTORIAL**	**TOTAL**
HOURS	**45**	**0**	**45**

TEXT BOOKS

1.Yu-Cheng Liu, Glenn A.Gibson, ―Microcomputer Systems: The 8086 / 8088 Family Architecture, Programming and Design‖, Second Edition, Prentice Hall of India, 2007.

2.Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C‖, Second Edition, Pearson education, 2011.

3.J.L.Antonakos, "An Introduction to the Intel Family of Microprocessors", Pearson, 1999.

4.D. V. Hall, "Micro processors and Interfacing", 2nd Edition, Tata McGrawHill, 2006.

5.Ramesh S. Goankar, "Microprocessor Architecture, Programming and Applications with 8085", 5thEdition, Prentice Hall,2014.

6.M.A.Mazidi&J.C.Mazidi "Microcontroller and Embedded systems using Assembly & C. (2/e)",Pearson Education, 2007.

7.John H. Davies**,"** MSP430 Microcontroller Basics", Elsevier Ltd., 2008.

REFERENCE BOOKS

1.B.B. Brey, "The Intel Microprocessors, (7/e), Eastern Economy Edition" , 2006.

2.K.J. Ayala, "The 8051 Microcontroller ", (3/e), Thomson Delmar Learning, 2004.

3.I. S. MacKenzie and R.C.W.Phan., " The 8051 Microcontroller.(4/e)", Pearson education, 2008.

4.A.K.Ray and K.M.Bhurchandani, "Advanced Microprocessors and Peripherals",2nd Edition, TMH, 2006.

5.K.UmaRao, AndhePallavi, "The 8051 Microcontrollers, Architecture and programming and

Applications", Pearson Education, 2009.
6.Liu and G.A.Gibson, "Micro Computer System 8086/8088 Family Architecture. Programming and Design",2nd Edition, PHI, 1986.
7.Ajay.V. Deshmukh "Microcontrollers and Applications", TMGH, 2005.
8.DoughlasV.Hall, ―Microprocessors and Interfacing, Programming and Hardware‖,TMH,2012
9.A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGraw Hill, 2012

E REFERENCES

1.https://onlinecourses.nptel.ac.in/noc18_ec03/preview
2.http://www.avr-tutorials.com/general/microcontrollers-basics
3.https://www.tutorialspoint.com/embedded_systems/es_microcontroller.htm

CO Vs PO Mapping

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	1	1	1	1				1
CO 2	3	3	2	2	1	1	1	1				1
CO 3	3	3	2	1	1	1	1	1				1
CO 4	3	3	2	1	1	1	1	1				1
CO 5	3	3	2	2	1	1	1	1				1
CO6	3	3	2	1	1	1	1	1				1
Total	**18**	**18**	**12**	**9**	**6**	**6**	**6**	**6**				**6**
Scaled Value	**4**	**4**	**3**	**2**	**2**	**2**	**2**	**2**				**2**

COURSECODE			**XEC409**	**L**	**T**	**P**	**C**
COURSE NAME			**ELECTRONIC CIRCUITS LAB**	**0**	**0**	**1**	**1**
PREREQUISITE							
C	**P**	**A**		**L**	**T**	**P**	**H**
2.8	**0.1**	**0.1**		**0**	**0**	**2**	**2**

LEARNING OBJECTIVES

- To instill the knowledge of students on feedback amplifiers
- To expose the students on the performance of various oscillators
- To enhance the knowledge of the students on the performance of Tuned amplifiers
- To develop the an understanding the performance of Multivibrators
- To educate the students on the waveforms of clippers and clampers

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Verify*** series and shunt feedback amplifiers	Psychomotor	Perception,
CO2	***Design***and verify various oscillators	Psychomotor Affective	origination, Internalising Values
CO3	***Design***and verify Tuned amplifiers	Psychomotor	Mechanism,
CO4	***Design*** and ***demonstrate***Multivibrators	Psychomotor Affective	origination, Valuing
CO5	***Construct*** and observe the waveform clippers and clampers	Psychomotor Affective	Mechanism, Receiving Phenomena

LIST OF EXPERIMENTS

1.Series feedback amplifiers-Frequency response, Input and output impedance
2.Shunt feedback amplifiers-Frequency response, Input and output impedance
3.RC Phase shift oscillator
4.Wien Bridge Oscillator
5.Hartley Oscillator
6.Colpitts Oscillator
7.Single Tuned Amplifier
8.RC Integrator and Differentiator circuits
9.Astable multivibrators
10.Monostable multivibrators
11.Clippers
12.Clampers

	PRACTICAL	**TOTAL**
HOURS	**45**	**45**

CO Vs PO Mapping

	PO1	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	3	2	2	2	2	2	1	2	1	1	2

CO 2	3	3	2	2	2	2	2	1	2	1	1	2
CO 3	3	3	2	2	2	2	2	1	2	1	1	2
CO 4	3	3	2	2	2	2	2	1	2	1	1	2
CO 5	3	3	2	2	2	2	2	1	2	1	1	2
CO6	3	3	2	2	2	2	2	1	2	1	1	2
	18	18	12	12	12	12	12	6	12	6	6	12

COURSECODE			**XEC410**	**L**	**T**	**P**	**C**
COURSE NAME			**MICROPROCESSOR AND MICROCONTROLLERSLAB**	**0**	**0**	**1**	**1**
PREREQUISITE							
C	**P**	**A**		**L**	**T**	**P**	**H**
2.8	**0.1**	**0.1**		**0**	**0**	**2**	**2**

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Verify*** the basic program in Microprocessor systems design with 8085.	Psychomotor	Perception,
CO2	***Design***and ***perform*** the Interfacing of peripherals with8085 Microprocessor.	Psychomotor Affective	origination, Internalising Values
CO3	***Assemble*** *and* ***verify*** the 8051 Microcontroller based arithmetic operations.	Psychomotor	Mechanism,
CO4	***Design*** and ***demonstrate***the Interfacing processes with different priority and real time constraints with 8051 Microcontroller.	Psychomotor Affective	origination, Valuing
CO5	***Construct*** *and* ***indentify***the timer applications using 8051 Microcontroller.	Psychomotor Affective	Mechanism, Receiving Phenomena

LIST OF EXPERIMENTS

1. Programs for 8/16 bit Arithmetic operations Using 8085.
2. Programs for Sorting and Searching Using 8085.
3. Parallel Communication between two MP Kits using Mode 1 and Mode 2 of 8255 with 8085.
4. Interfacing and Programming of Stepper Motor 8085/8086.
5. Interfacing and Programming 8279, 8259, and 8253with 8085/8086.
6. Interfacing ADC and DAC using 8085.

7.Programming using Arithmetic, Logical and Bit Manipulation Instructions of 8051 Microcontroller.
8. Serial Communication between two Microcontroller Kits using 8051.
9. Communication between 8051 Microcontroller kit and PC.
10. Interfacing and Programming of DC Motor using 8051.
11. Interfacing ADC and DAC using 8051.
12. Programming and verifying Timer, Interrupts and UART operations in 8051Microcontroller.

	PRACTICAL	TOTAL
HOURS	**45**	**45**

CO Vs PO Mapping

	PO1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO 8	PO9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	2	2	2	1	2	1	1	2
CO 2	3	3	2	2	2	2	2	1	2	1	1	2
CO 3	3	3	2	2	2	2	2	1	2	1	1	2
CO 4	3	3	2	2	2	2	2	1	2	1	1	2
CO 5	3	3	2	2	2	2	2	1	2	1	1	2
CO6	3	3	2	2	2	2	2	1	2	1	1	2
	18	18	12	12	12	12	12	6	12	6	6	12

COURSECODE			**XEC501**	**L**	**T**	**P**	**C**
COURSE NAME			**ANALOG INTEGRATED CIRCUITS**	**3**	**0**	**0**	**3**
PREREQUISITES			**Electronic Devices, Electronic Circuits**				
C	**P**	**A**		**L**	**T**	**P**	**H**

3	**0**	**0**		**3**	**0**	**0**	**3**

LEARNING OBJECTIVES

- To introduce the basic building blocks of linear integrated circuits
- To familiarize the linear and non-linear applications of operational amplifiers
- To impart the knowledge on the theory and applications of analog multipliers and PLL
- To disseminate the theory of ADC and DAC
- To enhance the fundamental knowledge on the concepts of waveform generation and introduce some special function ICs

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Understand***theprinciplesof differential amplifiers and operational amplifiers.	Cognitive	Understanding
CO2	***Analyze***theworking of operational amplifiers and basic applications.	Cognitive	Analyzing
CO3	***Apply*** the principles of op-amp for various applications.	Cognitive	Applying
CO4	***Understand*** the working of multivibrators, filters, schimitt trigger.	Cognitive	Understanding
CO5	***Understand*** and carry out the working of specialized ICs.	Cognitive	Understanding

UNIT I - DIFFERENTIAL AMPLIFIERS **(9 Hours)**

Differential amplifiers: Differential amplifier configurations using BJT, Large and small signal operations, input resistance, voltage gain, CMRR, non – ideal characteristics of differential amplifiers, frequency response of differential amplifiers, Operational amplifiers: Introduction, Block diagram, Ideal op-amp parameters, Equivalent circuit, Voltage transfer curve, Open loop op-amp configurations, Effect of finite open loop gain, Bandwidth and slew rate on circuit performance.

UNIT II - OP-AMP WITH NEGATIVE FEEDBACK **(9 Hours)**

Introduction, Feedback configurations, voltage series feedback, voltage shunt feedback, properties of practical op-amp, Op-amp applications: Inverting and non inverting amplifier, DC and AC amplifiers, Summing, Scaling and averaging amplifiers, Instrumentation amplifier.

UNIT III - OP-AMP APPLICATIONS **(9 Hours)**

Voltage to current converter, Current to voltage converter, Integrator, Differentiator, Precision rectifiers, Log and antilog amplifier, RC Phase Shift,Wien bridge ,Hartley, Colpitts and Crystal oscillators.

UNIT IV - MULTIVIBRATORS AND FILTERS	(9 Hours)
Bistable, monostable and astablemultivibrators, Triangular and saw toothwave generators, Comparators, Zero crossing detector, Schmitt Trigger, Active filters: Advantages, First and second order low pass, Highpass, Band pass and band reject filters, Design of filters using Butterworth approximations.	
UNIT V: SPECIALIZED ICS AND ITS APPLICATIONS	**(9 Hours)**
Timer IC 555: Bistable, monostable and astableoperations, applications, Analog multipliers, VCO, PLL and its applications Data converters: A/D converters, D/A converters.	

	LECTURE	TUTORIAL	TOTAL
	45	0	45

TEXT BOOKS

1. D.RoyChoudhry, Shail Jain, - Linear Integrated Circuits‖, New Age International Pvt. Ltd., 2018, Fifth Edition.
2. Sergio Franco, - Design with Operational Amplifiers and Analog Integrated Circuits‖, 4th Edition, Tata Mc Graw-Hill, 2016
3. Franco S., Design with Operational Amplifiers and Analog Integrated Circuits, 4/e,Tata McGraw Hill, 2015

REFERENCES

1. Botkar K. R., Integrated Circuits, 10/e, Khanna Publishers, 2010
2. A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010
3. Ramakant A. Gayakwad, ―OP-AMP and Linear ICs‖, 4th Edition, Prentice Hall / PearsonEducation, 2015.
4. Robert F.Coughlin, Frederick F.Driscoll, ―Operational Amplifiers and Linear Integrated Circuits‖, Sixth Edition, PHI, 2001.
5. William D.Stanley, ―Operational Amplifiers with Linear Integrated Circuits‖, PearsonEducation,4th Edition,2001.

E REFERENCES

1. https://nptel.ac.in/courses/108106068/

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2

CO 1	3	3		2	1				2			1		
CO 2	3	3		2	1					2		1		
CO 3	3	3		2	1				3	2		1		
CO 4	1	2		2	1							1		
CO 5	1	2		2	1					2		1		
Total	11	10		10	5				5	6		5		
Scaled Value	2	2		2	1				1	1		1		

0 - No Relation 1 - Low Relation ,2 – Medium Relation, 3- High Relation

OURSE CODE			**XEC502**	**L**	**T**	**P**	**C**
COURSE NAME			**DIGITAL COMMUNICATION**	**3**	**0**	**0**	**3**
PREREQUISITES			**XEC303, XEC404**	**L**	**T**	**P**	**H**
C	**P**	**A**		**3**	**0**	**0**	**3**
3	**0**	**0**					

LEARNING OBJECTIVES

- To impart the knowledge on the principles of sampling & quantization
- To instruct the various waveform coding schemes
- To familiarize the various baseband transmission schemes
- To enhance the fundamental knowledge on the various band pass signaling schemes
- To equip the students with the fundamentals of channel coding

COURSE OUTCOMES		**DOMAIN**	**LEVEL**
CO1	***Describe*** various methods to mitigate the effects of noise and ISI in baseband pulse transmission.	Cognitive	Remembering
CO2	***Explain and compare*** various digital modulation techniques	Cognitive	Understanding, Evaluate
CO3	***Describe*** and ***apply*** various error control techniques for reducing bit errors in digital communication.	Cognitive	Remembering, Applying
CO4	***Explain*** and ***illustrate*** Spread Spectrum Communication.	Cognitive	Understanding
CO5	***Explain*** Multiple Access Schemes	Cognitive	Understanding

UNIT I - COMMUNICATION THROUGH BANDLIMITED CHANNELS	**(9 Hours)**

Matched Filter- Error Rate due to noise –Inter symbol Interference- Nyquist's criterion for Distortion less Base band Binary Transmission- Correlative level coding –Baseband and Mary PAM transmission –Equalization – Linear, DFE and MLSE methods–Eye patterns	
UNIT II-DIGITAL MODULATION	**(9 Hours)**
Introduction – Geometric Representation of Signals -Conversion of the Continuous AWGN Channel into a Vector Channel - Optimum Receivers Using Coherent Detection- Probability of Error- Pass band Transmission model- Generation, Detection, Signal space diagram, bit error probability and Power spectra of ASK,BPSK, QPSK,QAM, FSK and MSK schemes – Differential phase shift keying – Comparison of Digital modulation systems using a single carrier – Carrier and symbol synchronization.	
UNIT III-ERROR CONTROL CODING	**(9 Hours)**
Discrete memoryless channels – Linear block codes - Cyclic codes - Convolutional codes – Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis codedModulation, Turbo codes, Introduction to LDPC codes,Polar Codes: Channel combining, Channel splitting, Polar coding	
UNIT IV-SPREAD SPECTRUM COMMUNICATION	**(9 Hours)**
Pseudo- noise sequences –a notion of spread spectrum – Direct sequence spread spectrum with coherent binary phase shift keying – RAKE Receiver, Signal space Dimensionality and processing gain –Probability of error – Frequency –hop spread spectrum –Pseudorandom Sequence Generation ,Maximum Length Sequences , Gold Sequences , Barker Sequences , Time-Hopping Spread Spectrum System with Pseudorandom Pulse Position Selection.Case study on SS for 3G, Wireless LAN and Satellite systems.	

UNIT V -MULTIPLE ACCESS TECHNIQUES				(9 Hours)
Introduction- Frequency Division Multiple Access-Time Division Multiple Access- Code Division Multiple Access-Single-Carrier CDMA-Multi-Carrier CDMA-Orthogonal Frequency Division Multiple Access-Single-Carrier FDMA-Space Division Multiple Access- Case Study: Multiple Access Scheme in GSM, 3GPP LTE Cellular System				
HOURS	**LECTURE**	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	45	**0**	**0**	**45**

TEXT BOOKS

1. Simon Haykins, "Communication Systems", 4th Edition, John Wiley & Sons, Reprint 2008.
2. Wesołowski, "Introduction to Digital Communication Systems", John Wiley & Sons, 2009.

REFERENCES

1. John Proakis, MassoudSalehi, "Digital Communications", 5th Editions, McGraw Hill Education India, 2014.
2. John R.Barry, Edward A. Lee, David G.Messerschmitt, "Digital Communication", 3rd Edition, Kluwer Academic Publishers, 2004.
3. E. Arıkan, "Channel polarization: A method for constructing capacity-achieving codes for symmetric binary-input memoryless channels," IEEE Trans. Inform. Theory, vol. 55, pp. 3051–3073, July 2009.

E- REFERENCES

1. http://freevideolectures.com/Course/2311/Digital-Communication(NPTEL,Digital Communication, Prof. Bikash Kumar Dey,IIT Bombay)
2. http://www.nptel.ac.in/syllabus/117105077/ (NPTEL, Digital Communication, Prof. SaswatChakrabarti, Prof. R.V. Rajakumar,IITKharagpur)

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	1	3								1		2	2	3
CO 2	1	3										1	2	3
CO 3	1	3								1		1	2	3
CO 4	1	2										1	2	3
CO 5		2										1	2	3
Total	4	13	0	0	0	0	0	0	0	2		6	10	15
Scaled Value	1	3	0	0	0	0	0	0	0	1	0	2	2	3

0 - No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSE CODE			XEC503	L	T	P	C
COURSE NAME			COMPUTER ARCHITECTURE AND ORGNAISATION	3	0	0	3
PREREQUISITES				L	T	P	H
C	P	A		3	0	0	3
3	0	0					

LEARNING OBJECTIVES

- To make the students to understand the basic structure and operation of digital computer.
- To familiarize the students with the arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations and memory system.
- To expose the students with the different ways of communicating with I/O devices and standard I/O interfaces.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Recognize*** the operation of functional units of a computer	Cognitive	Understanding
CO2	***Describe and compute*** the operation of hardware units associated with a computing device.	Cognitive	Remembering Applying
CO3	***Demonstrate*** the operation of processing unit.	Cognitive	Understanding
CO4	***Compare*** the performance of different types of memory	Cognitive	Analyzing
CO5	***Recognize*** the operation of interfacing devices.	Cognitive	Understanding

UNIT I - BASIC STRUCTURE OF COMPUTERS **9Hours**

Functional Units - Bus Structures - Performance - Evolution - Machine Instructions and programs - Memory operations - Instruction and instruction sequencing - addressing modes - Basic I/O operations - stacks and queues - subroutines - Encoding of Machine instructions.

UNIT II- ARITHMETIC UNIT **9 Hours**

Arithmetic - Design of fast adders - Binary Multiplication - Division - Floating point numbers and operations.

UNIT III- BASIC PROCESSING UNIT **9 Hours**

Processing unit - Fundamental concepts - Execution of a complete instruction - Multiple bus organization - Hardwired control – Micro programmed control - pipelining - Basic concepts - Hazards - Inference on instruction sets. Data path and control considerations - Performance issues.

UNIT IV-MEMORY SYSTEM **9 Hours**

RAM and ROM - Cache memories - Performance considerations - Virtual memories - secondary storage devices - Associative memories.

UNIT V- INPUT / OUTPUT ORGANIZATION				9 Hours
Accessing I/O devices - Interrupts - DMA - Buses - Interface circuits - standard I/O Interfaces. Case study of one RISC and one CISC processor.				
HOURS	**LECTURE**	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	45	**0**	**0**	**45**

TEXT BOOKS

1. V.CarlHamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organisation", 6th Edition, Mc Graw-Hill Inc, 2012.

REFERENCES

1. John P Hayes, "Computer Architecture and Organisation", Third edition, McGraw Hill , 2012.
2. David A Patterson and John L. Hennessy, 2002. " ComputerOrganisation and Design The Hardware / Software Interface", 2nd edition, Harcourt Asia, Morgan Kaufmann.
3. William Stallings "Computer Organization and Architecture", Seventh Edition, Pearson Education, 2006.

E-REFERENCES

1. https://www.nptel.ac.in/courses/106106092/
2. http://www.nptelvideos.in/2012/11/computer-organization.html

Table 1 :COs versus POs mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO 1	2	2	2	1						1		1		
CO 2	2	2	2	1						1		1		
CO 3	2	2	2	1								1		
CO 4	2	2	2	1					2			1		
CO 5	2	2	2	1								1		
Total	10	10	10	5	0	0	0	0	2	2	0	5	0	0
Scaled value	2	2	2	1	0	0	0	0	1	1	0	1	0	0

1-5 → 1, 6-10 → 2, 11-15 → 3

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSE CODE			XEC504	L	T	P	C
COURSE NAME			DIGITAL SIGNAL PROCESSING	3	0	0	3
PREREQUISITES				L	T	P	H
C	P	A		3	0	0	3
3	0	0					

LEARNING OBJECTIVES

- To introduce the mathematical approach to manipulate discrete time signals,which are useful to learn digital telecommunication.
- To bring out the concepts related to DFT and its computation
- To bring out the analysis and design techniques for digital filters
- To impart the concept of finite word length effect in signal processing
- To provide thorough understanding on the fundamentals and various types of digital signal processors

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Find*** and ***analyze*** Discrete Fourier Transform to signal processing	Cognitive	Remembering Analyzing
CO2	***Explain, Design*** and ***Apply*** FIR digital filters	Cognitive	Understanding Applying, Evaluating
CO3	***Explain, Design*** and ***Apply*** IIR digital filters	Cognitive	Understanding Applying, Evaluating
CO4	***Define*** and ***Classify***Finite word length	Cognitive	Remembering, Understanding Evaluating
CO5	***Define*** and***Classify***the hardware architecture, construct and ***justify*** signal processing modules in hardware	Cognitive	Understanding, Applying, Analyzing

UNIT I - DISCRETE FOURIER TRANSFORM **9 Hours**

Introduction to DSP and its applications – Efficient computation of DFT, Properties of DFT , FFT algorithms – Radix-2, Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms –Use of FFT algorithms in Linear Filtering and correlation. Convolution –overlap save and overlap add method.

UNIT II - DIGITAL FIR FILTERS DESIGN	9 Hours
Amplitude and phase responses of FIR filters – Linear phase filters – Windowing techniques for design of Linear phase FIR filters – Rectangular, Hamming, Hanning,Blackman,Kaiser windows – frequency sampling techniques, Realization structures for FIR	
UNIT III - DIGITAL IIR FILTERS DESIGN	**9 Hours**
IIR Filters – Magnitude response – Phase response – group delay - Design of Low Pass Butterworth filters (low pass) - Bilinear transformation – prewarping, impulse invariant technique - Realization structures for IIR Filters, direct-cascade and parallel form.	
UNIT IV - FINITE WORD LENGTH EFFECTS	**9 Hours**
Fixed point and floating point number representations-comparison- Truncation and rounding errors- Quantization noise – derivation for quantization noise power - coefficient quantization error- product quantization error-over flow error – Roundoff noise power –- limit cycle oscillations due to product round off and overflow errors – signal scaling- analytical model of sample and hold operations.	
UNIT V - DIGITAL SIGNAL PROCESSORS	**9 Hours**
Introduction to DSP architecture – Harvard architecture - Dedicated MAC unit - Multiple ALUs, Advanced addressing modes, Pipelining, Overview of instruction set of TMS320C5X and C54X	

	LECTURE	PRACTICAL	TOTAL
HOURS	**45**	**0**	**45**

TEXT BOOKS

1. Alan V. Oppenheim, Ronald Schafer, “Discrete Time signal Processing”, Pearson Education,3rd Edition, 2010.
2. John G Proakis, Dimtris G Manolakis,“Digital Signal Processing Principles, Algorithms and Application”,4th Edition, PHI, 2007,
3. Louis Scharf ,“Statistical Signal Processing”, Pearson Education,1991.
4. B.Venkataramani& M. Bhaskar, “Digital Signal Processor Architecture, Programming and Application” ,TMH, 2002.

REFERENCES

1. Avtarsingh, S.Srinivasan, "DSP Implementation using DSP Microprocessor with Examples from TMS32C54XX", Thomson / Brooks Cole Publishers, 2003
2. S.Salivahanan, A.Vallavaraj, Gnanapriya, "Digital Signal Processing", McGrawHill TMH,2000.
3. JohnyR.Johnson Introduction to Digital Signal Processing", Prentice Hall, 1984.
4. S.K.Mitra, "Digital Signal Processing- A Computer based approach", Tata McGraw Hill, NewDelhi, 1998.

E-REFERENCES

1. http://nptel.ac.in/courses/117102060/ (Prof: S. C. Dutta Roy, "Digital Signal Processing, Nptel online courses", Department of Electrical Engineering, Indian Institute of Technology, Delhi)
2. http://nptel.ac.in/courses/Webcourse- contents/IIT-KANPUR/Digi_Sign_Pro/ui/About-Faculty.html (Prof. Govind Sharma, "Digital Signal Processing, Nptel online courses", Department of Electrical Engineering, Indian Institute of Technology, Kanpur)

Mapping Of Course Outcomes With Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3	1	2	2	2			1	1	1	2		1
CO 2	2	2	2	2	2	2			1	1	1	2		1
CO 3	3	3	2	2	2	2			1	1	1	2		1
CO 4	3	2	2	2	3	2			1	1	1	2		1
CO 5	2	2	2	0	1	0			0	0	0	2		1
Total	13	12	9	8	10	8	0	0	4	4	4	10	0	5
Scaled Value	3	3	2	0	3	2	0	0	1	1	1	2	0	1

0 - No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSE CODE			XEC508	L	T	P	C
COURSE NAME			ANALOG INTEGRATED CIRCUITS LAB	0	0	1	1
PREREQUISITE			Electronic Devices, Electronic Circuits				
C	P	A		L	T	P	H
1	0	0		0	0	2	2

LEARNING OBJECTIVES

- To familiarize the basics of linear integrated circuits and available ICs
- To impart the knowledge on the characteristics of the operational amplifier.
- To teach the applications of operational amplifiers.
- To give insight into the basic knowledge of special function IC

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	**Understand**theprinciplesof differential amplifiers and hence operational amplifiers.	Cognitive Psychomotor	Understanding Mechanism
CO2	**Analyze**the working of operational amplifiers and basic applications.	Cognitive Psychomotor	Analyzing Understanding
CO3	**Apply**the principles of op-amp for various applications.	Cognitive	Applying
CO4	**Understand** the working of multivibrators, filters, schimitt trigger.	Cognitive	Understanding
CO5	**Understand**and carry out the working of specialized ICs.	Cognitive Psychomotor	Understanding Mechanism

LIST OF EXPERIMENTS (Discrete Components and Simulation)

S.No	List of Experiments	COs
1	Familiarization of Operational amplifiers - Inverting and Non inverting amplifiers, frequency response, Adder, Integrator, comparators.	CO1
2	Measurement of Op-Amp parameters.	CO1
3	Difference Amplifier and Instrumentation amplifier.	CO2
4	Schmitt trigger circuit using Op –Amps	CO2
5	Precision rectifiers using Op-Amp	CO3
6	RC Phase shift and Wien bridge oscillator using Op-Amp	CO3

7	Colpitts and Hartley Oscillator using Op –Amps	CO4
8	Astable , Bistable and Monostable multivibrators using IC 555 Timer	CO4
9	Active second order filters using Op-Amp (LPF, HPF, BPF and BSF).	CO4
10	A/D converters	CO5
11	D/A Converters	CO5
12	Study of PLL IC: free running frequency lock range capture range	CO5
	Mini Project: Application of Op- amp for Electronic Design	

HOURS	PRACTICAL	TUTORIAL	TOTAL
	30	0	30

TEXT BOOKS

1. Franco S., Design with Operational Amplifiers and Analog Integrated Circuits, 4/e, Tata McGraw Hill, 2015
2. Salivahanan S. ,V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008

REFERENCES

1. Botkar K. R., Integrated Circuits, 10/e, Khanna Publishers, 2010
2. A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010
3. Gayakwad R. A., Op-Amps and Linear Integrated Circuits, Prentice Hall, 4/e, 2010

E REFERENCES

1. https://nptel.ac.in/courses/108106068/

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3		2	1				2	2		1		
CO 2	3	3		2	1				2	2		1		
CO 3	3	3		2	1				3	2		1		
CO 4	1	2		2	1				2	2		1		
CO 5	1	2		2	1				2	2		1		
Total	11	10		10	5				11	10		5		
Scaled Value	2	2		2	1				2	2		1		

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSE CODE	XEC509	L	T	P	C
COURSE NAME	ANALOG AND DIGITAL COMMUNICATION LAB	0	0	1	1
PREREQUISITES	Communication Theory Digital Communication	L	T	P	H
C:P:A	1:0:0	0	0	2	2

LEARNING OBJECTIVES

- To introduce the different types of analog and digital modulation and demodulation
- To convey frequency division multiplexing and demultiplexing
- To expose the students line coding and decoding.
- To create awareness on the performance of digital modulation techniques in AWGN and Rayleigh channels

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Construct***,***Demonstrate*** and ***Simulate*** Amplitude Modulation, Demodulation, sensitivity and selectivity of AM receivers.	Cognitive Psycomotor	Mechanism Responding
CO2	***Construct***,***Demonstrate*** and ***Simulate*** Frequency Modulation, Demodulation, sensitivity and selectivity of FM receivers.	Cognitive Psycomotor	Mechanism Responding
CO3	***Construct*** and ***Demonstrate*** Frequency Division Multiplexingand demultiplexing.	Cognitive Psycomotor	Mechanism Responding
CO4	***Build***, ***Demonstrate*** and ***Simulate*** various types of analog and digital Pulse Modulations using trainer kits.	Cognitive Psycomotor	Mechanism Responding
CO5	***Simulate*** performance of digital modulation techniques in AWGN and Rayleigh channels.	Cognitive Psycomotor	Mechanism Responding

S.No	List of Experiments	COs
1	i)Amplitude Modulation and Demodulation using Kit. ii)DSB FC, DSB SC, SSB SC spectrum using Matlab software iii)Performance of AM receiver (Selectivity & Sensitivity) using Kit	CO1
2	i)Frequency Modulation and Demodulation using Kit and Matlab software ii)Performance of AM receiver (Selectivity & Sensitivity) using Kit	CO2
3	Sampling and Reconstruction using Kit and Matlab software	CO3
4	i)PAM/PWM/PPM modulation and Demodulation using kit ii)PCM and DPCM modulation and demodulation using kit iii)Delta modulation and Demodulation using kit	CO4
5	Line coding and decoding using kit	CO4
6	ASK, FSK, PSK and QPSK modulation using Kit	CO4
7	Demonstration of theoretical and simulated BER for M-PSK, M- QAM in AWGN using MATLAB	CO5
8	BER for BPSK/QPSK/QAM under Rayleigh channel	CO5
9	BER performance of BPSK using convolutional code under AWGN channel	CO5
10	Demonstration of Direct Sequence Spread Spectrum in AWGN	CO5

HOURS	TUTORIAL	PRACTICAL	TOTAL
	0	30	30

TEXT BOOKS

1. JOHN W. LEIS, "Communication Systems Principles Using MATLAB" 1st Edition, Wiley, 2018.
2. Kwonhue Choi and Huaping Liu, "Problem-Based Learning in Communication Systems Using MATLAB and Simulink (IEEE Series on Digital & Mobile Communication)" 1st Edition, Wiley-IEEE Press, 2016

REFERENCES

1.Amplitude Modulation Transmitter and Receiver User Manual, ACLT 001, United Electrotechnologies, Bangalore
2. Frequency Modulation Transmitter and Receiver User Manual,UnitedElectrotechnologies, Bangalore
3. Pulse Modulation Trainer PAM/PWM/PPM DCT 007 User Manual,UnitedElectrotechnologies, Bangalore
4. Channel Encode/Decode DCL -00 & DCL User Manual, Khodayss Systems Limited, Bangalore
5. Sampling and Reconstruction Unit DCLT001 User Manual, United Electrotechnologies, Bangalore
6. Pulse Code Modulation & Demodulation (Model No: VCT -07) User Manual, Vi Microsystems PVT Ltd, Chennai
7. Delta PCM Trainer (Model No: VCT -12) User Manual, Version 2.0, Vi Microsystems PVT Ltd, Chennai
8. Differential PCM Trainer (VCT – 34) User Manual Version 1.0, Vi Microsystems PVT Ltd, Chennai
9. TDM, PAM Modulation and Demodulation User Manual Version 1.0, Vi Microsystems PVT Ltd, Chennai

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO 1	2	2		1	2		1		2	2		1		1
CO 2	2	2		1	2		1		2	2		1		1
CO 3	2	2		1	2		1		2	2		1		1
CO 4	2	2		1	2		1		2	2		1		1
CO 5	2	2		1	2		1		2	2		1		1
Total	10	10		5	10		5		10	10		5		5
Scaled Value	2	2		1	2		1		2	2		1		1

COURSE CODE			XEC510	L	T	P	C
COURSE NAME			DIGITAL SIGNAL PROCESSING LABORATORY	0	0	1	1
PREREQUISITES				L	T	P	H
C	P	A		0	0	2	2
1	0	0					

LEARNING OBJECTIVES

- To compute the output response of the system for FFT spectrum.
- To make the students understand the behavior and response of the filter using different methods.
- To educate the students with the generation of the signals and arithmetic operation using DSP Processor

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Computation*** of linear and circular convolution	Cognitive Psychomotor Affective	Mechanism Responding
CO2	***Design*** of digital IIR digital filters.	Cognitive Psychomotor Affective	Mechanism Responding
CO3	***Design*** of digital FIR digital filters.	Cognitive Psychomotor Affective	Mechanism Responding
CO4	***Define*** and ***Classify***the hardware architecture, constructand ***justify*** signal processing modules in hardware	Cognitive Psychomotor Affective	Mechanism Responding
CO5	Design of varies projects	Cognitive Psychomotor Affective	Mechanism Responding

USING MATLAB®/SCILAB®&TMS320C5X		
S.No	**List of Experiments**	**COs**
1.	Generation of signals(Analog & Digital) (Using SciLab)	CO1
2.	Convolution of two sequences. (Using SciLab)	CO1
3.	Calculation of DFT and IDFT of a signal. (Using SciLab)	CO1
4.	Calculation of FFT and IFFT of a signal. (Using SciLab)	CO1
5.	Design of IIR filters. (Using SciLab)	CO2
6.	Design of FIR filters. (Using SciLab)	CO3
7.	Sine Wave generation (Using TMS320C5X)	CO1&CO5
8.	Convolution of two sequences (Using TMS320C5X)	CO1&CO5
9.	Calculation of DFT(Using TMS320C5X)	CO1&CO5
10.	Calculation of FFT(Using TMS320C5X)	CO1&CO5
11.	Implementation of IIR filter (Using TMS320C5X)	CO2&CO5
12.	Implementation of FIR filter (UsingTMS320C5X)	CO3&CO5

HOURS	**TUTORIAL**	**PRACTICAL**	**TOTAL**
	0	**20**	**20**

TEXT BOOKS
1. B.Venkataramani& M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application" ,TMH, 2002.
REFERENCES
1. Avtarsingh, S.Srinivasan, "DSP Implementation using DSP Microprocessor with Examples from TMS32C54XX", Thomson / Brooks Cole Publishers, 2003
E-REFERENCES
1. http://nptel.ac.in/courses/117102060/ (Prof: S. C. Dutta Roy, "Digital Signal Processing, Nptel online courses", Department of Electrical Engineering, Indian Institute of Technology, Delhi) 2. http://nptel.ac.in/courses/Webcourse- contents/IIT-KANPUR/Digi_Sign_Pro/ui/About-Faculty.html (Prof. Govind Sharma, "Digital Signal Processing, Nptel online courses", Department of Electrical Engineering, Indian Institute of Technology, Kanpur)

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	3		2	1				2	2		1		
CO 2	3	3		2	1				2	2		1		
CO 3	3	3		2	1				3	2		1		
CO 4	1	2		2	1				2	2		1		
CO 5	1	2		2	1				2	2		1		
Total	11	10		10	5				11	10		5		
Scaled	2	2		2	1				2	2		1		

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSECODE			XECM01	L	T	P	C
COURSE NAME			PCB DESIGN THROUGH ULTIBOARD	0	0	0	0
PREREQUISITE							
C	P	A		L	T	P	H
0	0	0		0	0	2	2

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Describe*** Printed Circuit Boards and ***design*** them using a CAD software.	Cognitive Psychomotor	Remember Complex Over Response

PCB characteristics- Materials - Laminates - Key Substrates- PCB design steps- Subtractive, additive and semi-additive processes- Chemical etching - drilling - coating - Creating a Board Outline- Placing Components - Dragging Components from Outside the Board Outline Dragging Components from the Parts Tab - Placing the Tutorial Components- Placing Parts from the Database - Moving Components Placing Traces-About Component Connections - Options for Placing Traces Placing a Manual Trace -Placing a Follow-me Trace Placing a Connection Machine Trace Net Bridges - PCB Transmission Line Calculator - PCB Differential Impedance Calculator -Preparing for Manufacturing/Assembly Cleaning up the Board - Adding Comments - Exporting a File- Viewing Designs in 3D

HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	5	0	10	15

TEXT BOOKS

1. National Instruments, "Ultiboard 9 PCB Layout User Guide", http://www.ni.com/pdf/manuals/371586b.pdf, 11500 North Mopac Expressway Austin, Texas 78759-3504 USA Tel: 512 683 0100, 2003–2006
2. Clyde Coombs and Happy Holden , "Printed Circuits Handbook, McGraw-Hill Education; 7 edition, 2016.

COURSECODE			XEC608	L	T	P	C
COURSE NAME			VLSI DESIGN AND EMBEDDED SYSTEMS LAB	0	0	1	1
PREREQUISITE			VLSI Design and Embedded Systems				
C	P	A		L	T	P	H
1	0	0		0	0	2	2

LEARNING OBJECTIVES

- To acquaint the students with the the concept of FGPA and constructthe FPGA circuits.
- To give insight to the students to developthe codesfor the circuit using verilog.
- To emphasis the students with the design and develop the software and hardware concept of processor in real time environment.
- To equip the students with the serial communication port ,RTOS on embedded systems
- To inculcate the understanding of interfacing of data I/O devices with embedded systems in real time and use the peripherals in embedded systems.

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Understand*** the concept of FGPA and ***construct*** the FPGA circuits.	Cognitive, Psychomotor	Understanding , Analyzing
CO2	***Define, select*** and ***develop*** the codesfor the circuit using verilog.	Cognitive, Psychomotor	Remembering, Understanding
CO3	***Describe, understand,*** and ***construct*** the embedded system design and **develop** the software and hardware concept of processor in real time environment.	Cognitive, Psychomotor	Remembering, Understanding
CO4	***Describe and understand*** the serial communication port ,RTOS on embedded systems	Cognitive, Psychomotor	Remembering, Understanding
CO5	***Understand*** the interfacing of data I/O devices with embedded systems in real time and use the peripherals in embedded systems.	Cognitive, Psychomotor	Analyzing, Understanding

S.No	List of Experiment	COs
1	Display the text in 2 x16 LCD using FPGA.	CO1
2	Study of simulation and synthesis for Logic Gates	CO1
3	Study of simulation and synthesis, place, root and back annotation for FPGAs	CO2
4	Study and implementation of schematic entry and Verilog code simulation of pipelined serial and parallel adder to add/subtract 8 number of size, 12 bit each in 2's complement.	CO2
5	Implementation of LEDs blinking controlled by switches using Verilog codes for Combinational circuits.	CO3
6	Implementation of LEDs blinking controlled by switches using Verilog codes for Sequential circuits.	CO3
7	Interfacing the LED using ARM Development board .	CO4
8	Interfacing to Input/output Devices (keyboard and LCD)using ARM Development board.	CO4
9	Serial communication using I2C with ARM Development Board.	CO4
10	Interfacing the stepper motor/servo motor/DC with ARM cortex board.	C05
11	Interfacing EPROM and interrupt with ARM cortex board.	CO5
12	Interfacing the ADC and DAC with ARM cortex board.	CO5
	Miniproject – Application of embedded systems on health, safety, environment	

	PRACTICAL	TUTORIAL	TOTAL
	30	0	30

TEXT BOOKS

1. Frank Vahid and Tony Givargis, "Embedded System Design", 3rd Edition, Wiley India, 2002.
2. Arnold S. Berger "Embedded Systems Design", 1st Edition, Taylor & Francis, 2002.
3. Rajkamal "Embedded Systems", 2nd Edition, Tata McGraw Hill, 2008.
4. A. Pucknell and Kamran Eshraghian, "Basic VLSI Design", 3rd Edition,PHI,1995.
5. K. Lal Kishore, V.S.V. Prabhakar, "VLSI Design", I.K. International Pvt.Ltd, 2010.
6. Neil H.E Weste, David Money Harris, "CMOS VLSI Design",3rd Edition, Pearson Education, 2005.
7. Neil weste and Kamran Eshraghian "Principles of CMOS VLSI Design – A Systems Perspective", 2nd Edition, Pearson Education, Reprint 2010.
8. Principles of CMOS VLSI Design, Addison Wesley N. Weste and K. Eshranghia Addison Wesley. 1985
9. The Design and Analysis of VLSI Circuits, L. Glaser and D. Dobberpuhl ,Addison Wesley,1985
10. Introduction to VLSI Systems ,C. Mead and L. Conway ,Addison Wesley1979
11. Digital Integrated Circuits: A Design Perspective, J. Rabaey, Prentice Hall India, 1997 5. VHDL ,D. Perry, McGraw Hill International 1995 2nd Ed.,

REFERENCES

1. David Kleidermacher, Mike Kleidermacher, "Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development", PHI, 2012.
2. Chattopadhyan, "Embedded System Design", 3rdEdition, PHI,2013.
3. M.J.S.Smith: "Application Specific integrated circuits", Pearson Education, 1997.
4. Wayne Wolf, "Modern VLSI Design", Pearson Education, 2003.
5. Bob Zeidmin "Introduction to verilog", Prentice Hall, 1999.
6. J .Bhaskar, "Verilog HDL Primer", Prentice Hall, 1999.
7. E. Fabricious, "Introduction to VLSI design", McGrawHill, 1990.
8. C. Roth, "Digital Systems Design Using VHDL", Thomson Learning, 2000.

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1. http://web.cs.mun.ca/~paul/transistors/node3.html
2. http://www.csee.umbc.edu/~cpatel2/links/315/lectures/chap3_lect09_processing2.pdf
3. http://www.aicdesign.org/scnotes/2002notes/Chapter02-2UP(8_13_02).pdf
4. www.verilog.com
5. http://www.ece.umd.edu/class/enee359a/verilog_tutorial.pdf
6. https://www.vidyarthiplus.com/vp/attachment.php?aid=24159
7. https://www.vidyarthiplus.com/vp/attachment.php?aid=20222
8. http://ic.sjtu.edu.cn/ic/dic/wp-content/uploads/sites/10/2013/04/CMOS-VLSI-design.pdf

9.https://swayam.gov.in/course/3573-embedded-systems-design

10.http://www.keil.com/dd/docs/data

Mapping of COs with POs:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO 1	3	2	1	3	3	3	1		3	3	2	3		
CO 2	3	1	1	3	3	3	1		3	3	2	3		
CO 3	2	1	1	3	3	3	1		3	3	2	3		
CO 4	2	1	1	3	3	3	1		3	3	2	3		
CO 5	2	2	1	3	3	3	1		3	3	2	3		
Total	12	7	1	15	15	15	5		15	15	10	15		
Scaled Value	3	2	1	3	3	3	1		3	3	3	3		0

0 - No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSECODE			XECM02	L	T	P	C
COURSE NAME			PLC AND SENSORICS	0	0	0	0
PREREQUISITE			XEC 304				
C	P	A		L	T	P	H
0	0	0		0	0	2	2

COURSE OUTCOMES		DOMAIN	LEVEL
CO1	***Describe*** the role of PLC and sensorics in Industrial Automation and ***integrate them*** using Indra logic software.	Cognitive Psychomotor	Remember Complex Overt Response

PLC architecture (L20DB) – ladder language coding for basic logic gates – AND,OR,NOR,NAND – user defined functions – Up counter, down counter, TON,TOFF ,Rising trigger, Falling trigger –sub program concept, set and reset concept-program for given case study (Ex:Traffic light signal control, Bottling etc) – Interfacing of PLC with hardware using communication parameter.

Sensorics-Construction and working principle of Inductive sensor, Capacitive sensor, Photo electric sensor, Ultrasonic sensor and Proximity sensor – study of characteristics of each sensor with respect to the sample material-interfacing of sensors with PLCs

	LECTURE	PRACTICAL	TOTAL
	5	10	15

TEXT BOOKS

1. Kelvin.T.Ericson , “Programmable Logic Controllers:An Emphasis on Design and Application”, 2nd Edition, 2011
2. Handbook on PLC and Sensorics –Bosch Rexroth .
3. Krzysztof Iniewski , “Smart Sensors for Industrial applications”, 2017 CRC Press

COURSE CODE			XEC702	L	T	P	C
COURSE NAME			EMBEDDED SYSTEMS AND VLSI DESIGN	3	0	1	4
PREREQUISITES			XEC303, XEC604	L	T	P	H
C	P	A		3	0	2	5
3	0.9	0.1					

COURSE OUTCOMES		Domain	Level
CO1	***Describe, understand***, ***construct and report*** embedded system design and development	Cognitive Psychomotor Affective	Remembering, Understanding, Applying Mechanism Responding to a phenomena
CO2	***Describe***, ***understand, react*** *and* ***perform*** *the* software and hardware concept of processor in real time environment.	Cognitive Psychomotor Affective	Remembering, Understanding Set Responding to a phenomena
CO3	***Define***, ***select ,compare, reproduce and identify*** the peripherals in embedded systems.	Cognitive Psychomotor Affective	Remembering, Understanding, Evaluate Guided Response Receiving Phenomena
CO4	***Outline***, ***explain*** the IC fabrication techniques and Design rules pertaining to CMOS technology.***construct and report the*** design of logic gates .	Cognitive Psychomotor Affective	Remembering, Understanding Mechanism Responding to a phenomena
CO5	***Design*** , ***create, construct and report the*** combinational and sequential circuits using Verilog	Cognitive Psychomotor Affective	Analyze, Create Mechanism Responding to a phenomena

UNIT I - INTRODUCTION TO EMBEDDED SYSTEMS AND DESIGN ANALYSIS	**9+6+6**

Complex systems and microprocessors – Embedded system design process – Formalism for system design-ARM processor – Architecture, Instruction sets and programming. CPU: Programming input and output – Coprocessor – Memory system mechanism– Memory devices – I/O devices – Component interfacing – Design with microprocessors – Development and Debugging – Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Analysis and optimization of execution time, power, energy, program size – Program validation and testing.

UNIT II PROCESSES,OPERATING SYSTEMS AND EMBEDDED SOFTWARE	**9+6+6**
Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Performance issues-Programming embedded systems in assembly and C – Meeting real time constraints –Multi-state systems and function sequences. Embedded software development tools –Emulators and debuggers.	
UNIT III - DEVICES AND BUSES FOR DEVICES NETWORK	**9+6+6**
I/O devices – device I/O types and examples – synchronous – Iso-synchronous and asynchronous communications from serial devices – examples of internal serial –communication devices – UART and HDLC – parallel port devices – sophisticated interfacing features in devices/ports – timer and counting devices – '12C', 'USB', 'CAN' and advanced I/O serial high speed buses – ISA, PCI, PCIX, CPCI and advanced buses.	
UNIT IV - CMOS TECHNOLOGY	**9+6+6**
An overview of Silicon semiconductor technology, Basic CMOS technology: well, P well, Twin tub and SOI Process. Interconnects, circuit elements: Resistors, capacitors, Electrically alterable ROMs, bipolar transistors, Latch up and prevention. Layout design rules, physical design: basic concepts, CAD tool sets, physical design of logic gates: Inverter, NAND, NOR, Design Hierarchies.	
UNIT V - SPECIFICATION USING VERILOG HDL	**9+6+6**
Basic Concepts: VLSI Design flow, identifiers, gate primitives, value set, ports, gate delays, structural gate level and switch level modeling, Design hierarchies, Behavioral and RTL modeling: Operators, timing controls, Procedural assignments conditional statements, Data flow modeling and RTL. Structural gate level description of decoder, equality detector, comparator, priority encoder, D-latch, D-ff, half adder, Full adder, Ripple Carry adder,Programming of PALs,ASIC design flow.	
LIST OF EXPERIMENTS	
	EMBEDDED SYSTEMS LAB
1	Write a program to blink LED using ARM Development board and Write a program to read and write a data into EEPROM using I2C using ARM Development Board.
2	Write a program for Interfacing to Input/OutputDevicesusing ARM Development board.
3	Write a program for serial communication architecture on ARM architecture
4	Study and Implementation (porting) of Process creation using fork system call in Embedded Linux on ARM Processor.
5	Study and Implementation (porting) of Synchronization of two threads to access resources using semaphore in Embedded Linux Environment on processor.
6	Display the text in 2 x16 LCD using FPGA.
7	Study of simulation and synthesis for Logic Gates
8	Study of simulation and synthesis, place, root and back annotation for FPGAs
9	Study and implementation of schematic entry and Verilog code simulation of pipelined serial and parallel adder to add/subtract 8 number of size, 12 bit each in 2's complement.
10	Implementation of LEDs blinking controlled by switches using Verilog codes for Combinational circuits.

11	Implementation of LEDs blinking controlled by switches using Verilog codes for Sequential circuits.
12	Mini project on FPGA.

	LECTURE	**TUTORIAL**	**PRACTICAL**	**TOTAL**
HOURS	**45**	**0**	**30**	**75**

TEXT BOOK

1. Frank Vahid and Tony Givargis, "Embedded System Design", 3rd Edition, Wiley India, 2002.
2. Arnold S. Berger "Embedded Systems Design", 1st Edition, Taylor & Francis, 2002.
3. Rajkamal "Embedded Systems", 2nd Edition, Tata McGraw Hill, 2008.
4. A. Pucknell and Kamran Eshraghian, "Basic VLSI Design", 3rd Edition,PHI,1995.
5. K. Lal Kishore, V.S.V. Prabhakar, "VLSI Design", I.K. International Pvt.Ltd, 2010.
6. Neil H.E Weste, David Money Harris, "CMOS VLSI Design",3rd Edition, Pearson Education, 2005.
7. Neil weste and Kamran Eshraghian "Principles of CMOS VLSI Design – A Systems Perspective", 2nd Edition, Pearson Education, Reprint 2010.

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1. David Kleidermacher, Mike Kleidermacher, "Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development", PHI, 2012.
2. Chattopadhyan, "Embedded System Design", 3rdEdition, PHI,2013.
3. M.J.S.Smith: "Application Specific integrated circuits", Pearson Education, 1997.
4. Wayne Wolf, "Modern VLSI Design", Pearson Education, 2003.
5. Bob Zeidmin "Introduction to verilog", Prentice Hall, 1999.
6. J .Bhaskar, "Verilog HDL Primer", Prentice Hall, 1999.
7. E. Fabricious, "Introduction to VLSI design", McGrawHill, 1990.
8. C. Roth, "Digital Systems Design Using VHDL", Thomson Learning, 2000.

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1. http://web.cs.mun.ca/~paul/transistors/node3.html
2. http://www.csee.umbc.edu/~cpatel2/links/315/lectures/chap3_lect09_processing2.pdf
3. http://www.aicdesign.org/scnotes/2002notes/Chapter02-2UP(8_13_02).pdf
4. www.verilog.com
5. http://www.ece.umd.edu/class/enee359a/verilog_tutorial.pdf
6. https://www.vidyarthiplus.com/vp/attachment.php?aid=24159
7. https://www.vidyarthiplus.com/vp/attachment.php?aid=20222
8. http://ic.sjtu.edu.cn/ic/dic/wp-content/uploads/sites/10/2013/04/CMOS-VLSI-design.pdf

Mapping of COs with POs:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
CO 1	3	3		2	1	1	2					1		
CO 2	2	2		2	2	1	1					1		
CO 3	3	3		3	2	2	2					1	2	2
CO 4	1	2		1	1							1		
CO 5	2	2		2	3	2	1					1		
Total	11	12		10	9	6	6					5		
Scaled value	3	3		2	2	2	2					1	1	1

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSE CODE			XEC703	L	T	P	C
COURSE NAME			MICROWAVE ENGINEERING AND OPTICAL COMMUNICATION	3	1	1	5
PREREQUISITES			XEC405	L	T	P	H
C	P	A		3	2	2	7
3	1	0					

COURSE OUTCOMES		Domain	Level
CO1	***Describe, demonstrate and analyse*** the parameters of passive microwave components.	Cognitive Psychomotor	Remembering, Understanding, Analyzing Perception
CO2	***Describe, assemble, demonstrate, measure and analyse*** the parameters of microwave sources and construct microwave bench.	Cognitive Psychomotor	Remembering, Understanding, Analyzing Perception, Mechanism
CO3	***Outline, assemble and distinguish*** various semiconductor devices.	Cognitive Psychomotor	Understanding, Remembering, Guided Response
CO4	***Explain, assemble, measure and analyse***the transmission characteristics of optical fibers.	Cognitive Psychomotor	Understanding, Analyzing Perception, Mechanism
CO5	***Explain, identify and measure*** the characteristics of optical sources and detectors.	Cognitive Psychomotor	Understanding Perception, Mechanism

UNIT I - MICROWAVE PASSIVE COMPONENTS	**9+6+6**
Microwave frequency range, significance of microwave frequency range - applications of microwaves. Scattering matrix -Concept of N port scattering matrix representation. Properties of S matrix- S matrix formulation of two-port junction. Microwave junctions - Tee junctions - Magic Tee - Rat race - Corners - bends and twists - Directional couplers - two hole directional couplers- Ferrites - important microwave properties and applications – Termination - Gyrator-Isolator-Circulator - Attenuator - Phase changer – S Matrix for microwave components – Cylindrical cavity resonators.	
UNIT II - MICROWAVE TUBES AND MEASUREMENTS	**9+6+6**
Microwave tubes- High frequency limitations - Principle of operation of Multicavity Klystron, Reflex Klystron, Traveling Wave Tube, Magnetron. Microwave measurements: Measurement of power, wavelength, impedance, SWR, attenuation, Q and Phase shift.	
UNIT III - MICROWAVE SEMICONDUCTOR DEVICES	**9+6+6**
Microwave semiconductor devices- operation - characteristics and application of BJTs and FETs -Principles of tunnel diodes - Varactor and Step recovery diodes - Transferred Electron Devices -Gunn diode- Avalanche Transit time devices- IMPATT and TRAPATT devices. Parametric devices -Principles of operation - applications of parametric amplifier .Microwave monolithic integrated circuit (MMIC) - Materials and fabrication techniques	

UNIT IV - TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS AND COMPONENTS	9+6+6
Introduction, Ray theory transmission- Total internal reflection-Acceptance angle – Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation – EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers – SM fibers. Attenuation – Material absorption losses in silica glass fibers – Linear and Non linear Scattering losses - Fiber Bend losses – Intra and inter Modal Dispersion – Over all Fiber Dispersion – Polarization- non linear Phenomena. Optical fiber connectors, Fiber alignment and Joint Losses – Fiber Splices – Fiber connectors – Expanded Beam Connectors – Fiber Couplers.	
UNIT V - SOURCES AND DETECTORS, FIBER OPTIC RECEIVER	**9+6+6**
Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, mono and hetero structures - internal - quantum efficiency, injection laser diode structures - comparison of LED and ILD Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise -Noise sources , Signal to Noise ratio , Detector response time. Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration – Probability of Error – Quantum limit.	

LIST OF EXPERIMENTS

1.	Gunn Diode – Characteristics
2.	Reflex Klystron – Mode characteristics
3.	VSWR, Frequency and Wave Length Measurement
4.	Directional Coupler – Directivity and Coupling Coefficient – S – parameter measurement
5.	E-Plane T, H-Plane T and Magic T, Isolator and Circulator – S - parameter measurement
6.	Attenuation and Power measurement
7.	Radiation Pattern and Gain of Antennas.
	OPTICAL EXPERIMENTS:
1.	Numerical Aperture Determination for Fibers
2.	Attenuation Measurement in Fibers
3.	Mode Characteristics of Fibers
4.	Fiber Optic Analog and Digital Links
5.	Measurement of Connector and Bending Losses.
6.	DC characteristics of LED and PIN Photo Diode.

	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	**45**	**30**	**30**	**105**

TEXT BOOKS

1. Samuel Y. Liao, “Microwave Devices & Circuits”, Prentice Hall of India, 2006.
2. John M. Senior, “Optical Fiber Communication”, 2nd Edition, Pearson Education, 2007.
3 Gerd Keiser, “Optical Fiber Communication”, 3rd Edition, McGraw Hill, 2000.

REFERENCES

1. Robert E.Collin, “Foundations of Microwave Engineering”,McGraw Hill, 1992.
2. Annapurna Das and Sisir K Das, “Microwave Engineering”, Tata McGraw Hill, 2004.

3. D.M.Pozar, “Microwave Engineering”, John Wiley &Sons, 2006.
4. John Gowar, “Optical Communication Systems”, Prentice Hall of India, 2001.
5. Rajiv Ramaswami, Kumar Sivarajan, Galen Sasaki, “Optical Networks: A Practical Perspective”, 3rd Edition, Morgan Kaufmann, 2010.
6. Govind P. Agrawal, “Fiber Optic Communication Systems”, 3rd Edition, John Wiley &Sons, 2004.

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1. http://www.nptel.ac.in/downloads/117101054/
2. http://www.microwaves101.com
3. http://www.lightwaveonline.com

Mapping of COs with POs:

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2		2	1	1						2		
CO 2	1	2		2	2	2						2		
CO 3	3	1		2	3	1						2		
CO 4	2	2		3	1	1						2	3	
CO 5	2	1		3	1	1						2	3	
Total	11	8		11	8	6						10	6	
Scaled value	2	2		3	2	2						2	2	

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

XEC 707 and XEC 804 Project Phase -1 and Phase II
Course Outcomes (COs)
Phase 1: L:T:P:C 0:0:2 C:P:A = 1:0.5:0.5
Phase II : L:T:P:C 0:0:12 C:P:A 6:3:3

	At the end of the course, the students will be able to		
CO	**Title**	**Domain**	**Level**
1	**Identify** the Engineering Problem relevant to the domain interest.	Cognitive	Analyzing
2	**Interpret and Infer** Literature survey for its worthiness.	Cognitive	Analyzing, Applying
3	**Analyse** and **identify** an appropriate technique for solve the problem.	Cognitive	Analyzing, Applying
4	**Perform** experimentation /Simulation/Programming/Fabrication, **Collect** and ***interpret*** data.	Psychomotor, Cognitive	CoR, Create, Applying
5	***Record* and *Report* the** technical findings as a document.	Cognitive	Remembering,

			Understanding
6	***Devote*** oneself as a responsible member and ***display*** as a leader in a team to***manage*** projects.	Affective, Cognitive	Value, Organization, Create
7	**Responding** of project findings among the technocrats.	Affective	Responding

Mapping of Course Outcomes (COs) with GAs)

XEE 707 –Project Phase -1 and XEE 804 Project Phase II

	CO1	CO2	CO3	CO4	CO5	CO6	CO7	Total	
GA1	**3**	**2**	**1**	**2**	**1**	**-**	**1**	**10**	**2**
GA2	**3**	**2**	**1**	**2**	**1**	**-**	**1**	**10**	**2**
GA3	**-**	**-**	**1**	**3**	**1**	**-**	**-**	**5**	**1**
GA4	**-**	**1**	**2**	**3**	**1**	**2**	**2**	**11**	**3**
GA5	**-**	**-**	**2**	**3**	**1**	**-**	**-**	**6**	**2**
GA6	**1**	**-**	**1**	**1**	**-**	**3**	**3**	**10**	**2**
GA7	**1**		**1**	**1**	**-**	**1**		**4**	**1**
GA8	**1**	**-**	**1**	**1**	**-**	**3**	**-**	**6**	**2**
GA9	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**6**	**2**
GA10	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**9**	**2**
GA11	**-**				**2**	**2**	**2**	**6**	**2**
GA12	**1**				**3**	**3**	**1**	**8**	**2**

0- No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSE CODE			**XGS708**	**L**	**T**	**P**	**SS**	**C**
COURSE NAME			**CAREER DEVELOPMENT SKILLS**	**0**	**0**	**0**	**2**	**0**
				L	**T**	**P**	**SS**	**H**
C	**P**	**A**	**0:0.5:1.5**	**0**	**0**	**0**	**2**	**2**
0	**0.5**	**1.5**						

COURSE OUTCOMES (COs)		**Domain**	**Level**
CO1	***Knowledge*** on a career related communication and learning the different formats of CV	Cognitive	Remembering, Understanding
CO2	***Prepare*** how to face an interview and to learn how to prepare for an interview	Psychomotor, Cognitive	Remembering, Understanding
CO3	***Communicates*** with the group of people in discussion	Affective	Remembering, Understanding

UNIT I - CV WRITING	**10**
Difference between resume and CV; characteristics of resume and CV; basic elements of CV and resume, use of graphics in resume and CV; forms and functions of Cover Letters.	
UNIT II- INTERVIEW SKILLS	**10**

Tips for various types of interviews. Types of questions asked ; body language, etiquette and dress code in interview, interview mistakes, telephonic interview , frequently asked questions. Planning for the interview.
UNIT III- WORK SHOP
Mock interviews - workshop on CV writing – Group Discussion

	Workshop	**Total**
	30	**30**

TEXT

1. **How To Write a CV That Really Works**: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Paul McGee Hachette UK, 2014
2. **Essentials of Business Communication**, Mary Ellen Guffey, Dana Loewy, Cengage Learning, 2012

Interview Skills that win the job: Simple techniques for answering all the tough questions, Michael Spiropoulos, Allen &Unwin, 2005

Effective Interviewing and Interrogation Techniques, William L. Fleisher, Nathan J. Gordon, Academic Press, 2010

REFERENCE WEBSITES

http://www.utsa.edu/careercenter/PDFs/Interviewing/Types%20of%20Interviews.pdf
http://www.amu.apus.edu/career-services/interviewing/types.htm
http://www.careerthinker.com/interviewing/types-of-interview/

Mapping of COs with GAs:

	GA1	**GA2**	**GA3**	**GA4**	**GA5**	**GA6**	**GA7**	**GA8**	**GA9**	**GA10**	**GA11**	**GA12**
CO1										2		
CO2							**1**			**2**		
CO3				2						**3**		
Total				2			**1**			**7**		
Scaled value				1			**1**			**2**		

0-No Relation 1 - Low Relation , 2 – Medium Relation, 3- High Relation

COURSECODE	**XEC710**	**L**	**T**	**P**	**C**

COURSE NAME			MATLAB FOR WIRELESS COMMUNICATION			0.5	0	0.5	1
PREREQUISITE			XEC602						
C	P	A				L	T	P	H
1	0	0				1	0	1	2
COURSE OUTCOMES					DOMAIN	LEVEL			
CO1			***Represent***various blocks of wireless communication as a programme and ***show*** that simulation results are same as theoretical.		Cognitive Psychomotor	Understand Set			

UNIT I	5+0+10

Simulation of a simple communication system and estimation bit error rate- BPSK, QPSK, QAM Modulation - Raised cosine pulses - AWGN channel - oversampled integrate-and-dump receiver front-end - Bit-error rate as a function of Es/N0 and oversampling rate. Rayleigh and Rician fading - Channel simulation - BER computation - passband and baseband systems - usage of baseband and advantages. Introduction to OFDM -Single-Carrier vs. Multi-Carrier Transmission - Basic Principle of OFDM OFDM Modulation and Demodulation - OFDM Guard Interval - OFDM Guard Band - BER of OFDM Scheme

HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	5	0	10	15

TEXT BOOKS

1. Yong Soo Cho et al.,"MIMO-OFDM wireless communications with MATLAB", John Wiley & Sons (Asia) Pte Ltd, 2 Clementi Loop, # 02-01, Singapore 129809, 2010.\

2. Dennis Silage, "Digital Communication Systems Using MATLAB and Simulink, 2e, Bookstand Publishing, 2016

SUBCODE	SUB NAME	L	T	P	C
YWC102	MODERNDIGITALCOMMUNICATION	3	0	1	4

UNIT I	8

POWERSPECTRUMANDCOMMUNICATIONOVERMEMORYLESSCHANNEL

Review of Autocorrelation and Spectral density, PSD of a synchronous data pulse stream; M-ary Markov source; Continuous phase modulation – Scalar and vector communication over memoryless channel – Detection criteria.

UNIT II	12

BLOCKCODEDDIGITALCOMMUNICATION

Architecture and performance – Binary block codes; Orthogonal; Biorthogonal; Tran orthogonal; Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes.

CONVOLUTIONALCODEDDIGITALCOMMUNICATION

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and

Threshold methods, Turbo Coding

UNIT III	8

OPTIMUMRECEIVERS

Shannon's channel coding theorem; Channel capacity; Optimum Receiver; Correlation demodulator, Matched filter demodulator, properties of the matched filter, Frequency domain interpretation of the matched filter.

UNIT IV	9

COHERENTANDNON-COHERENTCOMMUNICATION

Coded BPSK and DPSK demodulators Detections of Signals in Gaussian Noise: Decision Regions-correlation receivers- coherent detection- detection of PSK and multiple PSK-BER analysis-sampled matched filter-coherent detection of FSK - BER analysis. Non coherent Detection: Detection of DPSK, FSK-BER analysis- Performance of Non Coherent detection in Random phase, Rayleigh and Rician channels.

UNIT V	8

COMMUNICATIONS LINK ANALYSIS

Channel and sources of signal loss, Received Signal Power and Noise Power, Link Budget Analysis, Noise Figure, Noise Temperature, and System Temperature, Sample Link Analysis, Satellite Repeaters

	LECTURE	PRACTICAL	TOTAL
	45	30	75

REFERENCES

1. M.K.Simon, S.M.Hinedi and W.C.Lindsey, Digital communication techniques; Signalling and detection, Prentice Hall India, New Delhi. 1995.
2. Simon Haykin, Digital communications, John Wiley and sons, 2007
3. Bernard Sklar,"Digital Communications Fundamentals and Applications", 2nd Edition, Prentice Hall PTR, Upper Sadle River, New Jersey,2002.
4. B.P.Lathi Modern digital and analog communication systems, 3rd Edition, Oxford University press 1998.
5. Haykins, "Communication Systems", 5th ed., John Wiley, 2008. [Unit-I, III, V].
6. M. K. Simon and M. S. Alouini," Digital Communication over Fading Channels",Wiley-Interscience, 2nd Edition 2005.
7. R. G. Gallager, "Principles of Digital Communication", Cambridge University Press, 2008.

SUBCODE	SUB NAME	L	T	P	C
YWC103	WIRELESS NETWORKS	3	0	1	4

UNIT I	9

PHYSICAL AND WIRELESS MAC LAYER ALTERNATIVES

Wired transmission techniques: design of wireless modems, power efficiency, out of band radiation, applied wireless transmission techniques, short distance base band transmission, VWB pulse transmission, broad Modems for higher speeds, diversity and smart receiving techniques, random access for data oriented networks, integration of voice and data traffic..

UNIT II	**9**

WIRELESS NETWORK PLANNING AND OPERATION

Wireless networks topologies, cellular topology, cell fundamentals signal to interference ratio calculation, capacity expansion techniques, cell splitting, use of directional antennas for cell sectoring, micro cell method, overload cells, channels allocation techniques and capacity expansion FCA, channel borrowing techniques, DCA, mobility management, radio resources and power management securities in wireless networks.

UNIT III	**9**

WIRELESS WAN

Mechanism to support a mobile environment, communication in the infrastructure, IS-95 CDMA forward channel, IS – 95 CDMA reverse channel, pallert and frame formats in IS – 95, IMT – 2000; forward channel in W-CDMA and CDMA 2000, reverse channels in W-CDMA and CDMA-2000, GPRS and higher data rates, short messaging service in GPRS mobile application protocols.

UNIT IV	**9**

WIRELESS LAN

Historical overviews of the LAN industry, evolution of the WLAN industry, wireless home networking, IEEE 802.11. The PHY Layer, MAC Layer, wireless ATM, HYPER LAN, HYPER LAN – 2.

UNIT V	**9**

WPAN AND GEOLOCATION SYSTEMS

IEEE 802.15 WPAN, Home RF, Bluetooth, interface between Bluetooth and 802.11, wireless geolocation technologies for wireless geolocation, geolocation standards for E.911 service.

	LECTURE	**PRACTICAL**	**TOTAL**
	45	**30**	**75**

REFERENCES

1. KavehPahlavan, PrashantKrishnamoorthy, Principles of Wireless Networks, - A united approach - Pearson Education, 2002.
2. Jochen Schiller, Mobile Communications, Person Education – 2003, 2nd Edn.
3. X.Wang and H.V.Poor, Wireless Communication Systems, Pearson education, 2004.
4. M.Mallick, Mobile and Wireless design essentials, Wiley Publishing Inc. 2003.
5. P.Nicopolitidis, M.S.Obaidat, G.I. papadimitria, A.S. Pomportsis, Wireless Networks, John Wiley & Sons, 2003.

SUBCODE	SUB NAME	L	T	P	C
YWC106	DIGITAL COMMUNICATION LAB	0	0	1	1
	LIST OF EXPERIMENTS				

1. Demonstrate the theoretical and simulated BER for M-ary PSK MATLAB.
2. Demonstration of theoretical and simulated BER for M- QAM in AWGN using MATLAB
3. Rayleigh fading channel simulation
4. BER for BPSK/QPSK/QAM under Rayleigh channel
5. Single parity: Encoding and Decoding
6. Hamming code: Encoding and Decoding
7. Equalizers
8. Direct Sequence Spread Spectrum
9. Simulation of OFDM IN MATLAB
10. BER performance of BPSK using convolutional code under AWGN channel

REFERENCES:

http://www.vlab.co.in/
http://203.110.240.139/
http://iitg.vlab.co.in/?sub=59&brch =163
http://solve.nitk.ac.in/

SUBCODE	SUB NAME	L	T	P	C
YWC109	WIRELESS NETWORKS LAB	0	0	1	1
	LIST OF EXPERIMENTS				

1. Analysis of wireless network with wireshark.
2. TCL scripts and Xgraph.
3. Comparison of DSDV, DSR and AODV Routing protocols.
4. Implementation of MAC algorithm for wireless network.
5. Program to implement energy models for wireless nodes.
6. Implementation of symmetric key encryption using Ns2.
7. Implementation of Gray hole and wormhole attack in Ns2.
8. Program to calculate packet delivery ratio, packet loss, throughput, end to end delay and routing overhead for Wireless Networks.
9. Implementation of congestion control algorithms.
10. Simulate a wireless Personal Area Networks.
11. Measurement on the effect of RTS/CTS on a wireless link.
12. Performance comparison of GSM and CDMA networks

REFERENCES:

1. Advanced Network Technologies Virtual Lab @ www.virtual-labs.ac.in/cse28/

2. www.winlab.rutgers.edu/zhibinwu/pdf/tr_ns802_11.pdf
3. www.ittc.ku.edu/jpgs/courses/... / lecture-lab-intro2ns3- print.pdf
4. www.isi.edu/nsnam/ns/

SUBCODE	SUB NAME	L	T	P	C
YRM107	RESEARCH METHODOLOGY AND IPR	3	1	0	4

UNIT I — **9**

Meaning of research problem, Sources of research problem, Criteria-Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II — **9**

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT III — **9**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT IV — **9**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V — **9**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

REFERENCES

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
5. Mayall, “Industrial Design”, McGraw Hill, 1992.
6. Niebel, “Product Design”, McGraw Hill, 1974.

7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

SUBCODE	SUB NAME	L	T	P	C
YEGOE1	ENGLISH FOR RESEARCH PAPER WRITING	3	1	0	4

UNIT I	**9**
Planning and Preparation, Word Order, Breaking up long sentences,Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and vagueness	
UNIT II	**9**
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts.Introduction	
UNIT III	**9**
Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	
UNIT IV	**9**
key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	
UNIT V	**9**
skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	

	LECTURE	TUTORIAL	TOTAL
	45	15	60

REFERENCES

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011

SUBCODE	SUB NAME	c	T	P	C
YWC203	ADVANCED RADIATION SYSTEMS	3	0	0	3

UNITI BASICCONCEPTSOFRADIATION	**9**
Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of an Antennas, Impedance concept-	

Balance to Unbalanced transformer.

UNITII RADIATIONFROMAPERTURES **9**

Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas.

UNITIII SYNTHESISOFARRAYANTENNAS **9**

Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques.

UNITIVMICROSTRIPANTENNAS **9**

Radiation mechanisms, Feeding structure, Retangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Microstrip dipole, Microstrip arrays

UNITV EMIS/EMC/ANTENNAMEASUREMENTS **9**

Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Travelling Wave antenna, Antenna measurement and instrumentation ,Amplitude and Phase measurement, Gain, Directivity. Impedance and polarization measurement, Antenna range, Design and Evaluation

	LECTURE	TUTORIAL	TOTAL
	45	0	45

REFERENCES:

1. Kraus.J.D.,"Antennas"IIEdition,JohnwileyandSons,1997
2. Balanis.A,"AntennaTheoryAnalysisandDesign",JohnWileyandSons,NewYork,19823 .Collin.R.E.andZucker.F.,"AntennaTheory"PartI,McGrawHill,NewYork,1969
3. QizhengGu,“RFSystemDesignofTransceiversforWirelessCommunications”,Springer ,2010.
4. MichaelB.Steer,“MicrowaveandRFDesign:ASystemsApproach”,SciTechPublishing, 2009.
5. KenKuang,FranklinKimandSeanS.Cahill,“RFandMicrowaveMicroelectronicsPackag ing”,Springer,2009.
6. R.JacobBaker,“CMOSCircuitDesign,Layout,andSimulation”,3rdEdition(IEEEPressS eriesonMicroelectronicSystems),201

SUBCODE	SUB NAME	L	T	P	C
YWC206	RADIO FREQUENCY SYSTEMS LAB	0	0	1	1

1. Directional coupler
2. Circulator
3. Isolator
4. Attenuator
5. Slotted line bench
6. Microwave horn antenna
7. 2.Directional Simulation of Planar Transmission Lines and matching network
8. Simulation of Microwave Filters
9. Couplers and Power dividers
10. Patch antenna

REFERENCES:

1. Satish K. Sharma, "Experiment Manual on EE540L: Microwave Devices and Systems Laboratory Course", 2 nd Edition, Montezuma Publishing, Spring 201
2. D. M. Pozar, "Microwave Engineering", 4rth Edition, Wiley, 2011

SUBCODE	SUB NAME	L	T	P	C
YPSOE1	CONSTITUTION OF INDIA	3	1	0	4

UNIT I HISTORY AND PHIOLOSOPHY — **9**

History of Making of the Indian Constitution: History-Drafting Committee, (Composition & Working)Philosophy of the Indian Constitution: Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES: — **9**

Fundamental Rights -Right to Equality-Right to Freedom-Right against Exploitation-Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies-Directive Principles of State Policy-Fundamental Duties.

UNIT III ORGANS OF GOVERNANCE: — **9**

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive-President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications-Powers and Functions

UNIT IV LOCAL ADMINISTRATION — **9**

District's Administration head: Role and Importance, -Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT V ELECTION COMMISSION: — **9**

Election Commission: Role and Functioning. -Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

REFERENCES

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.