

**Department of
Electronics and Communication Engineering**

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**PERIYAR
MANIAMMAI
UNIVERSITY**
(Under Sec. 3 of UGC Act, 1956) • NAAC Accredited
think • innovate • transform

**SCHOOL OF ENGINEERING AND TECHNOLOGY
B.TECH. - ELECTRONICS AND COMMUNICATION ENGINEERING**

REGULATION 2015 – Revision 1

FOUR YEAR FULL TIME

CURRICULUM AND SYLLABUS

I – VIII SEMESTERS

APPROVAL	
BOS	23 rd ACM
13.04.2016	23.04.2016

1. University Vision and Mission

Vision

- To be a University of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society.

Mission

- **UM1:** Offering well balanced programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge.
- **UM2:** Providing student - centered education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work.
- **UM3:** Involving progressive and meaningful research with concern for sustainable development.
- **UM4:** Enabling the students to acquire the skills for global competencies.
- **UM5:** Inculcating Universal values, Self respect, Gender equality, Dignity and Ethics.

Core Values

- Student – centric vocation
- Academic excellence
- Social Justice, gender justice, equity, and equality.
- Skills and use of technology for global competency.
- Continual improvement
- Leadership qualities.
- Societal needs towards sustainability
- Learning, a life – long process
- Team work
- Entrepreneurship for all
- Rural development
- Basic, Societal, and applied research on Energy, Environment, and Empowerment.

2. Department Vision and Mission

Department of Electronics and Communication Engineering

Vision

To be an innovative leading department in the domain of Electronics and Communication Engineering in promoting academic growth by offering UG, PG and Ph.D programmes to augment the industrial and societal needs through cutting edge research activities.

Mission

DM1: To offer UG, PG and Ph.D programmes in Electronics and Communication Engineering through State-of-art facilities and Technology Enabled Teaching Methodologies.

DM2: To produce Exemplary Electronics and Communication Engineers to meet the contemporary requirements of the industries and institutions.

DM3: To excel in research and development activities along with establishing collaborative research ventures and linkages with leading organizations.

DM4: To cultivate entrepreneurial skill and concern for society among students.

3. Mapping of University Mission and Department Mission

	UM1	UM2	UM3	UM4	UM5
DM1	3	2	0	1	1
DM2	1	2	1	3	1
DM3	1	1	3	3	0
DM4	0	1	1	1	3
Total	5	6	4	8	5

1. Low Relation 2 – Medium Relation 3-High Relation

4. Program Educational Objectives (PEOs)

PEO1	Graduates will be successful Electronics and Communication Engineering Professionals in industries, higher education and research.
PEO2	Graduates will be technically competent in identifying, analyzing and creating appropriate Electronics and Communication engineering solutions to become an entrepreneur.
PEO3	Graduates will work as a member and lead following ethical practices.
PEO4	Graduates will strive to develop their knowledge and skills throughout their career for the benefit of the society.

Mapping of Department Mission (DM) with Program Educational Objectives (PEOs)

PEO / DM	DM1	DM 2	DM 3	DM4
PEO 1	3	2	1	1
PEO 2	2	3	1	1
PEO 3	0	2	2	2
PEO 4	0	1	1	3
5	8		5	7

1. Low Relation 2 – Medium Relation 3-High Relation

5. Graduate Attributes

1. **Knowledge base for Engineering:** Demonstrate competence in mathematics, natural sciences, engineering fundamentals and specialized engineering knowledge appropriate to the program.
2. **Problem Analysis:** Identify, formulate, analyse and solve diverse engineering problems.
3. **Design:** Solution for complicated open-ended engineering problems and design the components with appropriate standards to meet specified needs with proper attention to public health, safety, environment and society.
4. **Experimental Investigation:** Technical skills to conduct investigation, interpretation of observed data and provide solution for multifaceted problems.
5. **Modern Engineering tools usage:** Acquire, select, manipulate relevant techniques, resources and advanced engineering ICT tools to operate simple to complex engineering activities.
6. **Impact of engineering on society:** Provide a product / project for use by the public towards their health, welfare, safety and legal issues to serve the society effectively.
7. **Environment and Sustainability:** Design eco-friendly and sustainable products in demonstrating the technology development to meet present and future needs.
8. **High Ethical Standards:** Practice ethical codes and standards endorsed by professional engineers.
9. **Leadership and team work:** Perform as an individual and as a leader in diverse teams and in multi-disciplinary scenarios.
10. **Communication Skills:** Professional communication with the society to comprehend and formulate reports, documentation, effective delivery of presentation and responsible to clear instructions.
11. **Project management and Finance:** Appropriate in incorporating finance and business practices including project, risk and change management in the practice of engineering by understanding their limitations.
12. **Life-long learners:** Update the technical needs in a challenging world in equipping themselves to maintain their competence.

6. Program Outcomes(POs) and Program Specific Outcomes(PSOs)

Program Outcomes(POs)

1. Able to apply the knowledge of Mathematics, Science, Engineering and Technology in the field of Electronics and Communication Engineering
2. Capable to identify and analyse the Electronics and Communication engineering problems.
3. Proficient to provide solutions to meet the specific needs of the public health, safety, environment and society.
4. Competent to conduct experiments, interpret the data and compare the performance and provide solutions for complex problems.
5. Adept to handle modern Electronics and Communication Engineering tools, equipments and software.
6. Skillful to design Electronics and Communication products and validate by analysis and test for the benefit of the society towards safety and legal issues.
7. Efficient to develop a Electronics and Communication system or process to meet the economical growth, eco friendly environment and sustainability.
8. Instill to integrate professional, ethical and social responsibility in all walks of life.
9. Masterful to lead the group activities or as a team member for best outputs.
10. Effective to comprehend and formulate reports, deliver presentations and respond to the queries with clear ideas.
11. Capable to incorporate business practices and project management for the economical growth of the nation.
12. Able to update technical knowhow and engage in lifelong learning to meet the challenges of the modern world.

Program Specific Outcomes (PSOs)

13. (PSO1) Will be able to specialize networking practice.
14. (PSO2) will be able to specialize in Wireless Communications pertaining to physical layer.

7. Mapping of Program Outcomes (POs) with Graduate Attributes (GAs)

PO/GA	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
PO1	3	1	0	0	1	0	0	0	0	0	0	0
PO2	1	3	1	1	1	0	0	0	0	0	0	0
PO3	1	1	3	1	1	0	0	0	0	0	0	0
PO4	1	1	1	3	1	0	0	0	0	0	0	0
PO5	1	1	1	1	3	0	0	0	0	0	0	0
PO6	1	1	1	1	1	3	0	0	0	0	0	0
PO7	1	1	1	1	1	1	3	1	0	0	0	0
PO8	0	0	0	0	0	1	1	3	1	0	0	0
PO9	0	0	0	0	0	0	0	0	3	1	0	0
PO10	0	0	0	0	0	0	0	0	1	3	1	0
PO11	1	1	1	0	1	0	0	0	0	0	3	0
PO12	1	1	1	1	1	0	0	0	0	0	0	3
PS013	1	2	2	2	3	2	1	0	2	0	0	3
PS014	1	2	2	2	2	2	1	0	2	0	0	3

0-Relation 1- Low Relation 2 – Medium Relation 3-High Relation

8. Mapping of Program Outcomes (POs) with Program Educational Objectives (PEOs)

PEO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS013	PS014
PEO 1	3	3	2	3	3	2	1	0	0	1	2	0	3	3
PEO 2	2	3	2	3	3	2	2	0	1	3	2	3	3	3
PEO 3	0	0	1	0	0	1	2	1	3	0	3	3	1	1
PEO 4	2	2	1	1	2	3	2	3	1	1	3	0	3	3

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

Curriculum

SEMESTER I

Course Code	Course Name	Credits				Hours				
		L	T	P	C	L	T	P	S.S	Total
XMA101	Algebra, Differential Calculus and their applications	3	1	0	4	3	2	0	0	5
XEM102	Engineering Mechanics	3	1	0	4	3	2	0	0	5
XBE103	Electrical and Electronics Engineering Systems	3	1	1	5	3	2	2	0	7
XAP104	Applied Physics	3	1	1	5	3	2	2	0	7
XGS105	Study skills	1	0	0	1	1	0	0	2*	3
XUM106	Human Ethics, Values, Rights and Gender Equality	1	0	0	1	1	0	0	2*	3
	Total	14	4	2	20	14	8	4	4	30

***Non – credit hours**

Total Credits – 20

SEMESTER II

Course Code	Course Name	Credits				Hours				
		L	T	P	C	L	T	P	S.S	Total
XMA201	Calculus and Laplace Transforms	3	1	0	4	3	2	0	0	5
XCP202	Computer Programming	3	0	1	4	3	0	2	0	5
XBW203	Mechanical and Civil Engineering Systems	3	1	1	5	3	2	2	0	7
XAC204	Applied Chemistry	3	1	1	5	3	2	2	0	7
XEG205	Engineering Graphics	2	0	1	3	2	0	2	0	4
XGS206	Speech Communication	1	0	0	1	1	0	0	2*	3
	Total	15	3	4	22	15	6	8	2	31

***Non – credit hours**

Total Credits – 22

In-plant training during vocation for 15 days. The credits are added in III Semester.

SEMESTER III

Course Code	Course Name	Credits				Hours				
		L	T	P	C	L	T	P	S.S	T
XMA301	Transforms and Partial Differential Equations /Discrete Mathematics	3	1	0	4	3	2	0	0	5
XEC302	Electric Circuits Analysis	3	1	0	4	3	2	0	0	5
XEC303	Digital Electronics	3	0	1	4	3	0	2	0	5
XEC304	Electronic Devices and Circuits	3	1	1	5	3	2	2	0	7
XMS305	Material Science	3	0	0	3	3	0	0	0	3
XEP306	Entrepreneurship Development	2	0	0	2	2	0	0	1*	3
XGS307	Interpersonal Communication (Non credit course)	0	0	0	0	0	0	0	2*	2
XEC308	In-plant Training - I	-	-	-	1	-	-	-		-
	Total	17	3	2	23	17	6	4	3	30

*** Non-credit hours**

Total Credits – 23

SEMESTER IV

Course Code	Course Name	Credits				Hours				
		L	T	P	C	L	T	P	S.S	T
XRP401	Random process	2	1	0	3	2	2	0	0	4
XEC402	Signals and Systems	3	0	0	3	3	0	0	0	3
XEC403	Linear Integrated Circuits	3	0	1	4	3	0	2	0	5
XEC404	Communication Theory	3	1	1	5	3	2	2	0	7
XEC405	Electro Magnetic Fields and Transmission Lines	3	1	0	4	3	2	0	0	5
XUM406	Economics for Engineers	3	0	0	3	3	0	0	0	3
XGS407	Technical Communication	1	0	0	1	1	0	0	2*	3
	Extracurricular activities - NCC/NSS/YRC/RRC/Sports	-	-	-	-	-	-	-	-	-
	Total	18	3	2	23	18	6	4	2	30

*** Non-credit hours**

Total Credits – 23

In-plant training during vocation for 20 days.The credits are added in V Semester.

SEMESTER V

Course Code	Course Name	Credits				Hours				
		L	T	P	C	L	T	P	S.S	T
XMA501	Numerical Methods	2	1	0	3	2	2	0	0	4
XEC502	Computer Communication Networks	3	0	0	3	3	0	0	0	3
XEC503	Object Oriented Programming and Data structures	3	0	1	4	3	0	2	0	5
XEC504	Digital Signal Processing	3	1	1	5	3	2	2	0	7
XEC505*	Professional Elective – I	3	0	0	3	3	0	0	0	3
XTQ506	Total Quality Management	3	0	0	3	3	0	0	0	3
XGS507	Business Communication	1	0	0	1	1	0	0	2*	3
XEC508	In-plant Training – II	-	-	-	1	-	-	-	-	-
XEC509	PCB Design Using Ultiboard	0.5	0	0.5	1	1	0	1	0	2
	Total	18.5	2	2.5	24	19	4	5	2	30

*** Non-credit hours**

Total Credits – 24

SEMESTER VI

Course Code	Course Name	Credits				Hours				
		L	T	P	C	L	T	P	S.S	T
XOE601*	Open Elective – I	3	0	0	3	3	0	0	0	3
XEC602	Digital Communication	3	0	0	3	3	0	0	0	3
XEC603	Antennas and Wave Propagation	3	0	1	4	3	0	2	0	5
XEC604	Microprocessors and Microcontrollers	3	1	1	5	3	2	2	0	7
XEC605	Control Systems	3	1	0	4	3	2	0	0	5
XEC606*	Professional Elective – II	3	0	0	3	3	0	0	0	3
XUM607	Environmental Studies(Non credit course)	0	0	0	0	3*	0	0	0	3
XGS608	Academic writing (Non credit course)	0	0	0	0	0	0	0	2*	2
XEC609	PLC and Sensorics	0.5	0	0.5	1	1	0	1	0	2
	Total	18.5	2	2.5	23	22	4	5	2	33

*** Non-credit hours**

Total Credits – 23

In-plant training during vocation for 45 days.The credits are added in VII Semester.

SEMESTER VII

Course Code	Course Name	Credits				Hours				
		L	T	P	C	L	T	P	S.S	T
XOE701*	Open Elective – II	3	0	0	3	3	0	0	0	3
XEC702	Embedded Systems and VLSI Design	3	0	1	4	3	0	2	0	5
XEC703	Microwave Engineering and Optical Communication	3	1	1	5	3	2	2	0	7
XEC704*	Professional Elective - III	3	0	0	3	3	0	0	0	3
XEC705*	Professional Elective – IV	3	0	0	3	3	0	0	0	3
XUM706	Cyber Security (Non Credit Course)	0	0	0	0	3*	0	0	0	3
XEC707	Project Phase – I	0	0	2	2	0	0	4	0	4
XGS708	Career Development Skills (Non credit course)	0	0	0	0	0	0	0	1*	1
XEC 709	In-plant Training – III	-	-	-	2	-	-	-	-	-
XEC710	Matlab For Wireless Communication	0.5	0	0.5	1	1	0	1	0	2
	Total	13.5	1	4.5	23	19	2	9	1	30

* Non-credit hours

Total Credits – 23

SEMESTER VIII

Course Code	Course Name	Credits				Hours			
		L	T	P	C	L	T	P	T
XEC801*	Open Elective – III	3	0	0	3	3	0	0	3
XEC802*	Professional Elective – V	3	0	0	3	3	0	0	3
XEC803*	Professional Elective – VI	3	0	0	3	3	0	0	3
XEC804	Project Phase – II	0	0	12	12	0	0	24	24
	Total	9	0	12	21	9	0	24	33

Total Credits – 21

*Denotes A, B, C from corresponding Groups from Electives

Grant Total Credits: 179

LIST OF ELECTIVES

SEMESTER	COURSE TITLE	L	T	P	C
V Semester (PE-I)					
XEC505A	Medical Electronics	3	0	0	3
XEC505B	Instrumentation and Measurements	3	0	0	3
XEC505C	Power Electronics	3	0	0	3
VI Semester (PE-II)					
XEC606A	Telecommunication Switching and Networks	3	0	0	3
XEC606B	Electromagnetic Interference and Compatibility	3	0	0	3
XEC606C	Speech Processing	3	0	0	3
VII Semester (PE-III)					
XEC704A	DSP Processors and their Applications	3	0	0	3
XEC704B	Digital Image Processing	3	0	0	3
XEC704C	Advanced Microprocessors and Microcontrollers	3	0	0	3
VII Semester (PE- IV)					
XEC705A	Disaster Management	3	0	0	3
XEC705B	Wireless Communication Systems	3	0	0	3
XEC705C	Radar and Navigational Aids	3	0	0	3
VIII Semester (PE- V)					
XEC802A	Optical Networks	3	0	0	3
XEC802B	Wireless Networks	3	0	0	3
XEC802C	Television and Video Engineering	3	0	0	3
VIII Semester (PE- VI)					
XEC803A	Introduction to MEMS	3	0	0	3
XEC803B	Internet of Things	3	0	0	3
XEC803C	Software Defined Radio	3	0	0	3

LIST OF OPEN ELECTIVES

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
XECO1E1	Industrial Electronics	3	0	0	3
XECO1E2	Entertainment Electronics and Management	3	0	0	3

SYLLABUS

I SEMESTER

COURSECODE			XMA 101	L	T	P	C
COURSE NAME			ALGEBRA, DIFFERENTIAL CALCULUS AND THEIR APPLICATIONS	3	1	0	4
PREREQUISITE			BASIC CONCEPTS OF MATRICES, NUMBERS, DIFFERENTIATION AND INTEGRATION				
C	P	A		L	T	P	H
3	0	0		3	2	0	5
COURSE OUTCOMES				DOMAIN	LEVEL		
C01	Explain the Properties of Eigen values and Eigen vectors of the matrices, Make Use of orthogonal and similarity transformation and Construct the quadratic form to Canonical form.			Cognitive	Understanding Applying		
C02	Define and Find the radius and circle of curvature in cartesian and polar coordinates and to Explain evolutes and envelopes.			Cognitive	Remembering Understanding		
C03	Explain the convergence of series of positive terms, alternating series, and power series using tests of convergence.			Cognitive	Understanding		
C04	Find total and partial derivatives, Taylor series expansions of functions and the extremum of functions and their applications.			Cognitive	Remembering		
C05	Solve the linear equations of second and higher order with constant and variable coefficients and simultaneous first order differential equations and to Apply Method of variation of parameters to Solve the differential equation			Cognitive	Applying		
UNIT I - MATRICES							15
Eigen values and Eigenvectors of a real matrix –Properties of Eigen values and Eigen vectors – Cayley-Hamilton theorem (excluding proof) - Similarity transformation (Concept only) – Orthogonal matrix - Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to Canonical form by Orthogonal transformation.							

UNIT II- GEOMETRICAL APPLICATIONS OF DIFFERENTIAL CALCULUS			15
Curvature – Cartesian and polar co-ordinates – Centre and radius of curvature – Circle of curvature – Involutives and evolutes – Envelopes – Properties of envelopes and evolutes.			
UNIT III-INFINITE SERIES			15
Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D'Alembert's ratio test – Statement of theorems and problems only) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series (Simple problems only)			
UNIT IV -FUNCTIONS OF SEVERAL VARIABLES			15
Functions of two variables – Partial derivatives – Total differentiation – Taylor's expansion – Maxima and Minima – Constrained maxima and minima – Lagrange's Multiplier method – Jacobian Determinants.			
UNIT V -ORDINARY DIFFERENTIAL EQUATIONS AND APPLICATIONS			15
Linear equations of second and higher order with constant and variable coefficients (Euler's and Legendre's equations) – Simultaneous first order linear equations with constant coefficients – Method of variation of parameters - Applications to electrical circuit problems.			
HOURS	LECTURE	TUTORIAL	TOTAL
	45	30	75
TEXT			
1. Grewal, B.S. Higher Engineering Mathematics, 42 nd Edition, Khanna Publication, Delhi, (2012). 2. Erwin Kreyszig, "Advanced Engineering Mathematics", 8 th Edition, Wiley India, 2007. 3. T Veerarajan, Engineering Mathematics – I, First Edition, Published by McGraw Hill Education, 2013.			
REFERENCES			
1. Bali N.P and Narayana lyengar, Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi, 2003. 2. Kandasamy P., Thilagavathy K, and Gunavathy K, Engineering Mathematics Volume I, II and III, S. Chand & Co, New Delhi, 2005. 3. Venkataraman M. K, Engineering Mathematics, Volume I and II Revised enlarge Fourth Edition, The National Publishing Company, Chennai, 2004.			
E REFERENCES			
<u>www.nptel.ac.in</u> 1. Advanced Engineering Mathematics Prof. PratimaPanigrahi Department of Mathematics Indian Institute of Technology, Kharagpur.			

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	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			3					5		7

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

COURSE CODE			XEM 102	L	T	P	C
COURSE NAME			ENGINEERING MECHANICS	3	1	0	4
C	P	A		L	T	P	H
3	0	0		3	2	0	5
COURE COUTCOMES							
CO		TITLE		DOMAIN		LEVEL	
C01		Identify and choose various types of loading and support conditions that act on structural and dynamic systems.		Cognitive		Understanding	
C02		Apply pertinent mathematical, physical and engineering mechanics principles to the system to predict the problem.		Cognitive		Remembering Applying Evaluating	
C03		Apply knowledge on the concepts of centroid and moment of inertia of various sections and solids.		Cognitive Psycomotor		Remembering Applying Evaluating	
C04		Model the problem using free-body diagrams and accurate equilibrium equations and finding the solution.		Cognitive		Analyzing	
C05		Develop concepts of friction, rigid body kinematics and dynamics with an emphasis on the modeling and analysis and solving simple dynamic problems involving kinematics and momentum.		Cognitive Psycomotor		Remembering Applying Evaluating	
UNIT I BASICS AND STATICS OF PARTICLES							15
		Introduction - Units and Dimensions - Laws of Mechanics –Coplanar and Non coplanar Forces - Resolution and Composition of forces - Equilibrium of a particle - Equivalent systems of forces - Principle of transmissibility – single equivalent force.					
UNIT II - EQUILIBRIUM OF RIGID BODIES							15
		Free body diagram - Types of supports and their reactions - requirements of stable equilibrium – Equilibrium of Rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions.					

UNIT III- PROPERTIES OF SURFACES AND SOLIDS				15
	Determination of Areas and Volumes - First moment of area and the centroid - second and product moments of plane area - Parallel axis theorem and Perpendicular axis theorem - Polar moment of inertia – Mass moment of inertia - relation to area moment of inertia.			
UNIT IV - DYNAMICS OF PARTICLES				15
	Displacement, Velocity and Acceleration - their relationships - Relative motion - Curvilinear motion - Newton's Law - Work Energy Equation of particles - Impulse and Momentum - Impact of elastic bodies.			
UNIT V - ELEMENTS OF RIGID BODY DYNAMICS AND FRICTION				15
	Translation and Rotation of Rigid Bodies - Velocity and acceleration - General Plane motion - Moment of Momentum Equations - Rotation of rigid Body - Work energy equation. Frictional Force - Laws of Coulomb friction - Simple Contact friction - Rolling Resistance - Belt Friction.			
	HOURS	LECTURE	TUTORIAL	TOTAL
		45	30	75
Text books				
1. Engineering Mechanics: Statics (14th Edition) by <u>Russell C. Hibbeler</u> , Best Sellers, 2015 2. Engineering Mechanics: Dynamics (14th Edition) by <u>Russell C. Hibbeler</u> , Best Sellers, 2015 3. D.S.Kumar “A text book of Engineering Mechanics” Publishers S.K.Kataria and Sons , 2012 4. Velusami.M.A. “Engineering Mechanics with Vector Approach”: S.Chand Publishers, 2012 5. <u>J. L. Meriam, L. G. Kraige</u> “Engineering Mechanics: Dynamics”,Sixth Edition 2012 6. R.S.Khurmi “A Textbook of Engineering Mechanics” , S. Chand Publishers, 2011				
References				
1. Jayakumar and Kumar , Engineering Mechanics, PHI Learning Pvt Ltd, 2013 2. Chandramouli, Engineering Mechanics, PHI Learning Pvt Ltd, 2011 3. K.V.Natarajan, “Engineering Mechanics”, Dhanalakshmi Publishers, Chennai, 2006. 4. Beer F.P and Johnson E.R., “Vector Mechanics for Engineers – Statics and Dynamics”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2001. 5. N.Kottiswaran, ”Engineering Mechanics, Statics & Dynamics”, Sri Balaji Publications, 2004				

Program outcomes elements as addressed in the course and corresponding Indicators (I) and outcome elements

	Program outcomes	Course Outcome	Indicators
P01	An ability to apply knowledge of mathematics and science in identifying, formulating and solving engineering problems.	PI-1A	Explain the measuring Units and Dimensions.
		PI-1B	Explain the concepts of equilibrium of rigid bodies
		PI-1C	Properties of surfaces and solids
		PI-1D	Evaluate the concepts of Dynamics
P02	Identify, formulate, research literature and analysis complex civil engineering problems reaching substantiated conclusions using first principles of mathematics and Engineering Sciences.	PI-2A	Resolve all type of forces
		PI-2B	Determine the support reactions
		PI-2C	Calculation of centroid and Inertia
		PI-2D	Determination of Velocity, acceleration and related parameters.

Mapping of CO's with PO's:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01	3	3												
C02	3	3												
C03	3	3												
C04	3	3												
C05	3	3												

1 – Low relation, 2 – Medium relation, 3 – High relation 0- no relation

COURSE CODE			XBE103			L	T	P	C
COURSE NAME			ELECTRICAL AND ELECTRONICS ENGINEERING SYSTEMS			3	1	1	5
PREREQUISITES			Physics						
C	P	A				L	T	P	T
3	1	0				3	2	2	7
COURSE OUTCOMES					DOMAIN		LEVEL		
C01	Define, Relate, the fundamentals of electrical parameters and build and explain AC, DC circuits by Using measuring devices				Cognitive Psychomotor		Remembering Understanding Mechanism Set		
C02	Define and Explain the of operation of DC and AC machines.				Cognitive		Remembering Understanding		
C03	Recall, Illustrate , various semiconductor Devices and their applications and displays the input output characteristics of basic semiconductor devices.				Cognitive Psychomotor		Remembering Understanding Mechanism		
C04	Relate, Explain, the number systems and logic gates. Construct the different digital circuit.				Cognitive Psychomotor		Remembering Understanding Origination		
C05	Label, Outline different types of microprocessors and their applications.				Cognitive		Remembering Understanding		

UNIT - I	FUNDAMENTAL OF DC AND AC CIRCUITS, MEASUREMENTS	30
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). Basic concepts of electrical wiring.		
UNIT- II	ELECTRICAL MACHINES	15
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	20
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	16
Basic of Concepts of Number Systems, Logic Gates, Boolean Algebra, Adders, Subtractors, multiplexer, demultiplexer, encoder, decoder, Flipflops, Up/Down counters, Shift Registers.		
UNIT- V	MICROPROCESSORS	16
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 and subtractions			
HOURS	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	30	30	105
TEXT BOOKS				
1.Metha V.K., 2008. Principles of Electronics. S.Chand and Company .				
2.Malvino, A. P., 2006. Electronics Principles. 7 th ed. New Delhi: Tata McGraw-Hill.				
3. A.K. Theraja, B.L.,Theraja A Text book of Electrical Technology Volume -II				
3.Rajakamal, 2007. Digital System-Principle & Design. 2 nd ed. Pearson education.				
4.Moris Mano, 1999. Digital Design. Prentice Hall of India.				
5.Ramesh, S. Gaonkar, 2000. Microprocessor Architecture, Programming and its Applications with the 8085. 4 th 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://freevidelectures.com/Course/2335/Basic-Electrical-Technology#>, IISc Bangalore.
3. <http://nptel.ac.in/Onlinecourses/Nagendra/>, Dr. Nagendra Krishnapura , IIT Madras.
4. Dr.LUmanand , <http://www.nptelvideos.in/2012/11/basic-electrical-technology.html>, IISC Bangalore

Table: 1 Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO 1	3	3		2	1				1			1		
CO 2	2	3		1	1							1		
CO 3	2	3		2	1				1			1		
CO 4	3	3		3	1				1			1		
CO 5	2	3		1	1							1		
Total	12	15		13	5				3			5		
Scaled value	3	3		3	1				1			1		

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

COURSE CODE			XAP104 / XAP204	L	T	P	C
COURSE NAME			APPLIED PHYSICS	3	1	1	5
C	P	A		L	T	P	H
2.8	0.8	0.4		3	2	2	7
COURSE OUTCOMES				Domain		Level	
CO1	Identify the basics of mechanics, explain the principles of elasticity, viscosity and determine its significance in engineering systems and technological advances.			Cognitive: Psychomotor:		Remembering, Understanding Mechanism	
CO2	Describe the production, propagation, perception & analysis of acoustical wave and locate basic acoustical problem encountered in constructed buildings.			Cognitive: Affective:		Remembering, Analyzing, 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:		Understanding, Applying Mechanism Receiving	
CO4	Analyse different crystal structures, discuss and use physics principles of latest technology by visualizing.			Cognitive: Psychomotor: Affective:		Understanding, Analyze Mechanism Receive	
CO5	Develop Knowledge on engineering materials, its properties and application.			Cognitive:		U, App	
UNIT I - MECHANICS AND PROPERTIES OF MATTER							9+6+12
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 - I shape girders. Viscosity: Coefficient of viscosity - Laminar flow - streamline flow - turbulent flow - Reynold's number - Poiseuille's method.							
UNIT II - ACOUSTICS, ULTRASONICS AND SHOCK WAVES							9+6+0
Acoustics: Classification of sound - Characteristics of musical sound - Loudness - Weber Fechner law - Decibel - Absorption coefficient - Reverberation - Reverberation time - Sabin's formula (growth and decay) - Factors affecting acoustics of buildings (reverberation time, loudness, focussing, echo, echelon effect - resonance and noise) and their remedies. Ultrasonics: Production: Magnetostriction and Piezoelectric methods - NDT: Ultrasonic flaw detector. Shock waves: Definition of Mach number - Description of a shock wave - Characteristics - Methods of creating shock waves.							
UNIT III - OPTICS, LASERS AND FIBRE OPTICS							9+6+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 - Semiconductor Laser (homojunction) - Applications Fibre Optics: Principle and propagation of light in optical fibre - Numerical aperture and acceptance angle - Types of optical fibre - Fibre optic communication system	
UNIT IV - SOLID STATE PHYSICS	9+6+6
Crystal Physics: Lattice - Unit cell - Lattice planes - Bravais lattice - Miller indices - Sketching a plane in a cubic lattice - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing density for SC, BCC, FCC and HCP structures. Semiconductors: Semiconductor properties - Types of semiconductor - Intrinsic - Extrinsic: P-type and N-type semiconductor - PN junction diode - Biasing - Junction diode characteristics.	
UNIT V - NOVEL ENGINEERING MATERIALS AND BIOMETRICS	9+6+0
Novel Engineering Materials: Introduction - Metallic glasses: Melt spinning technique, properties, applications - Shape Memory Alloys: Transformation temperature, working of SMA, characteristics - Biomaterials: Properties, interaction of biomaterials with tissues, applications - Nano phase materials: Production, properties and applications. Biometrics: Introduction - definition - instrumentation - devices -advantages	
TEXT BOOKS	
1. Avadhanulu M. N. and Kshirsagar P. G., "A Text Book of Engineering Physics", 7th Enlarged Revised Edition., S. Chand & Company Ltd., New Delhi, 2005. 2. Senthil Kumar G., "Engineering Physics", 2nd Enlarged Revised Edition, VRB Publishers, Chennai, 2003. 3. Mani P., "Engineering Physics", Dhanam Publications, Chennai, 2005. 4. Prabu P. and Gayathri P., " Applied Physics", PMU Press, Thanjavur, 2013	
REFERENCE BOOKS	
1. Gaur R.K. and Gupta S. L., "Engineering Physics", Dhanpat Rai Publishers, New Delhi, 2001. 2. Pillai S.O., "Solid State Physics", 5th Edition, New Age International Publication, New Delhi,2003.	
E RESOURCES	
NPTEL , Engineering Physics, Prof. M. K. Srivastava, Department of Physics, IIT, Roorkee.	
<u>LABORATORY</u>	
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.	Poiseuille's flow - Determination of coefficient of viscosity of the given liquid.
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. Srinivasan M. & others, "A text book of Practical Physics", Sultan Chand & Sons, 2001. 2. Shukla R.K., "Practical Physics", New Age International Publication, New Delhi, 2011. 3. UmayalSundari AR., "Applied Physics Laboratory Manual", PMU Press, Thanjavur, 2012.					
HOURS		LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
		45	30	30	105

Table:1 Mapping of CO's with PO

	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS1	PS2
C01	3	2	2	2	1	-	-	-	1	-	-	1		
C02	3		1		1	-	-	-		-	-	1		
C03	3	2	2	2	1	-	-	-	1	-	-	1		
C04	3	2	2	2	1	-	-	-	1	-	-	1		
C05	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		

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

COURSE CODE			XGS105	L	T	P	SS	C
COURSE NAME			STUDY SKILLS	1	0	0	2	1
C	P	A		L	T	P	SS	H
1.8	0.6	0.6		1	0	0	2	3
COURSE OUTCOMES:				Domain		Level		
CO1	Identify different strategies of reading and writing skills.			Cognitive		Remembering		
CO2	Revise the library skills in their learning process.			Affective		Internalizing Values		
CO3	Apply different techniques to various types of material such as a novel, newspaper, poem, drama and other reading papers.			Cognitive		Applying		
CO4	Use visual aids to support verbal matters into language discourse.			Cognitive		Understanding		
CO5	Prepare to face the written exam with confidence and without any fear or tension.			Cognitive Psychomotor		Understanding Guided Responding		
UNIT I - INTRODUCTION TO STUDY SKILLS								5
Learning Skills and Strategies of Learning - Cognitive Study skills and physical study skills, Library skills (How to use Library), familiarization of library facilities by the librarian - familiarization of basic cataloguing techniques, how to ransack the library etc.								
UNIT II - REFERENCE SKILLS								5
How to use the library facilities for research and to write assignments - how to find out reference books, articles, journals and other e- learning materials - how to use a dictionary and thesaurus.								
UNIT III - READING RELATED STUDY SKILLS								5
Process of reading, various types of reading materials and varied reading techniques - familiarization to materials written by various authors - features of scientific writing and familiarization to scientific writing by renowned authors - note making skills.								
UNIT IV - WRITING RELATED STUDY SKILLS								5
Process of writing - characteristics of writing - discourse analysis - use of visual aids, and note making and note taking skills.								
UNIT V - EXAM PREPARATION SKILLS								5
Anxiety reduction skills - familiarization with various types of exam / evaluation techniques etc								

Text books
Appropriate Chapters/Units from the following textbooks 1. Narayanaswamy. Strengthen Your Writing. Orient Longman. New Delhi, 2006 2. Sasikumar, Writing with A Purpose, Champa Tickoo, Oxford University Press. 2009 3. Freeman, Sarah: <i>Study Strategies</i>. New Delhi: Oxford University Press, New Delhi 1979. 4. Peter Viney. <i>Streamline English: Destinations</i>, Oxford University Press, 1992.
References
1. Susan Fawcett Evergreen: A Guide to Writing with Readings Paperback – 2013 2. Raymond Murphy. English. Grammar in Use A reference and practice book for Intermediate, Third Edition, OUP, New Delhi, 2010 3. Kiranmai Dutt and Geetha Rajeevan. A Course in Listening and Speaking I & II. New Delhi: Foundation Books, Cambridge House, 2006. 4. David Bolton, English Grammar in Steps, Richmond Publishing, New Delhi, 2000

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 Relation

COURSE CODE			XUM106			L	T	P	S.S	C
COURSE NAME			HUMAN ETHICS, VALUES, RIGHTS AND GENDER EQUALITY			1	0	0	2	1
C	P	A				L	T	P	SS	H
2.7	0	0.3				1	0	0	2	3
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 of women issues and challenges				Cognitive & Affective	Analyzing Receiving				
CO4	Classifyand 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
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 II- GENDER EQUALITY										9
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, Thanthai Periyar and Phule to Women Empowerment.										
UNIT III- WOMEN ISSUES AND CHALLENGES										9
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
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
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.			
TOTAL HOURS	LECTURE	SELF STUDY	TOTAL
	15	30	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, (Periyar Maniammai University, Vallam, Thanjavur: 2010). 10. 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

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01								2						
C02								3	1					
C03								2						
C04								3		2				
C05								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

II SEMESTER

COURSE CODE			XMA201	L	T	P	C
COURSE NAME			CALCULUS AND LAPLACE TRANSFORMS	3	1	0	4
PREREQUISITES			Basic concepts of Differentiation, Integration, Vectors and Complex numbers.				
C	P	A		L	T	P	H
3	0	0		3	2	0	5
COURSE OUTCOMES				DOMAIN		LEVEL	
C01	MakeUse of standard results to Find the Laplace transforms of derivatives and integrals and tosolve differential equations.			Cognitive		Remembering, Applying	
C02	CO2.Apply multiple integral concepts toFind thearea, volume and to understand the order of integration.			Cognitive		Remembering, Applying	
C03	CO3. Define the gradient, divergent curl of vectors. Find directional derivative, unit vector normal to the surface. Apply corresponding theorems to Find the line, surface and Volume integrals.			Cognitive		Remembering, Applying	
C04	Construct and examine the analytic functions, and their the complex Conjugate and to Explain the concept of conformal mapping and to Construct the bilinear transformation.			Cognitive		Understanding, Applying	
C05	Explain the poles , singularities and residues of functions and tosolve the problems using contour integration			Cognitive		Understanding, Applying	
UNIT I - LAPLACE TRANSFORMS							15
Transforms of elementary functions – properties – derivatives and integrals of transforms- Transforms of derivatives and integrals - Transforms of unit step function and impulse function - Transform of periodic functions – Convolution Theorem – Inverse transforms – Solutions of differential and integral equations.							
UNIT II -MULTIPLE INTEGRALS							15
Double integration – Cartesian and polar coordinates – change of order of integration - area as a double integral – change of variables between Cartesian and polar coordinates - triple integration-- Simple applications (Finding area & volume of a certain region).							
UNIT III - VECTOR CALCULUS							15
Gradient, divergence and curl - directional derivative – normal and tangent to a given surface – angle between two surfaces – irrotational and solenoidal vector fields - Line, Surface and Volume Integral – Green’s theorem in a plane, Gauss divergence theorem and Stoke’s theorem (excluding proof).							
UNIT IV - ANALYTIC FUNCTIONS							15
Function of a complex variable – analytic function – necessary and sufficient condition (excluding proof) – Cauchy Riemann equations – properties of analytic functions - harmonic conjugate -							

construction of an analytic function – Conformal mapping: $w = z + c$, cz , $\frac{1}{z}$, $\sin z$, $\cosh z$, $z + \frac{k^2}{z}$ - Bilinear transformation.			
UNIT V COMPLEX INTEGRATION			15
Statement and application of Cauchy's integral theorem and integral formula - Taylor's and Laurent's expansion - Residues – Cauchy's Residue Theorem - Contour integration over unit circle.			
Total Hours	LECTURE	TUTORIAL	TOTAL
	45	30	75
TEXT			
1. Grewal, B.S. Higher Engineering Mathematics, 41 st Edition, Khanna Publication, Delhi, 2011. 2. Kreyszig, E, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Son(Asia) Ltd, Singapore, 2001.			
REFERENCES			
1. Bali N.P and Narayana lyengar, Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi, 2003. 2. Veerarajan T, Engineering Mathematics Fourth Edition, Tata – McGraw Hill Publishing Company Ltd, New Delhi, 2005. 3. Kandasamy P., Thilagavathy K, and Gunavathy K, Engineering Mathematics Volume I, II and III, S. Chand & Co, New Delhi, 2005. 4. Venkataraman M. K, Engineering Mathematics, Volume I and II Revised enlarge Fourth Edition, The National Publishing Company, Chennai, 2004.			
E REFERENCES			
<u>www.nptel.ac.in</u> Advanced Engineering Mathematics Prof. Jitendra Kumar Department of Mathematics Indian Institute of Technology, Kharagpur			

Mapping of COs with Pos

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO 1	3											1
CO 2	3											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	3	3	6

1 - Low, 2 - Medium, 3- high

COURSE CODE			XCP202			L	T	P	C
COURSE NAME			COMPUTER PROGRAMMING			3	0	1	4
C	P	A				L	T	P	H
3	1	0				3	0	2	5
COURSE OUTCOMES					DOMAIN		LEVEL		
C01	Define programming fundamentals and Solve simple programs using I/O statements.				Cognitive Psychomotor		Remembering Guided Response		
C02	Define syntax and write simple programs using control structures and arrays				Cognitive Psychomotor		Remembering Guided Response		
C03	Explain and write simple programs using functions and pointers				Cognitive Psychomotor		Understanding Guided Response		
C04	Explain and write simple programs using structures and unions				Cognitive Psychomotor		Understanding Guided Response		
C05	Explain and write simple programs using files and Build simple projects				Cognitive Psychomotor		Understanding Guided Response		
UNIT I - PROGRAMMING FUNDAMENTALS AND INPUT /OUTPUT STATEMENTS									15
- Theory - Program – Flowchart – Pseudo code – Software – Introduction to C language – Character set – Tokens: Identifiers, Keywords, Constants, and Operators – sample program structure -Header files – Data Types - Output statements – Input statements. - Practical 1. Program to display a simple picture using dots. 2. Program for addition of two numbers 3. Program to swap two numbers 4. Program to solve any mathematical formula.									
UNIT II - CONTROL STRUCTURE AND ARRAYS									15
- Theory - Control Structures – Conditional Control statements: Branching, Looping - Unconditional control structures: switch, break, continue, goto statements – Arrays: One Dimensional Array – Declaration – Initialization – Accessing Array Elements – Searching – Sorting – Two Dimensional arrays - Declaration – Initialization – Matrix Operations – Multi Dimensional Arrays - Declaration – Initialization. Storage classes: auto – extern – static. Strings: Basic operations on strings. - Practical 1. Program to find greatest of 3 numbers using Branching Statements 2. Program to display divisible numbers between n1 and n2 using Looping Statement 3. Program to remove duplicate element in an array. 4. Program to perform string operations.									
UNIT III- FUNCTIONS AND POINTERS									15
- Theory - Functions: Built in functions – User Defined Functions - Parameter passing methods - Passing arrays to functions – Recursion - Programs using arrays and functions. Pointers - Pointer declaration - Address operator - Pointer expressions & pointer arithmetic - Pointers and function - Call by value - Call by Reference - Pointer to arrays - Pointers and structures - Pointers on pointer. - Practical 1. Program to find factorial of a given number using four function types. 2. Programs using Recursion 3. Programs using Pointers									

UNIT IV - STRUCTURES AND UNIONS			9+7
• Theory Structures and Unions - Giving values to members - Initializing structure - Functions and structures - Passing structure to elements to functions - Passing entire function to functions - Arrays of structure - Structure within a structure and Union. Practical 1. Program to read and display student mark sheet <u>Structures</u> with variables 2. Program to read and display student marks of a class using <u>Structures</u> with arrays 3. Program to create linked list using <u>Structures</u> with pointers			
UNIT V - FILES			15
• Theory File management in C - File operation functions in C - Defining and opening a file - Closing a file - The getw and putw functions - The fprintf & fscanf functions - fseek function – Files and Structures. Practical 1. Program for copying contents of one file to another file. 2. Program using files using structure with pointer			
		LECTURE	PRACTICAL
		45	30
		TOTAL	
		75	
TEXT BOOKS			
1. Byron Gottfried, "Programming with C", III Edition, (Indian Adapted Edition), TMH publications, 2010 2. Yeshwant Kanethker, "Let us C", BPB Publications, 2008			
REFERENCES			
1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education Inc. (2005). 2. Behrouz A. Forouzan and Richard. F. Gilberg, "A Structured Programming Approach Using C", II Edition, Brooks–Cole Thomson Learning Publications, 2001. 3. Johnsonbaugh R. and Kalin M., "Applications Programming in ANSI C", III Edition, Pearson Education India, 2003. 4. https://iitbombayx.in/courses/IITBombayX/BMWCS101.1x/2015_T1/courseware			

Mapping of COs with Pos

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01								2						
C02								3	1					
C03								2						
C04								3		2				
C05								3	2	2		2		
Total		2						13	3	4		2		
Scaled Value		1						3	1	1		1		

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

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

COURSE CODE			XWE203	L	T	P	C
COURSE NAME			MECHANICAL AND CIVIL ENGINEERING SYSTEMS (WORKSHOP PRACTICE INCLUDED)	3	1	1	5
C	P	A		L	T	P	H
1.5	1.5	0		3	2	2	7
COURSE OUTCOMES				DOMAIN		LEVEL	
C01	Define and visualize the working principles of the various boilers, turbines and engines			Cognitive Psychomotor		Knowledge	
C02	Differentiate and auscultate the measurements by using various metrology instruments			Cognitive Psychomotor		Comprehension	
C03	Categorise and palpate the various metal forming, joining and cutting processes			Cognitive Psychomotor		Synthesis	
C04	Characterize and diagnose the quality of the good Building materials; and measure linear and angular dimensions			Cognitive Psychomotor		Knowledge	
C05	Summarize and palpate the components of a substructures and super structures.			Cognitive Psychomotor		Evaluation	
UNIT I-Basics of Thermal and Energy Systems							21
Introduction to Mechanical Engineering – Streams – Thermal, Design, and Manufacturing Conventional and non conventional sources of energy – Heat energy – Modes of heat transfer – Working principles of Boilers and Turbines – Classification of IC Engines – 4 stroke and 2 stroke engines – Petrol and diesel engines – Performance and heat balance – Working principles of hydel, steam and nuclear power plants.							
Practical:							
Petrol engine performance – BHP							
Diesel engine performance – BHP							
Demonstration of refrigeration and air conditioning units							
UNIT II -Fundamentals of Machine Elements and Measurements							15
Engineering materials – Machine elements – fasteners and support systems – Belt drives – Types – Velocity ratio and Length of belt – Gear drives – Types – Velocity ratio.							
Principle of measurements – Accuracy – Precision – Errors – Measuring instruments – Scale – Vernier Caliper – Micrometer – Slip gauges – Spirit level.							
Practical:							
Measurements using Vernier Caliper, Micrometer, Slip gauges and Spirit level.							
Demonstration of transmission system in machines and suspension system in automobiles.							

UNIT III - Elements of Manufacturing				15	
Manufacturing processes – Classification – Principles of metal forming – forging, moulding, casting – Principles of metal joining – welding, soldering and brazing.					
Machining – turning, drilling, milling and grinding – Machining time and material removal rate.					
Practical:					
Exposure to workshop tools					
Fitting exercises: Square and triangle					
Simple turning and drilling					
Demonstration of welding and mould preparation					
UNIT IV-Surveying and Construction Materials				15	
Surveying: Definition – Survey Instruments – Classification of Survey – Linear and Angular Measurements – Measurement of area – Illustrative Examples.					
Construction Materials:Bricks – Stones – Timber – Steel – Cement – Sand – Aggregates – Concrete					
Practical: Surveying					
UNIT V- Components and of Construction of Civil Structures				15	
Substructure:Bearing capacity - Types of Foundation – Application – Requirement of good foundations.					
Superstructure:Brick masonry – Types of bond – Flooring – Beams – Columns – Lintels – Roofing – Doors and windows fittings – Introduction to bridges and dams – Building drawing					
Practical: Building drawing, Carpentry, Plumbing.					
Total Hours		LECTURE	TUTORIAL	PRACTICAL	TOTAL
		45	30	30	105
TEXT BOOKS					
1. Dr. P.K. Srividhya, P. Pandiyaraj, S. Balamurugan, “Basic Civil and Mechanical Engineering”, PMU Publications, Vallam, 2013.					
2. Dr. B.C.Punmia, Ashok Kumar Jain, “Basic Civil Engineering”, Laxmi Publications, New Delhi, 2003.					
3. Dr. B.C.Punmia, “Surveying – Volume I”, Laxmi Publications, New Delhi, 2005					
REFERENCES					
1. Venugopal K., Basic Mechanical Engineering, Anuradha Publications, Kumbakonam, 2007.					
2. Shanmugam G. and Palanichamy M. S., "Basic Civil and Mechanical Engineering", Tata Mc Graw Hill Publishing Co., New Delhi, 3rd Edition, 2009.					

Mapping of CO's with PO's:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	2	-	-	2	-	-	-	-	-	-	-	-
CO2	2			2		1	-	-	-	-	-	-
CO3		2			2	-	-	-	-	-	-	-
CO4		3		1		-	-	-	-	-	-	-
CO5	1	1			3	-	-	-	-	-	-	-
Total	5	6	-	5	5	1	-	-	-	-	-	-

1 - Low, 2 – Medium, 3 – High

COURSE CODE			XAC204			L	T	P	C
COURSE NAME			APPLIED CHEMISTRY			3	1	1	5
C	P	A				L	T	P	H
2.8	0.8	0.4				3	2	2	7
COURSE OUTCOMES					DOMAIN	LEVEL			
C01	Identify and describe the various water quality parameters and methods to purify water in contest with boilers and domestics usage.				Cognitive Psychomotor	Remembering Perception			
C02	Explain the fundamental principles of electrochemical reactions, its applications in redox reactions and calculate the different electrochemical processes.				Cognitive Psychomotor	Understanding Set			
C03	Interpret thetypes of corrosion, use and measure its control by various methods including protective techniques.				Cognitive Psychomotor Affective	Applying Mechanism Receive			
C04	Describe, Illustrate and Discuss the generation of energy in batteries, nuclear reactors, solar cells, fuel cells and anaerobic digestion.				Cognitive Affective	Remembering Analyzing Respond			
C05	Apply and measure the different types of spectral techniques for quantitative chemical analysis and listnanomaterials for various engineering processes.				Cognitive Psychomotor	Remembering Applying Mechanism			
UNIT I -WATER TECHNOLOGY								7 + 8 +9	
Sources and types of water – water quality parameters – BIS and ISO specifications- hardness: types and estimation of hardness (problems) – alkalinity: types and estimation (problems) – boiler feed water – requirements – disadvantages of using hard water in boilers – internal treatment, external treatment – demineralization process – desalination using reverse osmosis –domestic water treatment – Effluent treatment processes in industries									
UNIT II -ELECTROCHEMISTRY								8+5 +15	
Basic concepts of conductance – Kohlraush’s law and conductometric titrations –electrode potentials- Nernst equation: derivation and problems – reversible and irreversible cells – electrolytic and electrochemical cells– emf and its measurements – types of electrodes-reference electrodes – primary and secondary – glass electrode – determination of pH using quinhydrone and glass electrodes – electrochemical series and its applications – Galvanic cells and concentration cells – potentiometric titrations - redox titrations.									
UNIT II-CORROSION AND PROTECTIVE COATINGS								9 + 4 +3	
Corrosion- causes- types-chemical, electrochemical corrosion (galvanic, differential aeration) corrosion in electronic devices, corrosion control - material selection and design aspects · electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: paints- constituents and functions - electroplating of copper and gold, Electroless plating - Distinction between electroplating and electroless plating, advantages of electroless plating, electroless plating of nickel and copper on PCB.									

UNIT IV- ENERGY STORAGE DEVICES AND NUCLEAR ENERGY	12 +7+0
Energy storage devices – Batteries: Types – primary (dry cell, alkaline cells) and secondary (lead acid Ni-Cd and Lithium ion batteries) - Supercapacitors – Fuel cells-Hydrogen-Oxygen fuel cell- Solar cells . Nuclear energy: nuclear fission and fusion –chain reaction and its characteristics – nuclear energy and calculations (problems) – atom bomb –Nuclear reactor- light water nuclear power plant – breeder reactor- Weapon of mass destruction- nuclear, radiological, chemical and biological weapons Disarmament - National and International Cooperation- Chemical Weapon Convention (CWC), Peaceful Uses of Chemistry. Bio fuels: biomethanation- anaerobic digestion process, biomass: sources and harness of energy.	
UNIT V SPECTROSCOPY AND NANOCHEMISTRY	9 +6 +3
Electromagnetic spectrum - Lambert law and Beer-Lambert's law (derivation and problems) - molecular spectroscopy -UV- visible spectroscopy: electronic transitions - chromophores and auxochromes – instrumentation (block diagram) - applications – IR spectroscopy: principle - fundamental modes of vibrations – calculations of vibrational frequency – IR spectrophotometer instrumentation (block diagram) – applications of IR spectroscopy. Nanochemistry - Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis ; properties and applications of nano materials-Buckminster fullerenes, CNT'S(Single walled carbon nano tubes and Multi-walled carbon tubes)-Graphene- advantages and applications.	
TEXT BOOKS	
1. Jain and Jain , "A Text book of Engineering Chemistry", Dhanapatrai Publications, New Delhi, 2011. 2. Gadag and Nityananda Shetty , "Engineering Chemistry", I.K International publishing House Pvt. Ltd, 2010. 3. P. Atkins, J.D. Paula , "Physical Chemistry" , Oxford University Press, 2009. 4. S. S. Dara, S. S. Umare, "A Text Book of Engineering Chemistry", S. Chand Publishing, 2011 5. C.P. Poole and F.J. Owens, " Introduction to Nanotechnology" , , Wiley, New Delhi ,2007.	
REFERENCES	
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 REFERENCES	
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
1. Determination of total hardness, temporary and permanent hardness of water by EDTA method. 2. Determination of alkalinity of water sample. 3. Determination of chloride content of water sample by Argentometric method. 4. Conductometric titration of a strong acid with a strong base. 5. Determination of strength of hydrochloric acid by pH metric method. 6. Conductometric precipitation titration using barium chloride and sodium sulphate. 7. Determination of strength of iron by potentiometric method using dichromate. 8. Potentiometric acid-base titration using quinhydrone electrode.	

9. Corrosion inhibition efficiency by weight loss method.
10. Estimation of iron by colorimetric method.

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.
3. Sirajunnisa.A., Sundaranayagi.S., Krishna., Rajangam.R., Gomathi.S., "Applied Chemistry Lab Manual", Department of Chemistry, PMU Press, Thanjavur, 2016.

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>

	LECTURE	TUTORIAL	PRACTICAL	TOTAL HOURS
HOURS	45	30	30	105

Mapping of CO's with PO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
C01	3	3	3	3	3	1	2	3	1	3	1	1	2	1
C02	3	2	3	3	3	2	3	3	1	3		1	2	1
C03	3	3	3	3	3	1	3	3	1	2	1	1	2	2
C04	3		3	3	3	3	3	3	1	1		1	3	2
C05	1	3		2	2	1	2		1	1		1	2	2
Total	13	11	12	14	14	8	13	12	5	10	2	5	11	8
Scaled Value	3	3	3	3	3	2	3	3	1	2	1	1	1	2

1 – 5 → 1, 6 – 10 → 2, 11 – 15 → 3

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

COURSE CODE			XEG205			L	T	P	C
COURSE NAME			ENGINEERING GRAPHICS			2	0	1	3
C	P	A				L	T	P	H
1	1	1				2	0	2	4
COURSE OUTCOMES					DOMAIN	LEVEL			
C01	Apply the national and international standards, <i>construct</i> and <i>practice</i> various curves				Cognitive Psychomotor Affective	Applying Guided Response			
C02	Interpret, <i>construct</i> and <i>practice</i> orthographic projections of points, st. lines and planes.				Cognitive Psychomotor Affective	Understanding Mechanism Response			
C03	Construct <i>Sketch</i> and <i>Practice</i> projection of solids in various positions and true shape of sectioned solids.				Cognitive Psychomotor Affective	Applying Comprehension Response			
C04	Interpret, <i>Sketch</i> and <i>Practice</i> the development of lateral surfaces of simple and truncated solids, intersection of solids.				Cognitive Psychomotor Affective	Applying Comprehension Response			
C05	Construct, <i>sketch</i> and <i>practice</i> isometric and perspective views of simple and truncated solids.				Cognitive Psychomotor Affective	Applying Comprehension Response			
UNIT I- INTRODUCTION, FREE HAND SKETCHING OF ENGG OBJECTS AND CONSTRUCTION OF PLANE CURVE								6+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.									
UNIT II-PROJECTION OF POINTS, LINES AND PLANE SURFACES								6+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.									
UNIT III- PROJECTION OF SOLIDS AND SECTIONS OF SOLIDS								6+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.									
UNIT IV- DEVELOPMENT OF SURFACES AND INTERSECTION OF SOLIDS								6+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.			
UNIT VI-SOMETRIC AND PERSPECTIVE PROJECTIONS			6+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.			
	LECTURE	PRACTICAL	TOTAL
	30	30	60
TEXT			
1. Natarajan,K.V, “ A Textbook of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2006 . 2. 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 REFERENCES			
1. http://periyarnet/Econtent 2. http://nptel.ac.in/courses/112103019/			

Mapping of CO's with PO:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
C01	3	2	3	1	1							1
C02	3	2	1	1	1							1
C03	3	2	1	1	1							1
C04	3	2	1	1	1							1
C05	3	2	1	1	1							1
Total	15	10	7	5	5							5
Scaled	3	2	2	1	1							1

1 – Low Relation, 2 – Medium Relation, 3 – High Relation

COURSE CODE			XGS206			L	T	S.S	C
COURSE NAME			SPEECH COMMUNICATION			1	0	2	2
C	P	A				L	T	S.S	H
3	0	0				1	0	2	3
COURSE OUTCOMES					DOMAIN	LEVEL			
C01	Identify different styles to various forms of public speaking skills and presentation skills				Cognitive	Remembering			
C02	Understand and identify the proper tone of language required in writing and speaking				Cognitive	Understanding			
C03	Adapt the speech structures and develop the speech outline according to the audience.				Cognitive Psychomotor	Applying			
C04	Ability to communicate and develop presentation skills				Cognitive Affective	Response			
C05	Equip the speaker to face the audience without any anxiety.				Psychomotor	Guided Response			
UNIT I- INTRODUCTION TO PUBLIC SPEAKING									9
Functions of oral communication; skills and competencies needed for successful speech making; importance of public speaking skills in everyday life and in the area of business, social, political and all other places of group work.									
UNIT II- TYPES OF SPEECH									9
Manuscript, impromptu, memorized and extemporaneous speeches; analyzing the audience and occasion; developing ideas; finding and using supporting materials.									
UNIT III- ORGANIZATION OF SPEECH									9
Introduction, development and conclusion; language used in various types of speeches; Adapting the speech structures to the Audience; paralinguistic features.									
UNIT IV- USE OF VISUAL AIDS									9
How to present a paper/assignment etc; using visual aids to the speeches; using body language to communicate									
UNIT V-SPEECH ANXIETY									9
Public speaking and speech anxiety, public speaking and critical listening Speech practice (4-6 speeches per student)									
Total Hours					LECTURE	TUTORIAL		TOTAL	
					45			45	
TEXT BOOKS									
1. Principles and Types of Public Speaking - 2002 by Raymie E. McKerrow (Author), Bruce E. Gronbeck ,Douglas Ehninger , Alan H. Monroe									
2. Communication : Principles for a lifetime, portable Edition- volume 2 Interpersonal Communication, Stevan A. Beebe, Texas State Universtiy- San Marcos, 2008.									
3. Writing and Speaking Author: John Sealy, Oxford University Press, New Delhi Third Edition 2009. Communicating in Business (8th Edition) Paperback – 2012 by Williams K S , Engage Learning India Pvt. Ltd.									

Mapping of Cos with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	PO 10	PO 11	PO 12
C01	0	0	0	0	3	0	0	2	0	2	0	0
C02	0	1	0	0	0	1	0	2	0	1	0	0
C03	0	0	0	0	0	0	0	0	0	2	0	0
C04	0	0	0	2	0	2	0	0	0	1	0	0
C05	0	0	0	0	0	3	0	0	0	3	0	0
Total	0	1	0	2	3	6	0	4	0	9	0	0
Scaled Value	0	1	0	1	1	2	0	1	0	2	0	0

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

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

III SEMESTER

COURSE CODE			XMA301			L	T	P	C
COURSE NAME			TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS / DISCRETE MATHEMATICS			3	1	0	4
C	P	A				L	T	P	H
3	0	0				3	2	0	5
COURSE OUTCOMES						DOMAIN	LEVEL		
C01	Explain and Demonstrate the basic concepts in partial differential equations and to solve linear, nonlinear, homogeneous and nonhomogeneous partial Differential equations.					Cognitive	Remembering		
C02	Demonstrate the basic concept and properties of Fourier series and to state Parseval's identity and Diritchlet's condition.					Cognitive	Remembering, Understanding		
C03	Solve the standard Partial Differential Equations, arising in engineering Problems, like Wave equation and Heat flow equation by Fourier series method.					Cognitive	Applying		
C04	Explain and Apply the concept of Fourier transform and its properties.					Cognitive	Understanding , Applying		
C05	State and Apply the properties of Z transform and to Find the Z transform and inverse Z transform .					Cognitive	Remembering, Applying		
UNIT I - Partial Differential Equations									15
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									15
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									15
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									15
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									15
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.									
Total Hours						LECTURE	TUTORIAL	TOTAL	
						45	30	75	

TEXT BOOKS												
1. Grewal, B.S., "Higher Engineering Mathematics", 40th Edition Khanna Publishers, New Delhi, (2007). 2. Narayanan, S., Manicavachagom Pillay, T.K. and Ramaniah, G., "Advanced Mathematics for Engineering Students", Volumes II and III, S.Viswanathan (Printers and Publishers) Pvt. Ltd. Chennai, (2002).												
REFERENCES BOOKS												
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)												
E REFERENCES												
1. www.nptel.ac.in, "Advanced Engineering Mathematics", Prof. Jitendra Kumar, Department of Mathematics, Indian Institute of Technology, Kharagpur.												

Mapping of Cos with GAs:

	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
Total	15	6	0	0	2	0	0	0	0	5	3	6
Scaled value	3	2			1					1	1	2

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

COURSE CODE			XEC302	L	T	P	C
COURSE NAME			ELECTRIC CIRCUITS ANALYSIS	3	1	0	4
C	P	A		L	T	P	H
3	0	0		3	2	0	5
COURSE OUTCOMES				DOMAIN		LEVEL	
C01	Outline andreproduce DC circuits.			Cognitive		Remembering	
C02	State and distinguish various theorems pertaining to electric circuits.			Cognitive		Remembering, Understanding	
C03	Outline and explain AC circuits.			Cognitive		Remembering, Understanding	
C04	Understand and classify transients and resonance circuit			Cognitive		Understanding, Applying	
C05	Discuss and explain coupled circuits and networks.			Cognitive		Understanding Applying	
UNIT I- DC CIRCUIT ANALYSIS							9+ 6
Basic components and electric circuits – Charge – Current – Voltage and Power– Voltageand Current Sources – Ohms Law – Voltage and Current laws – Kirchoff’s Current Law –Kirchoff’s voltage law – The single Node – Pair Circuit – Series and Parallel ConnectedIndependent Sources – Resistors in Series and Parallel – Voltage and Current division –Basic Nodal and Mesh analysis – Nodal analysis – Mesh analysis.							
UNIT II – NETWORK THEOREM AND DUALITY							9+ 6
Superposition theorem, Thevenin’s and Norton’s theorems, Reciprocity, Compensation,Maximum power transfer theorems, Tellegan’s and Millman’s theorems, Application oftheorems to DC circuits. Transfer – Delta – Wye Conversion – Duality – Dual circuits.							
UNIT III – SINUSOIDAL STEADY STATE ANALYSIS							9+ 6
Sinusoidal Steady – State analysis – Characteristics of Sinusoids– The Complex ForcingFunction– The Phasor– Phasor relationship for R– L – C – impedance and Admittance –Nodal and Mesh Analysis– Phasor Diagrams – AC Circuit Power Analysis –Instantaneous Power – Average Power – Computation of active- reactive and complexpowers- Apparent Power and Power Factor – Complex Power.							
UNIT IV – TRANSIENTS AND RESONANCE IN RLC CIRCUITS							9+6
Basic RL and RC Circuits – The Source – Free RL Circuit – The Source–Free RC Circuit –The Unit-Step Function – Driven RL Circuits – Driven RC Circuits – RLC Circuits –Frequency Response – Series and Parallel Resonance – Quality Factor- Synthesis of RL and RC circuits							
UNIT V – COUPLED CIRCUITS AND TOPOLOGY							9+6
Magnetically coupled circuits – Mutual inductance – the Linear Transformer – the IdealTransformer – An introduction to Network Topology – Trees and General Nodal analysis– Links and Loop analysis.							
	LECTURE		TUTORIAL		PRACTICAL		TOTAL
HOURS	45		30		0		75
TEXT BOOKS							
1. William H.Hayt Jr., Jack E.Kemmerly, Steven M.Durbin,“Engineering CircuitAnalysis”, 6 th Edition , Tata McGraw-Hill, 2006.							
2. Robert L. Boylestad , “Introductory Circuit Analysis”, Pearson Education, 12 th Edition, 2010.							

REFERENCES

1. Nilsson, Riedel., "Electric Circuits", 8th Edition, Pearson Education, 2008.
2. Charles K. Alexander & Mathew N.O.Sadiku., "Fundamentals of Electric Circuits", 2nd Edition, McGraw- Hill, 2003.
3. A. Sudhakar, Shyammohan S. Palli., "Circuits and networks : analysis and synthesis" 1st Edition, McGraw-Hill, 2008.
4. D.R.Cunningham, . J.A. Stuller., "Basic Circuit Analysis", Jaico Publishing House, 1996.
5. David E.Johnson, Johny R.Johnson, John L.Hilburn., "Electric Circuit Analysis", 2nd Edition, Prentice Hall, 1997.
6. K.V.V.Murthy, M.S.Kamath, "Basic Circuit Analysis", Jaico Publishing House, 1999.
7. M.E Vanvalkenburg, "Network Analysis", 3rd Edition, PHI, 2003.
8. Franklin F.Kuo, "Network Analysis and Synthesis", 2nd Edition, John Wiley & Sons, 2003.
9. T.Nageswara Rao, "Electric Circuit Analysis", A.R Publications, Sirkali, Tamil Nadu, 2009
10. Joseph A Edminister, Mahmood Nahvi, "Electric Circuits", 3rd Edition, Schaum's Outline Series, Tata McGraw Hill, 2000.

E-REFERENCES

1. www.nptel.iitm.ac.in/108102042/lec1.pdf, (NPTEL Lecture Series on Circuit Theory by 'Prof.S.C Dutta Roy', Department of Electrical Engineering IIT Delhi).

Mapping of Cos with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO 1	3	2		1	2				2			2		
CO 2	3	2		1	2				2			2		
CO 3	3	2		1	2				2			2		
CO 4	3	2		1	2				2			2		
CO 5	2	1			1				2			2		
Total	14	9		4	9				10			10		
Scaled value	3	2		1	2				2			2		

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

COURSE CODE			XEC303	L	T	P	C
COURSE NAME			DIGITAL ELECTRONICS	3	0	1	4
C	P	A		L	T	P	H
3	0.9	0.1		3	0	2	5
COURSE OUTCOMES				DOMAIN		LEVEL	
CO1	Construct and verify the universal building blocks, understand the digital IC families and related hazards.			Cognitive Psychomotor		Understanding Origination	
CO2	Convert from one code to another code, Simplify boolean expression, design and present using logic gates			Cognitive Psychomotor Affective		Understanding, Origination, Response	
CO3	Use Boolean laws to design, display and perform the output of combinational logic circuits			Cognitive Psychomotor Affective		Applying, Create, Set Response	
CO4	Design, construct and report the functioning of sequential logic circuits.			Cognitive Psychomotor Affective		Create, Origination, Response	
CO5	Describe and discuss the various memory devices and programmable logic devices.			Cognitive		Remembering, Understanding	
UNIT I - LOGIC GATES AND DIGITAL IC FAMILIES							9+6
Logic families: AND, OR, NOT, NAND, NOR, Exclusive OR and Exclusive NOR- Demorgan's Theorem - Implementations of Logic Functions using gates -NAND and NOR implementations – Multi level gate implementations- Multi output gate implementations. Digital IC families: DTL, TTL, ECL, MOS and CMOS. Hazards: Static and Dynamic –Hazards elimination.							
UNIT II - BINARY CODES AND MINIMIZATION TECHNIQUES							9+9
Binary codes: Weighted codes, Binary Coded Decimal,2421, Gray code, Excess 3 code and ASCII code , Error detecting and correcting codes and Hamming code, Code converters Basic postulates and fundamental theorems of Boolean algebra - Principle of Duality - De-Morgan's Theorem- Standard representation of logic functions : Sum of Products (SOP) and Product of Sums (POS), Minterm and Maxterm forms - Canonical forms -Conversion between canonical forms , Simplification of switching functions - K-map Minimization, Don't care conditions and Minimization Techniques.							
UNIT III - COMBINATIONAL CIRCUITS							9+6
Combinational Logic circuits: Adders and Subtractors – Serial adder/ Subtractor - Parallel adder/ Subtractor- Carry look ahead adder- BCD adder- Magnitude Comparator- Multiplexer/ Demultiplexer- Encoder / Decoder – Parity generator and Parity checker. Implementation of combinational logic using MUX, ROM, PAL and PLA							
UNIT IV - SEQUENTIAL CIRCUITS							9+9
Flip flops SR, JK, T, D and Master slave – Characteristic table and equation –Application table – Edge triggering –Level Triggering –Realization of one flip flop using other flip flops – Asynchronous / Ripple counters – Synchronous counters –Modulus N counter –Classification of sequential circuits – Moore and Mealy -Design of Synchronous counters: state diagram- State table –State minimization –State assignment- Register – shift registers- Universal shift register – Shift Register counters . Design of fundamental mode and pulse mode circuits–primitive state/flow table – Minimization of primitive state table –state assignment – Excitation table – Excitation map- cycles							

UNIT V - MEMORY DEVICES				9+0
Classification of memories: RAM organization - Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell, ROM organization , PROM ,EPROM , EEPROM, EAPROM. Programmable Devices : Programmable Logic Array (PLA), Programmable Array Logic (PAL), SPLD, GAL, CPLD and Field Programmable Gate Arrays (FPGA)				
LIST OF EXPERIMENTS				
1.	Verify the truth table of logic gates.			
2.	a)Design and implement Binary to gray code converter. b)Design and implement gray to binary code converter.			
3.	a)Design and implement Excess 3 to BCD code converter. b)Design and implement BCD to Excess 3 code converter.			
4.	Design, construct and verify the truth table of half adder, Full adder, Half subtractor and Full subtractor.			
5.	Design and implement 4 bit adder and subtractor.			
6.	Design and implement odd/even parity checker/ generator.			
7.	Design and implement multiplexer and demultiplexer.			
8.	Design and implement Encoder and Decoder.			
9.	Construct and verify 4 bit ripple counter.			
10.	Design and implement binary synchronous up counter.			
11.	Design and implement binary synchronous down counter.			
12.	Design and implement shift register.			
		LECTURE	TUTORIAL	PRACTICAL
HOURS		45	0	30
TOTAL				
TEXT BOOKS				
1. M. Morris Mano, “Digital Design”, Prentice Hall of India Pvt. Ltd., New Delhi, 2003. 2. John .M Yarbrough, “Digital Logic Applications and Design”, Vikas Publishing House, New Delhi, 2002. 3. M.Morris Mano, Michael D.Ciletti, “Digital Design: With an Introduction to Verilog HDL”,5 th Edition, Pearson Education, 2012.				
REFERENCES				
1. S. Salivahanan and S.Arivazhagan, “Digital Circuits and Design”, 2 nd Edition, Vikas Publishing House, New Delhi, 2004. 2. Charles H.Roth. “Fundamentals of Logic Design”, Thomson Publication, 2003. 3. Donald P.Leach and Albert Paul Malvino, “Digital Principles and applications, 5 th Edition, Tata McGraw Hill, New Delhi, 2003. 4. R.P.Jain, “Modern Digital Electronics”, 3 rd Edition, Tata McGraw Hill, New Delhi, 2003.				
E- REFERENCES				
1. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html 2. http://web.iitd.ac.in/~shouri/eel201/lectures.php 3. http://nptel.ac.in/courses/117106086/1 4. http://ceit.aut.ac.ir/~arabzadeh/Parand/Logic/Books/Roth%20Fundamentals%20of%20Logic%20Design%207th%20c2014%20txtbk.pdf				

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO1
CO 1	3	2		2	2							1		
CO 2	2	2		3	2							1		
CO 3	2	2		3	2				2			1		
CO 4	2	2		3	2				2			1		
CO 5	2	2			2							1		
Total	13	10		8	10				2			5		

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

COURSE CODE			XEC304	L	T	P	C
COURSE NAME			ELECTRONIC DEVICES AND CIRCUITS	3	1	1	5
C	P	A		L	T	P	T
3	0.9	0.1		3	2	2	7
COURSE OUTCOMES				DOMAIN		LEVEL	
CO1	Describe, predict, show and practice semiconductor diodes.			Cognitive Psychomotor Affective		Remembering, Understanding Set, Response	
CO2	Explain, predict, show and report the operation of various special diodes and BJT			Cognitive Psychomotor Affective		Understanding Set, Response	
CO3	Understand, predict, show and report field effect transistors and power control devices			Cognitive Psychomotor Affective		Understanding, Applying Set, Response	
CO4	Understand, calculate, design, construct and justify transistor biasing and various types of amplifiers.			Cognitive Psychomotor Affective		Understanding, Applying, Create, Mechanism Value set	
CO5	Explain and analyze feedback mechanisms and design, assemble and verify the functioning of oscillators.			Cognitive Psychomotor Affective		Understanding, Analyzing, Create Mechanism Value set	
UNIT I - ELECTRONIC COMPONENTS AND SEMICONDUCTOR DIODES							9+6+6
Active components and passive components - Energy Band structure of PN junction – Forward biasing and Reverse biasing of PN junction – Current Component in a PN junction – V-I characteristic of a diode - Derivation of diode equation – Expression for dynamic resistance – Calculation of transition and diffusion capacitance -- Switching characteristics of diode – Effect of temperature on PN junction diode – Zener breakdown – Avalanche breakdown – Zener diode as voltage regulator.							
UNIT II - DIODE APPLICATIONS, SPECIAL DIODES AND BIPOLAR JUNCTION TRANSISTORS							9+6+6
Half-wave, full-wave and bridge rectifiers – Analysis for DC voltage , DC current, rms voltage, rms current , ripple voltage and efficiency of half wave and full wave rectifier– Types of filters: C, LC, and π filters – Clippers – Clampers - Varactor diode – Backward diode – Tunnel diode – IMPATT diode – CCD – Gunn diode and Schottky diode - Construction of PNP and NPN transistors – BJT current components – Emitter efficiency – Transport factor – Large signal current gain – Early effect – Punch through effect – Input and output characteristics of transistor configurations – Ebers–Moll model – Hetero junction transistor – Switching characteristics of Transistor.							
UNIT III - FIELD EFFECT TRANSISTORS AND POWER CONTROL DEVICES							9+6+6
Construction and Characteristics of JFET – Parameters of JFET – Construction and characteristics of D-MOSFET and E- MOSFET – Characteristics and equivalent circuit of UJT – intrinsic stand off ratio, UJT relaxation oscillator – PNPN diode – SCR– IGBT – TRIAC – DIAC.							
UNIT IV -TRANSISTOR BIASING AND CLASSIFICATION OF AMPLIFIERS							9+6+6
Faithful amplification - Load line and quiescent point analysis - Stability factor - Different types of biasing circuits – Single stage amplifiers – multi stage amplifiers – Direct coupling – RC							

coupling – Transformer coupling – power amplifiers – Class A, Class B, Class C amplifiers - Tuned amplifiers.				
UNIT V-FEEDBACK AMPLIFIERS AND OSCILLATORS				9+6+6
The four basic feedback topologies and the type of gain stabilized by each type of feedback - Analysis of feedback amplifiers - Nyquist criterion for stability of feedback amplifiers - Barkhausen Criterion - Mechanisms for start of oscillation and stabilization of amplitude - RC phase shift Oscillator - Wienbridge Oscillator - Analysis of LC Oscillators, Colpitts, Hartley, Clapp, Miller and Pierce oscillators.				
LIST OF EXPERIMENTS				
1.	V-I characteristics of PN junction diode and Zener diode.			
2.	Design and implementation of Half wave and full wave rectifiers.			
3.	Design and implementation of clippers and clampers.			
4.	Input and Output characteristics of Bipolar Junction Transistor Configuration (CE, CB, CC).			
5.	Drain and Transfer characteristics of JFET.			
6.	Characteristics of UJT.			
7.	Characteristics of SCR.			
8.	Design and implementation of Fixed bias and voltage divider bias.			
9.	Design and implementation of Source follower.			
10.	Design and implementation of the class A and Class B power amplifiers to measure the frequency response.			
11.	Design and implementation of the class C tuned amplifier to measure the frequency response			
12.	Design and implementation of RC Oscillator using transistor.			
13.	Design and implementation of Hartley and Colpitts Oscillators using transistor.			
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	30	30	105
TEXT BOOKS				
1. Robert L. Boylestad and Louis Nashelsky , “Electronics devices and Circuit Theory”, 11 th Edition, UBS Publishers, New Delhi, 2013. 2. Jacob Millman and Christos C.Halkias, “Electronic Devices and Circuits” 3 rd Edition, Tata McGraw Hill, New Delhi, 2010. 3. David A. Bell ,”Electronic devices and circuits”, Prentice Hall of India, 2004. 4. S.Salivahanan, “Electronics devices and circuits”. 2 nd Edition, Tata McGraw Hill, 2008.				
REFERENCES				
1. J.B Gupta. “Electronic Devices and Circuits” , Revised 1 st Edition, S.K.Kataria & Sons, 2013. 2. Floyd, “Electron Devices” , 5 th Edition, Pearson Education, Asia, 2001. 3. A. S. Sedra and K.C Smith, “Microelectronics Circuits”, 5 th Edition, Oxford University Press, 2004. 4. V.K. Mehta & Rohit Metha, “Principles of Electronics”, 11 th Edition, S.Chand & Company, 2008. 5. J. D. Irwin, “Basic Engineering Circuit Analysis”, 7 th Edition, Prentice Hall, 2002. 6. A.P.Godse, U.A.Bakshi, “Electronic Circuits”, 1 st Edition, Technical Publication, Pune, 2010.				

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. Chitralkha Mahanta, 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)

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO 1	1	1		2	1	2	1		1	1		1		
CO 2	2	3		2	2	2	1		1	1		1		
CO 3	1	1		2	2	2	1		1	1		1		
CO 4	2	3		2	2	2	1		1	1		1		
CO 5	2	3		2	2	2	1		1	1		1		
Total	8	11		10	9	10	5		5	5		5		
Scaled value	2	3		2	2	2	1		1	1		1		

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

COURSE CODE			XMS305			L	T	P	C
COURSE NAME			MATERIALS SCIENCE			3	0	0	3
C	P	A				L	T	P	H
3	0	0				3	0	0	3
COURSE OUTCOME:					Domain		Level		
C01		Recall and distinguish various crystal structures.			Cognitive		Remembering, Analyzing		
C02		Know about the impacts of defects at the atomic and microstructure scales.			Cognitive		Remembering, Understanding		
C03		Describe the various Ceramic, Electrical & Electronic Materials.			Cognitive		Remembering, Analyzing		
C04		Describe the basics of mechanical properties of material and identify how they can be tested.			Cognitive		Remembering, Analyzing		
C05		Recognize and Describe various Magnetic Materials and Nano Materials.			Cognitive		Remembering		
UNIT I -Crystal Structure									9
Atomic structure and inter-atomic bonding; Structure of crystalline solids; Lattices, unit cells; Crystal systems, Bravais lattices; Indexing of directions and planes, notations, Inter-planar spacings and angles, co- ordination number, packing factors.									
UNIT II-Defects in Crystals									9
Point defects; Dislocations, Types of dislocations, Burgers vector and its representation; Planar defects, stacking faults, twins, grain boundaries.									
UNIT III -Ceramic, Electrical & Electronic Materials									9
Ceramic Materials: Introduction, ceramic structures, silicate structures, processing of ceramics; Properties, glasses; Composite Materials- Introduction, classification, concrete, metal-matrix and ceramic –matrix composites. Electrical & Electronic Properties of Materials: Electrical Conductivity, Electronic and Ionic Conductivity, Intrinsic and Extrinsic Semi conductivity, Semiconductor Devices, Dielectric Properties, Piezo-electricity.									
UNIT IV-Mechanical Properties of Materials									9
Concepts of stress and strain, Stress-Strain diagrams; Properties obtained from the Tensile test; Elastic deformation, Plastic deformation. Impact Properties, Strain rate effects and Impact behavior. Hardness of materials.									
UNIT V-Magnetic Materialsand Nano Materials									9
Magnetic Materials: Introduction, Magnetic fields or quantities, types of magnetism, classification of magnetic materials, soft magnetic materials, H magnetic materials, Ferrites, Ferro, Para Magnetic materials. Nano Materials: Introduction – Nano material preparation, purification, sintering nano particles of Alumina and Zirconia, Silicon carbide, nanoop, nano-magnetic, nano-electronic, and other important nano materials.									
					LECTURE	TUTORIAL	PRACTICAL		TOTAL
HOURS					45	0	0		45

Text Books:	
1.	Askeland D.R.,& P. P. Fullay (2007), The Science and Engineering of Materials – 7 th Cengage Learning Publishers.
2.	William D. Callister, Jr (2008), Callister"s Materials Science and Engineering, (Adopted by R. Balasubramaniam) Wiley-Eastern
Reference books :	
1.	A.S. Edelstein and R.C. Cammarata Ed.(1998), Nano Materials: Synthesis, Properties and Applications, Inst. Of Physics Publishing, UK.
2.	Raghavan V (2007), Materials Science and Engineering - A First Course, Prentice Hall, India
3.	James F. Shackelford (1996), Introduction to Materials Science for Engineers, Prentice Hall, India

CO Vs GA Mapping

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01	3	3		0			0			0		
C02	3	0		0			0			3		
C03	3	0		0			3			0		
C04	3	3		3			0			0		
C05	3	0		0			0			0		
Total	15	6		3			3			3		
Scaled	3	2		1			1			1		

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

COURSE CODE			XEP306		L	T	S.S	C
COURSE NAME			ENTREPRENEURSHIP DEVELOPMENT		2	0	1	2
C	P	A			L	T	S.S	H
3	0	1			2	0	1	3
Course Outcome:					Domain		Level	
CO1	Recognise and describe the personal traits of an entrepreneur.				Affective Cognitive	Receiving Understand		
CO2	Determine the new venture ideas and analyse the feasibility report.				Cognitive	Understanding Analyzing		
CO3	Develop the business plan and analyse the plan as an individual or in team.				Affective Cognitive	Receiving Analyzing		
CO4	Describe various parameters to be taken into consideration for launching and managing small business.				Cognitive	Understanding		
CO5	Describe Technological management and Intellectual Property Rights				Cognitive	Understanding		
There are 6 Cs and 2 As for 3:0:1								
UNIT I - ENTREPRENEURIAL TRAITS AND FUNCTIONS								9
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 II- NEW PRODUCT DEVELOPMENT AND VENTURE CREATION								9
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 III- ENTREPRENEURIAL FINANCE								9
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 IV- LAUNCHING OF SMALL BUSINESS AND ITS MANGEMENT								9
Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units.								
UNIT V-TECHNOLOGY MANAGEMENT, IPR PORTFOLIO FOR NEW PRODUCT VENTURE								9
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
HOURS					30	15	0	45

TEXT BOOKS												
1. Hisrich, 2016, <i>Entrepreneurship</i> , Tata McGraw Hill, New Delhi.												
2. S.S.Khanka, 2013, <i>Entrepreneurial Development</i> , S.Chand and Company Limited, New Delhi.												
REFERENCE BOOKS												
1. Mathew Manimala, 2005, <i>Entrepreneurship Theory at the Crossroads, Paradigms & Praxis</i> , Biztrantra ,2nd Edition.												
2. Prasanna Chandra, 2009, <i>Projects – Planning, Analysis, Selection, Implementation and Reviews</i> , Tata McGraw-Hill.												
3. P.Saravanavel, 1997, <i>Entrepreneurial Development</i> , Ess Pee kay Publishing House, Chennai.												
4. Arya Kumar,2012, <i>Entrepreneurship: Creating and Leading an Entrepreneurial Organisation</i> , Pearson Education India.												
5. Donald F Kuratko, T.V Rao, 2012, <i>Entrepreneurship: A South Asian perspective</i> , Cengage Learning India.												
6. Dinesh Awasthi, Raman Jaggi, V.Padmanand, <i>Suggested Reading / Reference Material for Entrepreneurship Development Programmes (EDP/WEDP/TEDP)</i> , EDI Publication, Entrepreneurship Development Institute of India, Ahmedabad. Available from: http://www.ediindia.org/doc/EDP-TEDP.pdf												
E-REFERENCES												
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/												

MAPPING COURSE OUTCOME WITH GRADUATE ATTRIBUTES:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01									3	3	3	1
C02			1	2	3	2	1	1	1	2	3	
C03						1		2	3	3		2
C04						1	1	2	3		3	3
C05						1	1	3				3
Total			1	2	3	5	3	8	10	8	9	9
Scaled			1	1	1	2	1	2	3	2	2	2

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

COURSE CODE			XGS307			L	T	P	SS	C
COURSE NAME			INTERPERSONAL COMMUNICATION			0	0	0	2	0
C	P	A				L	T	P	SS	H
0.4	0.4	1.2				0	0	0	2	2
COURSE OUTCOMES:						Domain	Level			
CO1	Recognize culture and a need for interpersonal communication.					Cognitive	Remembering			
CO2	Demonstrate on the need for effective communication between two people.					Cognitive	Understanding			
CO3	Explain on family and social relationships and need for socialization.					Cognitive	Understanding			
CO4	Practice the IP principles as to how to reduce and repair conflict in interpersonal relationships.					Psychomotor	Guided Response			
CO5	Makeuse to use effective and appropriate language at various interpersonal situations to avoid conflict.					Cognitive	Applying			
UNITI - UNIVERSALS OF INTERPERSONAL COMMUNICATIONS.										5
Axioms of interpersonal Communication; culture in interpersonal communication and the self in interpersonal communication										
UNITII -APPREHENSION AND ASSERTIVENESS										5
Aggressiveness and assertiveness; perception in interpersonal communication; listening in interpersonal communication.										
UNITIII -VERBAL AND NON VERBAL MESSAGES										5
Relationship and involvement; relationship maintenance and repair.										
UNITIV -POWER IN INTERPERSONAL RELATIONSHIP										5
Conflict in interpersonal relationship; friends and relatives; primary and family relationships.										
UNIT V- SOCIALIZATION,										10
Need for socialization and benefits of socialization among students.										
Total Hours										30

TEXT BOOKS

1. <i>DeVito, Joseph</i> , The <i>Interpersonal Communication</i> Book, 13th Edition - , Published by <i>Longman</i> Pub Group, Updated in its <i>13th edition</i> , 2000
2. Kathleen S. Verderber, <i>Inter-Act: Interpersonal Communication Concepts, Skills and Contexts</i> , Rudolph F. Verderber, 2000
3. Clifford Whitcomb, <i>Effective Interpersonal and Task Communication Skills for Engineers</i> , Atlantic Publishers. 2010

Mapping COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01										2		
C02										2		
C03				2						1		
C04												1
C05										1	2	
Total				2						6	2	1
Scaled				1						2	1	1

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

COURSE CODE			XEC308	L	T	P	C
COURSE NAME			IN-PLANT TRAINING - I	0	0	0	1
C	P	A		L	T	P	H
1	1	1					
COURSE OUTCOMES				DOMAIN		LEVEL	
C01	Relate classroom theory with workplace practice			Cognitive		Understand	
C02	Comply with Factory discipline, management and business practices			Affective		Respond	
C03	Demonstrates teamwork and time management.			Affective		Value	
C04	Describe and Display hands-on experience on practical skills obtained during the programme.			Psychomotor		Perception Set	
C05	Summarize the tasks and activities done by technical documents and oral presentations.			Cognitive		Evaluate	
Note:							
Revised Bloom Taxonomy of the Cognitive Domain Simpson's Taxonomy of the Psychomotor Domain Krathwohl's Taxonomy of the Affective Domain							

Mapping COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01	2											
C02							1	3			1	
C03									3	1	3	1
C04		1	2	1	3							3
C05				3						3		1
Total	2	1	2	4	3	0	1	3	3	4	4	5
Scaled	1	1	2	1	1	0	1	1	1	1	1	1

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

IV SEMESTER

COURSE CODE			XRP401	L	T	P	C
COURSE NAME			RANDOM PROCESS	2	1	0	3
C	P	A		L	T	P	H
3	0	0		2	2	0	4
COURSE OUTCOMES				DOMAIN	LEVEL		
C01	Define basic concepts of probability theory and to Find their Statistics of one dimensional distribution functions.			Cognitive	Remembering		
C02	Apply the concepts of probability on two dimensional random variables to Find correlation coefficients and regression equation.			Cognitive	Remembering, Applying		
C03	Demonstrate the concepts and properties of Stationary, Markov, Poisson and Random telegraph process.			Cognitive	Understanding		
C04	State and Explain the concepts of auto correlation and cross correlation and to Find power and cross spectral density.			Cognitive	Remembering, Understanding		
C05	State the principles of continuous and discrete-time signals and to Find the response of linear & time-invariant systems.			Cognitive	Remembering		
UNIT I - Random variables							9
Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions .							
UNIT II- Two-Dimensional Random Variables							9
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression .Central limit theorem (for independent and identically distributed random variables).							
UNIT III - Random Processes							9
Classification – Stationary process – Markov process - Poisson process – Random telegraph process.							
UNIT IV - Correlation and Spectral Densities							9
Auto-correlation functions – Cross-correlation functions – Properties – Power spectral density – Cross-spectral density – Properties – Wiener-Khinchine relation, theorem.							
UNIT V- Linear Systems with Random Inputs							9
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto-correlation and Cross-correlation functions of input and output – White noise.							
				LECTURE	TUTORIAL	TOTAL	
				30	30	60	
TEXT BOOKS							
1. Peebles, P.Z., “Probability, Random Variables and Random Signal Principles”, Tata McGraw Hill, 4th edition, New Delhi, (2002).							
2. Veerarajan .T, Probability, “Statistics and Random Processes”, Tata McGraw Hill, 3rd edition, (2008).							
3. Kandasamy.P, Thilagavathy.K, Gunavathy.K, “ Probability, Random Variables and							

Random Processes”, S.Chand & Company Ltd, (2008).

REFERENCES

1. Yates, R.D. and Goodman, D.J., “Probability and Stochastic Processes”, John Wiley and Sons, 2nd edition, (2005).
2. Stark, H. and Woods, J.W., “Probability and Random Processes with Applications to Signal Processing”, Pearson Education, Asia, 3rd edition, (2002).
3. Miller, S.L. and Childers, D.G., “Probability and Random Processes with Applications to Signal Processing and Communications”, Academic Press, (2004).
4. Hwei Hsu, “Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes”, Tata McGraw Hill edition, New Delhi, (2004).

E REFERENCES

1. www.nptel.ac.in, Advanced Engineering Mathematics , Prof. Somesh Kumar
Department of Mathematics, Indian Institute of Technology, Kharagpur.

Mapping COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	3											1
CO 2	3											1
CO 3	3	2								1	1	2
CO 4	3	2								1	1	1
CO 5	3	2			1					1	1	2
Total	15	6	0	0	1	0	0	0	0	3	3	7
Scaled	3	2			1					1	1	2

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

COURSE CODE			XEC402	L	T	P	C
COURSE NAME			SIGNALS AND SYSTEMS	3	0	0	3
C	P	A		L	T	P	H
3	0	0		3	0	0	3
COURSE OUTCOMES				DOMAIN		LEVEL	
C01	Describe and <i>classify</i> the signals & systems			Cognitive		Remembering Understanding	
C02	Find and <i>analyze</i> the properties of continuous time signal using Fourier and Laplace Transform,			Cognitive		Remembering, Analyzing	
C03	Find and <i>analyze</i> the continuous time LTI system performance of Fourier and Laplace Transform.			Cognitive		Remembering, Analyzing	
C04	Find and <i>apply</i> the properties of discrete time signal using Fourier and Z Transform and <i>explain</i> sampling theorem.			Cognitive		Remembering, Applying , Understanding	
C05	Solve, <i>analyze</i> and <i>determine</i> the performance of Discrete Time LTI system in Fourier and Z Transform.			Cognitive		Applying, Analyzing, Evaluating	
UNIT I - CLASSIFICATION OF SIGNALS AND SYSTEMS							9
Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals - Periodic & Aperiodic signals, Deterministic& Random signals, Energy & Power signals - CT systems and DT systems Classification of systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal&Noncausal, Stable & Unstable.							
UNIT II - ANALYSIS OF CONTINUOUS TIME SIGNAL							9
Fourier series analysis-spectrum of Continuous Time (CT) signals- Fourier and Laplace Transforms in CT Signal Analysis - Properties.							
UNIT III - LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS							9
Differential Equation-Block diagram representation-impulse response, convolution integrals- Fourier and Laplace transforms in Analysis of CT systems.							
UNIT IV - ANALYSIS OF DISCRETE TIME SIGNALS							9
Baseband Sampling of CT signals- Aliasing, Reconstruction of CT signal from DT signals DTFT and properties, Z-transform & properties.							
UNIT V - LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS							9
Difference Equations-Block diagram representation-Impulse response - Convolution sum- Discrete Fourier and Z Transform Analysis of Recursive & Non-Recursive systems.							
				LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS				45	0	0	45
TEXT BOOKS							
1. P.Ramakrishna Rao, “Signals and Systems”, Tata McGraw Hill Publications, 2008. 2. B.P.Lathi, “Principles of Linear Systems and Signals”, 2 nd Edition, Oxford University Press, 2009.							
REFERENCES							
1. R.E Zeimer, W.H.Tranter. and . R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson Education, 2009. 2. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson Learning , 2007. 3. M.J .Roberts, “Signals & Systems Analysis using Transform Methods & MATLAB”, Tata McGraw Hill, 2007. 4. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson Education, Indian Reprint, 2007.							

E-REFERENCES

1. <http://nptel.ac.in/courses/117104074> (Prof.K.S.Venktesh, "NPTEL, Signals and Systems", IIT- Kanpur)
2. http://tutorialspoint.com/signals_and_systems/index.htm
3. <http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/>
4. <https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxvZWVmc9udHhBhZ2V8Z3g6M2lyMzlkZDg3Yzk0YzY0Zg>
5. https://www.princeton.edu/~cuff/ele301/files/lecture2_2.pdf
6. http://highereducation.com/sites/0070667551/student_view0/index.html

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO 1	3	2		2	2	1						1		
CO 2	2	3		2	1	1						1		
CO 3	3	3		2	2	1						1		
CO 4	3	2		3	1	1						1		
CO 5	3	3		2	2	1						1		
Total	14	13		11	8	5						5		
Scaled	3	3		2	2	1						1		

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

COURSE CODE				XEC403		L	T	P	C
COURSE NAME				LINEAR INTEGRATED CIRCUITS		3	0	1	4
C	P	A				L	T	P	H
3	0.9	0.1				3	0	2	5
COURSE OUTCOMES						DOMAIN		LEVEL	
CO1		Infer the Current sources, DC and AC characteristics of operational amplifiers.				Cognitive		Understanding	
CO2		Explain, Apply, Analyze, Construct and Report the linear and non-linear applications of an operation amplifier.				Cognitive Psychomotor Affective		Understanding Applying, Analyzing. Mechanism, Response	
CO3		Describe and distinguish, construct and report various types of wave form generators and PLL.				Cognitive Psychomotor Affective		Remembering, Understanding. Mechanism, Response	
CO4		Classify and design, construct and report different types of active filters and Voltage regulators				Cognitive		Understanding, Analyzing, Mechanism, Response	
CO5		Discuss the working principle of data converters, function of specific ICs				Cognitive		Understanding	
UNIT I – OP-AMP FUNDAMENTALS & CHARACTERISTICS									9+0+0
Basics of Operational Amplifiers: Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages - and internal circuit diagrams of IC 741. Characteristics: Ideal op-amp characteristics-Non ideal characteristics- DC characteristics – Input bias current-Input offset voltage- Input offset current- Thermal drift- AC characteristics- Frequency response- Frequency compensation- Slew rate.									
UNIT II-OP-AMP APPLICATIONS									9+0+12
Basic op-amp circuits: Inverting & Non-inverting voltage amplifiers - Voltage follower - Summing, scaling & averaging amplifiers - AC amplifiers. Linear Applications: Instrumentation Amplifiers-V-to-I and I-to-V converters-Differentiators and Integrators. Non-linear Applications: Precision Rectifiers – Wave Shaping Circuits (Clipper and Clampers) – Log and Antilog Amplifiers – Analog voltage multiplier circuit and its applications – Operational Trans-Conductance Amplifier (OTA) - Comparators and its applications – Sample and Hold circuit.									
UNIT III-WAVEFORM GENERATORS AND PLL									9+0+12
Waveform Generators: Sine-wave Generators – Square / Triangle / Sawtooth Wave generators. IC 555 Timer: Monostable operation and its applications – Astable operation and its applications. PLL: Operation of the Basic PLL-Closed loop analysis of PLL-Voltage Controlled Oscillator-PLL applications.									
UNIT IV-ACTIVE FILTERS & VOLTAGE REGULATOR									9+0+6
Filters: Comparison between Passive and Active Networks-Active Network Design – Filter Approximations-Design of LPF, HPF, BPF and Band Reject Filters – State Variable Filters – All Pass Filters – Switched Capacitor Filters. Voltage Regulators: Basics of Voltage Regulator – Linear Voltage Regulators using Op-amp – IC Regulators (78xx, 79xx, LM 317, LM 337, 723)-Switching Regulators.									

UNIT V-DATA CONVERSION DEVICES AND SPECIAL FUNCTION ICs				9+0+0
Digital to Analog Conversion: DAC Specifications – DAC circuits – Weighted Resistor DAC-R-2R Ladder DAC-Inverted R-2R Ladder DAC Monolithic DAC Analog to Digital conversion: ADC specifications-ADC circuits-Ramp Type ADC-Successive Approximation ADC-Dual Slope ADC-Flash Type ADC- Monolithic ADC. Special function ICs: Frequency to Voltage converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.				
LIST OF EXPERIMENTS				
1	Design and test Inverting, Non inverting and Differential amplifiers.			
2	Design and test Integrator and Differentiator.			
3	Design and test Instrumentation amplifier.			
4	Design and test Active lowpass, high pass and bandpass filter.			
5	Design and test Active lowpass, high pass and bandpass filter using MultiSIM			
6	Design and test Astable, Monostable multivibrators and Schmitt Trigger using op-amp.			
7	Design and test Phase shift and Wien bridge oscillator using op-amp.			
8	Design and test Astable and monostable using NE555 Timer.			
9	Design and test Astable and monostable using NE555 Timer with MultiSIM			
10	Design and test Frequency Multiplier using PLL with MultiSIM.			
11	Design and test DC power supply using LM317 and LM723.			
12	Study of SMPS control IC SG3524 / SG3525.			
		LECTURE	TUTORIAL	PRACTICAL
HOURS		45	0	30
TEXT BOOKS				
1. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", 4 th Edition, New Age International Publishers, 2010. 2. Ramakant A.Gayakwad, "Op-Amps and Linear Integrated Circuits", Prentice Hall, 2012.				
REFERENCES				
1. Robert F.Coughlin, Frederick F. Driscoll, "Operational-Amplifiers and Linear Integrated Circuits", 6 th Edition, Prentice Hall, 2001. 2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3 rd Edition, Tata McGraw Hill, 2002.				
E-REFERENCES				
1. http://www.nptel.ac.in/courses/Webcourse-contents/IIT-ROORKEE/Analog%20circuits/index.htm 2. http://nptel.ac.in/video.php?subjectId=108106068 3. http://freevidelectures.com/Course/2915/Linear-Integrated-Circuits				

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO 1	3	3	2		1	1						1		
CO 2	3	2	2	1	2	2	1					1		
CO 3	2	3	1	1	1	1	1					1		
CO 4	2	2	1	1	1	3	2					1		
CO 5	3	2										1		
Total	13	12	6	3	5	7	4					5		
Scaled value	3	3	2	1	1	2	1					1		

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

COURSE CODE			XEC404			L	T	P	C
COURSE NAME			COMMUNICATION THEORY			3	1	1	5
PREREQUISITES			XMA401			L	T	P	H
C	P	A				3	2	2	7
3	0.9	0.1							
COURSE OUTCOMES						DOMAIN		LEVEL	
CO1	Describe and reproduce Amplitude modulation Schemes.					Cognitive Psychomotor		Remember, Guided Response	
CO2	Describe and reproduce Frequency Modulation Schemes.					Cognitive Psychomotor		Remember, Guided Response	
CO3	Define and explain various noise sources and their effect in AM and FM systems					Cognitive		Remember, Understand	
CO4	Describe and reproduce Pulse modulation schemes.					Cognitive Psychomotor		Remember, Guided Response	
CO5	Explain and solve problems related to maximizing information flow through a communication channel.					Cognitive		Understand Apply	
UNIT I AMPLITUDE MODULATION SYSTEMS									9+6+8
Review of Spectral Characteristics of Periodic and Non-periodic signals; Generation and Demodulation of AM, DSBSC, SSB and VSB Signals; Comparison of Amplitude Modulation Systems; Frequency Translation; FDM; Non – Linear Distortion.									
UNIT II ANGLE MODULATION SYSTEMS									9+6+8
Phase and Frequency Modulation; Single tone, Narrow Band and Wideband FM; Transmission Bandwidth; Generation and Demodulation of FM Signal. Superheterodyne Radio receiver and its characteristic;									
UNIT III NOISE THEORY									9+6+8
Review of Probability, Random Variables and Random Process; Guassian Process; Noise – Shot noise, Thermal noise and white noise; Narrow band noise, Noise temperature; Noise Figure. SNR; Noise in DSBSC systems using coherent detection; Noise in AM system using envelope detection and its FM system; FM threshold effect; Pre-emphasis and De-emphasis in FM; Comparison of performances.									
UNIT IV CONVERSION OF ANALOG WAVEFORMS INTO CODED PULSES									9+6+6
Sampling Theory -Pulse-Amplitude Modulation - Quantization and its Statistical Characterization - Pulse-Code Modulation - Noise Considerations in PCM Systems - Prediction-Error Filtering for Redundancy Reduction - Differential Pulse Code Modulation -Delta Modulation - Line Codes									
UNIT V INFORMATION THEORY									9+6
Discrete Messages and Information Content, Concept of Amount of Information, Average information, Entropy, Information rate, Source coding to increase average information per bit, Shannon-Fano coding, Huffman coding, Lempel-Ziv (LZ) coding, Shannon’s Theorem, Channel Capacity, Bandwidth- S/N trade-off, Mutual information and channel capacity, rate distortion theory, Lossy Source coding.									

LIST OF EXPERIMENTS				
1	AM transmitter design using Kit and SciLab/Matlab® simulation.			
2	DSB FC, DSB SC, SSB SC generation and spectrum plotting by MultiSim software			
3	Characteristics of AM receiver (Selectivity & Sensitivity) using Kit and SciLab/Matlab® simulation			
4	Characteristics of FM receiver (Selectivity & Sensitivity) using Kit and Scilab/Matlab® simulation			
5	Sampling and Quantization			
6	Pulse code modulation			
7	Line coding and decoding			
8	Time Division Multiplexing			
9	Delta Modulation			
10	Differential PCM			
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	30	30	105
TEXT BOOKS				
1. Simon Haykin, "Communication Systems", 4 th Edition, John Wiley & Sons, 2001. 2. Herbert Taub & Donald L. Schilling, "Principles of Communication Systems", 3 rd Edition Tata McGraw Hill, 2008.				
REFERENCES				
1. Dennis Roddy & John Coolen, "Electronic Communication", 4 th Edition, Prentice Hall of India, 1995. 2. Bruce Carlson, "Communication Systems", 3 rd Edition, Mc Graw Hill, 2002. 3. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3 rd Edition, Oxford University Press, 2007. 4. R.P Singh and S.D.Sapre, "Communication Systems – Analog and Digital", Tata McGraw Hill, 2 nd Edition, 2007. 5. John G. Proakis, Masoud Salehi, "Fundamentals of Communication Systems", 2 nd Edition Prentice Hall, 2002.				
E- REFERENCES				
1. http://nptel.ac.in/courses/117102059/ (NPTEL, Communication Engineering, Prof. Surendra Prasad, Department of Electrical Engineering Indian Institute of Technology, Delhi). 2. http://een.iust.ac.ir/profs/Beheshti/communication%20system/Carlson%20-%20Communication%20Systems%20-%204ed%20.pdf				

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
CO 1	1	2	1	0	0	1	0	0	0	1	0	1	2	3
CO 2	1	2	1	0	0	1	0	0	0	0	0	1	2	3
CO 3	2	2	0	0	0	0	0	0	0	0	0	1	2	3
CO 4	0	3	0	0	0	0	0	0	0	0	0	1	2	3
CO 5	3	1	0	0	0	0	0	0	0	1	0	1	2	3
Total	7	10	2	0	0	2	0	0	0	2	0	5	10	15
Scaled value	2	2	1			1				1		1	2	3

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

COURSE CODE			XEC405				L	T	P	C
COURSE NAME			ELECTRO MAGNETIC FIELDS AND TRANSMISSION LINES				3	1	0	4
PREREQUISITES			XMA101,XMA201, XEC302				L	T	P	H
C	P	A					3	2	0	5
2.9	0	0.1								
COURSE OUTCOMES						Domain	Level			
CO1		<i>Understand, apply</i> vector calculus to static electric field and <i>analyze</i> field potentials				Cognitive	Understanding, Applying, Analyzing			
CO2		<i>Explain, apply</i> vector calculus to steady state magnetic field and <i>analyze</i> field potentials				Cognitive	Understanding Applying, Analyzing			
CO3		<i>Understand, analyze</i> the relation between the fields under time varying situations.				Cognitive	Understanding, Analyzing			
CO4		<i>Discuss</i> the propagation of signals through transmission lines and <i>determine</i> and <i>report</i> the transmission parameters.				Cognitive Affective	Understanding, Evaluate Response			
CO5		<i>Analyze</i> signal propagation at Radio frequencies and <i>determine</i> and <i>practice</i> the parameters				Cognitive Affective	Analyzing, Evaluate Response			
UNIT I – ELECTROSTATICS									9+6	
Vector Algebra, Coordinate Systems, Vector differential operator, Gradient, Divergence, Curl, Divergence theorem, Stokes theorem, Coulombs law, Electric field intensity, Point, Line, Surface and Volume charge distributions, Electric flux density, Gauss law and its applications, Gauss divergence theorem, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.										
UNIT II - STEADY MAGNETIC FIELDS									9+6	
Biot -Savart Law, Magnetic field Intensity, Estimation of Magnetic field Intensity for straight and circular conductors, Ampere"s Circuital Law, Point form of Ampere"s Circuital Law, Stokes theorem, Magnetic flux and magnetic flux density, The Scalar and Vector Magnetic potentials, Derivation of Steady magnetic field Laws.										
UNIT III -TIME VARYING FIELDS AND MAXWELL’S EQUATIONS									9+6	
Fundamental relations for Electrostatic and Magnetostatic fields, Faraday"s law for Electromagnetic induction, Transformers, Motional Electromotive forces, Differential form of Maxwell"s equations, Integral form of Maxwell"s equations, Potential functions, Electromagnetic boundary conditions, Wave equations and their solutions, Poynting"s theorem, Time harmonic fields, Electromagnetic Spectrum.										
UNIT IV -TRANSMISSION LINE THEORY									9+6	
Different types of transmission lines – Definition of Characteristic impedance – The transmission line as a cascade of T-Sections - Definition of Propagation Constant. General Solution of the transmission line – The two standard forms for voltage and current of a line terminated by an impedance – physical significance of the equation and the infinite line – The two standard forms for the input impedance of a transmission line terminated by an impedance – meaning of reflection coefficient – wavelength and velocity of propagation. Waveform distortion – distortion										

less transmission line – The telephone cable – Inductance loading of telephone cables. Input impedance of lossless lines – reflection on a line not terminated by Z_0 - Transfer impedance – reflection factor and reflection loss – T and Π Section equivalent to lines.				
UNIT V -THE LINE AT RADIO FREQUENCIES				9+6
Standing waves and standing wave ratio on a line – One eighth wave line – The quarter wave line and impedance matching – the half wave line. The circuit diagram for the dissipation less line – The Smith Chart – Application of the Smith Chart – Conversion from impedance to reflection coefficient and vice-versa. Impedance to Admittance conversion and vice-versa – Input impedance of a lossless line terminated by impedance – single stub matching and double stub matching.				
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	30	0	75
TEXT BOOKS				
1. G.S.N.Raju, “Electromagnetic Field Theory and Transmission Lines”, Pearson Education, New Delhi, 2005. 2. Gottapu Sasibhushana Rao, “Electromagnetic Field Theory and Transmission Lines”, 1 st edition, Wiley Publications, 2012. 3. Matthew N. O. Sadiku, “Elements of Electromagnetics”, 4 th Edition, Oxford University Press, 2009.				
REFERENCES				
1. W. H.Hayt Jr, J.A.Buck, “Engineering Electromagnetics”, 8 th Edition, McGraw Hill, New York, 2012. 2. Edward Conrad Jordan and Keith George Balmain, “Electromagnetic Waves and Radiating Systems”, 2 nd Edition, Prentice Hall, 1968. 3. Kraus and Fleisch, “Electromagnetic with Applications”, 5 th Edition, McGraw Hill, 1999. 4. R. F. Harington, “Time Harmonic EM Fields”, 2 nd Edition, McGraw Hill, 2001.				
E-REFERENCES				
1. http://nptel.ac.in/courses/117101056 (Prof.R.K.Shevgaonkar, NPTEL:Transmission Lines and E.M. Waves) 2. http://www.amanogawa.com/archive/transmissionA.html				

Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO 1	3	3	1		2							2
CO 2	3	3	1		2							2
CO 3	3	3	1		2							2
CO 4	3	3	1		2							2
CO 5	3	3	1		2							2
Total	15	15	5		10							10
Scaled value	3	3	1		2							2

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

COURSE CODE			XUM406			L	T	P	C
COURSE NAME			ECONOMICS FOR ENGINEERS			3	0	0	3
C	P	A				L	T	P	H
3	0	0				3	0	0	3
COURSE OUTCOMES						Domain		Level	
CO 1		Understand the concepts of economics in engineering				Cognitive		Remembering	
CO 2		InterpretBreak-even analysis				Cognitive		Understanding	
CO 3		Illustratevalue engineering procedure				Cognitive		Understanding	
CO 4		Understandand analyze replacement problem				Cognitive		Understanding	
CO 5		Explaindepreciation				Cognitive		Understanding	
UNIT I - INTRODUCTION TO ECONOMICS									08
Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- types of costing, element of costs, preparation of cost sheet and estimation, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost									
UNIT II-BREAK-EVEN ANALYSIS & SOCIAL COST BENEFIT ANALYSIS									12
Margin of Safety, Profit, Cost & Quantity analysis-Product Mix decisions and CVP analysis, Profit/Volume Ratio (P/V Ratio), Application of Marginal costing, Limitations Social Cost Benefit Analysis: compare different project alternatives, Calculate direct, indirect and external effects; Monetizing effects; Result of a social cost benefit analysis.									
UNIT III -VALUE ENGINEERING &COST ACCOUNTING:									10
Value engineering – Function, aims, Value engineering procedure - Make or buy decision Business operating costs, Business overhead costs, Equipment operating costs									
UNIT IV -REPLACEMENT ANALYSIS									07
Replacement analysis –Types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset.									
UNIT V -DEPRECIATION									08
Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation, Annuity method of depreciation, service output method of depreciation.									
					LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS					45	0	0	45	
TEXT BOOKS									
1. Sp Gupta, Ajay Sharma & Satish Ahuja, “Cost Accounting”, V K Global Publications, Faridabad, Haryana, 2012									
2. S.P.Jain & Narang, “Cost accounting – Principles and Practice”, Kalyani Publishers, Calcutta, 2012									
3. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.									
4. William G.Sullivan, James A.Bontadelli & Elin M.Wicks, “Engineering Economy”, Prentice Hall International, New York, 2001.									

REFERENCES

1. Luke M Froeb / Brian T Mccann, " Managerial Economics – A problem solving approach" Thomson learning 2007
2. Truett & Truett, "Managerial economics- Analysis, problems & cases " Wiley India 8th edition 2004.
3. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
4. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002

Mapping of COs with GAs:

	GA 1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CO 1	2					1	1				1	1
CO 2	2	3		1		2					2	1
CO 3	2			2		1	1	1		2	1	1
CO 4	3	1		1		1					3	1
CO 5	2			1		2	1				1	2
Total	11	4	0	5	0	7	3	1	0	2	8	6
Scaled	3	1	0	1	0	2	1	1	0	1	2	1

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

COURSE CODE			XGS407			L	T	P	SS	C
COURSE NAME			TECHNICAL COMMUNICATION			1	0	0	2	1
C	P	A				L	T	P	SS	H
1.8	0.8	0.4				1	0	0	2	3
					DOMAIN			LEVEL		
CO 1	Identify the features of a technical project report and Knowledge on the linguistic competence to write a technical report				Cognitive			Remembering		
CO 2	Integrate both technical subject skill and language skill to write a project.				Cognitive			Create		
CO 3	Confidence to present a project in 10 to 15 minutes				Affective			Response		
CO 4	The learner identifies and absorbs the pronunciation of sounds in English Language and learns how to mark the stress in a word and in a sentence properly				Cognitive			Remembering		
CO 5	Enables the speaker speaks clearly and fluently with confidence and it trains the learner to listen actively and critically				Psychomotor			Perception		
UNIT I - BASIC PRINCIPLES OF GOOD TECHNICAL WRITING										9
Style in technical writing, out lines and abstracts, language used in technical writing: technical words, jargons etc										
Unit II -SPECIAL TECHNIQUES										9
used in technical writing: Definition, description of mechanism, Description of a process, Classifications, division and interpretation										
Unit III -REPORT/ PROJECT										9
Layout the formats: chapters, conclusion, bibliography, annexure and glossary, Graphics aids etc - Presentation of the written project 10 – 15 minutes										
Unit IV -SOUNDS OF ENGLISH LANGUAGE;										9
Reading for facts, meanings from context, scanning, skimming, inferring meaning, critical reading, active listening, listening for comprehension etc.										
Unit V -READING COMPREHENSION										9
Reading for facts, meanings from context, scanning, skimming, inferring meaning, critical reading, active listening, listening for comprehension etc.										
				LECTURE	SELF STUDY		PRACTICAL		TOTAL	
HOURS				15	30		0		45	
TEXT BOOKS										
1. Gordon H. Mills, Technical Writing – April, 1978, Oxford Univ Press										
2. Barun K. Mitra, Effective Technical Communication: A Guide for scientists and Engineers. Author, Publication: Oxford University press. 2007										
Software for lab: English Teaching software (Young India Films)										

Mapping of COs with GAs:

	GA 1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01										2		
C02										2		
C03				2						1		
C04												1
C05				2						1	2	1
Total				4						6	2	2
Scaled value				1						2	1	1

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

V SEMESTER

COURSE CODE			XMA501	L	T	P	C	
COURSE NAME			NUMERICAL METHODS	2	1	0	3	
C	P	A		L	T	P	H	
3	0	0		2	2	0	4	
				DOMAIN		LEVEL		
C01.	Solve algebraic and transcendental equations and to Find Eigen values of a matrix by Power method.			Cognitive		Remembering Applying		
C02.	Interpret and Approximate the data using Interpolation methods			Cognitive		Understanding		
C03	Solve the Numerical Differentiation and Integration and to Apply the Trapezoidal and Simpson's rules.			Cognitive		Applying		
C04.	Solve the first order and second order differential equations using single step and multistep methods.			Cognitive		Applying		
C05	Apply Finite difference methods to Solve two-point linear boundary value problems and to Solve One dimensional heat-flow equation and wave equation.			Cognitive		Applying		
UNIT I - Solution of Equations and Eigenvalue Problems							12	
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton-Raphson method- Solution of linear system of equations - Gauss Elimination method –Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method.								
UNIT II-Interpolation And Approximation							12	
Interpolation with equal intervals - Newton's forward and backward difference formulae-Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation								
UNIT III- Numerical Differentiation And Integration							12	
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.								
UNIT IV - Initial Value Problems for Ordinary Differential Equations							12	
Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-corrector methods for solving first order equations.								
UNIT V-Boundary Value Problems in Ordinary and Partial Differential Equations							12	
Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit methods - One dimensional wave equation by explicit method.								
				LECTURE		TUTORIAL		TOTAL
				30		30		60

TEXT BOOKS
Grewal, B.S. and Grewal, J.S., “ Numerical methods in Engineering and Science”, 6 th Edition, Khanna Publishers, New Delhi, (2004). Sankara Rao, K. “Numerical methods for Scientists and Engineers”, 3rd Edition, Prentice Hall of India Private Ltd., New Delhi, (2007).
REFERENCES
1. Chapra, S. C and Canale, R. P. “Numerical Methods for Engineers”, 5th Edition, Tata McGraw-Hill, New Delhi, (2007). 2. Gerald, C. F. and Wheatley, P. O., “Applied Numerical Analysis”, 6th Edition, Pearson Education Asia, New Delhi, (2006). Brian Bradie, “A friendly introduction to Numerical analysis”, Pearson Education Asia, New Delhi, (2007) Jain M.K. , Iyengar S.R.K, Jain R.K, “Numerical Methods problems and solutions”, Revised Second Edition (2007).
E REFERENCES
<u>www.nptel.ac.in</u> Elementary Numerical Analysis Prof. Rekha P. Kulkarni. Department of Mathematics, Indian Institute Of Technology, Bombay.

Mapping of COs with GAs:

	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									1		1
CO 4	3	2			1					1	1	1
CO 5	3	2			1					1	1	1
Total	15	4	0	0	2	0	0	0	0	5	2	5
Scaled value	3	1			1					1	1	1

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

COURSE CODE		XEC502	L	T	P	C
COURSE NAME		Computer Communication Networks	3	0	0	3
PREREQUISITES		XEC404	L	T	P	H
C:P:A		3:0:0	3	0	0	3
COURSE OUTCOMES:			Domain		Level	
CO1	<i>Outline</i> and <i>classify</i> the types of networks, media and topologies.		Cognitive		Remembering, Applying	
CO2	<i>Explain</i> the activities of Data link Layer		Cognitive		Understanding	
CO3	<i>Illustrate</i> the concepts of switching and different routing techniques.		Cognitive		Understanding	
CO4	<i>Explain</i> the aspects of reliable delivery of messages.		Cognitive		Understanding	
CO5	<i>Explain</i> the aspects of secure communication.		Cognitive		Applying	
UNIT I - DATA COMMUNICATIONS						9
Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics –Modems – RS232 Interfacing sequences.						
UNIT II -DATA LINK LAYER						9
Error – detection and correction – Parity – LRC – CRC – Hamming code – Flow Control and Error control: stop and wait – Go back N ARQ – selective repeat ARQ- sliding window techniques – HDLC. LAN: Ethernet IEEE 802.3, IEEE 802.4, and IEEE 802.5 – IEEE 802.11–FDDI, SONET – Bridges.						
UNIT III-NETWORK LAYER						9
Internetworks - Packet Switching and Datagram approach – ARP, RARP and IP addressing methods – Sub netting – Routing – Distance Vector Routing – Link State Routing – Routers.						
UNIT IV -TRANSPORT LAYER						9
Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.						
UNIT V- APPLICATION LAYER						9
Domain Name Space (DNS) – SMTP, FTP, HTTP, WWW – Security – Cryptography.						
		LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS		45	0	0	45	
TEXT BOOKS						
1. Behrouz.A.Forouzan, “Data Communication and Networking”, Tata McGraw Hill, 2004.						
REFERENCES						
1. James .F.Kurouse & W.Rouse, “Computer Networking: A Top down Approach Featuring the Internet”, Pearson Education, 2000.						
2. Larry L.Peterson & Peter.S.Davie, “Computer Networks”, The Morgan Kaufmann Series 3 rd Edition, 2003.						
3. Andrew S. Tannenbaum, “Computer Networks”, 4 th Edition, PHI, 2003.						
4. William Stallings, “Data and Computer Communication”, 6 th Edition, Pearson Education, 2000.						
5. Kevin Fall, KannanVaradhan, “The Ns Manual”, April 2002.						
6. Ulf Lamping, Richard Sharpe, “Ns Computer Software and Services”.						

E-REFERENCES

1. <http://nptel.ac.in/courses> (Prof.Sujoy Ghosh, NPTEL:Computer Networks).

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	1	2		1		1			1			1	2	2
CO 2	1	2		3	2	1			1			2	1	2
CO 3	2	1		3	2	1			2			1	3	2
CO 4	1	1		2	2	1						1	3	3
CO 5	1	1		2	2	1			1			2	2	2
Total	6	7		11	8	5			5			7	11	11
Scaled value	2	2		3	2	1			1			2	3	3

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

COURSE CODE			XEC503		L	T	P	C
COURSE NAME			OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES		3	0	1	4
PREREQUISITES			XCP202		L	T	P	H
C	P	A			3	0	2	5
2.875	0.875	0.25						
COURSE OUTCOMES:				Domain	Level			
C01	Explain the concepts of overloading, Demonstrate the usage of modularity, classes and scope of the class members and build programs for the same			Cognitive Psychomotor	Understanding Guided Response			
C02	Discuss the aspects of polymorphism and inheritance and construct programs.			Cognitive Psychomotor	Understanding, Mechanism			
C03	Understand and implement various linear data structures			Cognitive Psychomotor	Understanding, Applying Guided Response			
C04	Understand, implement and build programs for various non linear data structures.			Psychomotor Cognitive Psychomotor	Understanding, Applying Guided Response			
C05	Discuss different searching and sorting techniques and build programs.			Cognitive Psychomotor	Understand ing Guided Response			
UNIT I- INTRODUCTION							9+0+6	
Object oriented programming concepts – objects – classes – methods and messages – Abstraction and encapsulation – inheritance – abstract classes – polymorphism. Introduction to C++ – classes – access specifiers – function and data members – default arguments – function overloading – friend functions – const. and volatile functions - static members – Objects – pointers and objects – constant objects – nested classes – local classes.								
List of Experiments:								
1. Design C++ classes with static members, methods with default arguments, friend functions. (For example, design matrix and vector classes with static allocation, and a friend function to do matrix-vector multiplication)								
2. Implement complex number class with necessary operator overloading and type conversions such as integer to complex, double to complex, complex to double etc.								
UNIT II - PROGRAMMING IN C++							9 +0+ 6	
Constructors – default constructor – Parameterized constructors – Constructor with dynamic allocation – copy constructor – destructor – operator overloading – overloading through friend functions – overloading the assignment operator – type conversion – explicit constructor.								
List of Experiments:								
1. Implement Matrix class with dynamic memory allocation and necessary methods. Give proper constructor, destructor, copy constructor, and overloading of assignment operator.								
2. Overload the new and delete operators to provide custom dynamic allocation of memory.								

UNIT III - FUNCTION IN C++				9+0+6
Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and Unexpected functions – Uncaught exception.				
List of Experiments: 1. Develop a template of linked-list class and its methods. 2. Develop a program to implement swapping of two numbers using the concept of function template. 3. Develop a program to demonstrate the exception handling mechanisms				
UNIT IV - INHERITANCE AND POLYMORPHISM				9+0+6
Inheritance – public, private, and protected derivations – multiple inheritance - virtual base class – abstract class – composite objects - Polymorphism - Runtime polymorphism – virtual functions – pure virtual functions – RTTI – typeid – dynamic casting – RTTI and templates – cross casting – down casting.				
List of Experiments: 1. Compile time polymorphism • Operator overloading • Function overloading 2. Run time polymorphism • Inheritance • Virtual functions • Virtual base classes				
Templates				
UNIT V - FILE HANDLING				9+0+6
Streams and formatted I/O - I/O manipulators - file handling - random access - object serialization - namespaces - std namespace - ANSI String Objects - standard template library.				
List of Experiments: 1. File handling with Sequential access 2. File handling with Random access				
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	0	30	75
TEXT BOOKS				
1. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2013, ISBN: 0198083963, 9780198083962. 2. Paul Deitel, Harvey Deitel, "C++ How to Program", Sixth Edition, Prentice Hall, 2011, ISBN-13: 978-0132662369, ISBN-10: 0132662361.				

REFERENCES

1. Balagurusamy E., "Object oriented programming with C++", Fifth Edition, Third Reprint, Tata McGraw-Hill Education 2011.
2. Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition, Reprint 2007.
3. B. Stroustrup, "The C++ Programming language", Third edition, Addison-Wesley Professional, 4th edition 2013, ISBN-10: 0321563840, ISBN-13: 978-0321563842.

E -REFERENCES

1. http://spoken-tutorial.org/tutorial-search/?search_foss=C+and+Cpp&search_language=
2. <http://www.nptel.ac.in>
3. <http://www.learncpp.com/>
4. <http://vlab.co.in>

Mapping of COs with POs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01	3	3	3	2	1	1	1	1	1	0	0	1
C02	2	1	1	1	1	1	1	1	1	0	0	1
C03	2	2	2	1	1	1	1	1	1	0	0	1
C04	1	1	1	1	0	0	0	0	0	0	0	1
C05	1	1	1	2	2	1	1	2	2	0	0	1
Total	9	8	8	7	5	4	4	5	5	0	0	5
Scaled	2	2	2	2	1	1	1	1	1	0	0	1

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	1	1	5
PREREQUISITES			XMA201,XEC402	L	T	P	H
C	P	A		3	2	2	7
3	0.9	0.1					
COURSE OUTCOMES				Domain		Level	
CO1	Find, analyze and practice, Discrete Fourier Transform to signal processing.			Cognitive	Remembering		
				Psychomotor	Analyzing		
				Affective	Mechanism		
CO2	Define, Classify the hardware architecture, Finite word length effect and construct and justify signal processing modules in hardware.			Cognitive	Remembering,		
				Psychomotor	Understanding		
				Affective	Evaluating		
CO3	Explain, Apply, Analyze, construct and report IIR digital filters.			Cognitive	Mechanism		
				Psychomotor	Responding		
				Affective	Understanding		
CO4	Explain, Apply, Analyze, construct and report FIR digital filters.			Cognitive	Applying,		
				Psychomotor	Analyzing		
				Affective	Mechanism		
CO5	Define, categorize Multirate signal processing			Cognitive	Responding		
					Understanding,		
					Analyze		
UNIT I - DISCRETE FOURIER TRANSFORM							9+6+9
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 - FINITE WORD LENGTH EFFECTS AND DIGITAL SIGNAL PROCESSORS							9+6+7
Quantization noise – derivation for quantization noise power - over flow error – truncation error – co-efficient quantization error - limit cycle oscillation – signal scaling – analytical model of sample and hold operations.							
Introduction to DSP architecture – Harvard architecture - Dedicated MAC unit - Multiple ALUs, Advanced addressing modes, Pipelining, Overview of instruction set of TMS320C5X and C54X							
UNIT III - DIGITAL IIR FILTERS DESIGN							9+6+7
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 - DIGITAL FIR FILTERS DESIGN							9+6+7
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 V - MULTI RATE SIGNAL PROCESSING	9+6
Multi rate Signal Processing: Sampling rate reduction: decimation by integer factors, Sampling rate increase: interpolation by integer factors, sampling rate conversion by non integer factors. Applications of Multi rate Signal Processing.	

LIST OF EXPERIMENTS				
USING MATLAB®/SCILAB®				
1.	Generation of signals(Analog & Digital) (Using SciLab)			
2.	Sine Wave generation (Using TMS320C5X)			
3.	Sampling and effect of aliasing (Using SciLab)			
4.	Sampling of input signal and display (Using TMS320C5X)			
5.	Linear and circular convolution of two sequences. (Using SciLab)			
6.	Linear convolution of two sequences (Using TMS320C5X)			
7.	Calculation of DFT and IDFT of a signal. (Using SciLab)			
8.	Calculation of FFT and IFFT of a signal. (Using SciLab)			
9.	Calculation of DFT & FFT(Using TMS320C5X)			
10.	Design of IIR filters. (Using SciLab)			
11.	Implementation of IIR filter (Using TMS320C5X)			
12.	Design of FIR filters. (Using SciLab)			
13.	Implementation of FIR filter (UsingTMS320C5X)			
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	30	30	105
TEXT BOOKS				
1. Alan V. Oppenheim, Ronald Schafer, "Discrete Time signal Processing", Pearson Education, 3 rd Edition, 2010. 2. John G Proakis, Dimtris G Manolakis, "Digital Signal Processing Principles, Algorithms and Application", 4 th 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. Johny R.Johnson Introduction to Digital Signal Processing", Prentice Hall, 1984. 4. S.K.Mitra, "Digital Signal Processing- A Computer based approach", Tata McGraw Hill, New Delhi, 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 COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO 1	PSO 2
CO 1	3	3	1	2	2	2	-	-	1	1	1	2	-	1
CO 2	3	2	2	2	3	2	-	-	1	1	1	2	-	1
CO 3	3	3	2	2	2	2	-	-	1	1	1	2	-	1
CO 4	2	2	2	2	2	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	-	-	4	4	4	10	-	5
Scaled	3	3	2	0	3	2	-	-	0	1	1	2	-	1

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

COURSE CODE			XTQ506			L	T	P	C
COURSE NAME			TOTAL QUALITY MANAGEMENT			3	0	0	3
C	P	A				L	T	P	H
3	0	0				3	0	0	3
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	
CO3		Explain and Apply the Statistical Process Control Tools				Cognitive		Understanding, Applying	
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 I - INTRODUCTION									9
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
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
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
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.									
						LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS						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”, 5 th 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.Tapan P.Bagchi, IIT, Kharagpur.

COs Vs GA mapping

	C01	C02	C03	C04	C05	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			XGS507		L	T	S.S	C
COURSE NAME			BUSINESS COMMUNICATION		1	0	1	0
PREREQUISITES					L	T	S.S	H
C	P	A			1	0	2	3
1	1	0						
COURSE OUTCOMES:					Domain		Level	
CO1		To choose and apply different styles to various forms of business communication.			Cognitive		Remembering Understanding	
CO2		Identify the proper tone of language required in writing and speaking in business communication.			Cognitive		Understanding	
CO3		Display knowledge on grammar and other linguistic features in writing various forms of business communication.			Cognitive		Understanding	
CO4		To distinguish between letters and memos and various forms of Business Communication						
CO5		Apply: Learn how to write business reports, minutes, proposals.			Cognitive		Understanding	
Units I - INTRODUCTION TO BUSINESS COMMUNICATION								5
Modern developments in the style of writing letters memos and reports: block letters, semi block letters, full block letters, simplified letters etc.,								
Units II- USE OF LANGUAGE								5
Memos/minutes/telephone memos/ letters/ assignments art of writing E-mail etc. Advantages of written and spoken communication.								
Units III- GRAMMAR								5
The use of active and passive voice; the use of grammar, propriety, accuracy , exactness , the tone & other elements of language used in these writings.								
Units IV- TYPES OF REPORT								5
The format of various types of Reports/ projects etc.,								
Units V- BUSINESS WRITING								10
Writing Business reports, proposals and minutes.								
						Self Study		Total
HOURS						30		30
Text Books and Reference Books:								
1. John Sealy, Writing and Speaking Author:, Oxford University Press, New Delhi Third Edition 2009.								
2. Williams K S, Communicating in Business (8th Edition) Engage Learning India Pvt. Ltd.; 2012								
3. John Sealy, Writing and Speaking, Oxford University Press, New Delhi Third Edition 2009.								

Mapping of Course :

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01										2		
C02										2		
C03				2						1		
C04												
C05										1		
Total				2						6		
Scaled Value				1						2		

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

COURSE CODE			XEC508		L	T	P	C
COURSE NAME			In-plant Training/ Internship programme		0	0	0	1
C	P	A						
2/1	2/1	2/1						
COURSE OUTCOMES:					Domain		Level	
C01	Relate classroom theory with workplace practice				Cognitive		Understanding	
C02	Comply with Factory discipline, management and business practices.				Affective		Responding	
C03	demonstrates teamwork and time management				Affective		Value	
C04	Describe and Display hands-on experience on practical skills obtained during the programme.				Psychomotor		Perception , Set	
C05	Summarize the tasks and activities done by technical documents and oral presentations.				Cognitive		Evaluate	
All COs are equally weighted								
Note:								
Revised Bloom Taxonomy of the Cognitive Domain								
Simpson's Taxonomy of the Psychomotor Domain								
Krathwohl's Taxonomy of the Affective Domain								

Table 1: Mapping COs with B.Tech GAs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01	2											
C02							1	3			1	
C03									3	1	3	1
C04		1	2	1	3							3
C05				3						3		1
Total	2	1	2	4	3	0	1	3	3	4	4	5
Scaled	1	1	2	1	1	0	1	1	1	1	1	1

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

COURSECODE			XEC509		L	T	P	C
COURSE NAME			PCB DESIGN THROUGH ULTIBOARD		0.5	0	0.5	1
PREREQUISITE			XEC304					
C	P	A			L	T	P	H
1	0	0			1	0	1	2
COURSE OUTCOMES					DOMAIN	LEVEL		
CO1		Describe Printed Circuit Boards and design them using a CAD software.			Cognitive Psychomotor	Remember Complex Over Response		
UNIT I -								5+0+10
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.								

VI SEMESTER

COURSE CODE			XEC602			L	T	P	C
COURSE NAME			DIGITAL COMMUNICATION			3	0	0	3
PREREQUISITES			XEC404,XEC303			L	T	P	H
C	P	A				3	0	0	3
3	0	0							
COURSE OUTCOMES:						Domain		Level	
C01	Describe various methods to mitigate the effects of noise and ISI in baseband pulse transmission.					Cognitive		Remembering	
C02	Explain and compare various digital modulation techniques					Cognitive		Understanding, Evaluate	
C03	Describe and apply various error control techniques for reducing bit errors in digital communication.					Cognitive		Remembering, Applying	
C04	Explain and illustrate Spread Spectrum Communication.					Cognitive		Understanding	
C05	Explain Multiple Access Schemes					Cognitive		Understanding	
UNIT I - COMMUNICATION THROUGH BANDLIMITED CHANNELS									9
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
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
Discrete memoryless channels – Linear block codes - Cyclic codes - Convolutional codes – Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis coded Modulation, Turbo codes, Introduction to LDPC codes									
UNIT IV-SPREAD SPECTRUM COMMUNICATION									9
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.									
UNIT V -MULTIPLE ACCESS TECHNIQUES									9
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 the 3GPP LTE Cellular System									
					LECTURE	TUTORIAL	PRACTICAL		TOTAL
HOURS					45	0	0		45
TEXT BOOKS									
1. Simon Haykins, “Communication Systems”, 4 th Edition, John Wiley & Sons, Reprint 2008.									
2. Wesolowski, “Introduction to Digital Communication Systems”, John Wiley & Sons, 2009.									

REFERENCES	
1.	John Proakis, Massoud Salehi, "Digital Communications", 5 th Editions, McGraw Hill Education India, 2014.
2.	John R.Barry, Edward A. Lee, David G.Messerschmitt, "Digital Communication", 3 rd Edition, Kluwer Academic Publishers, 2004.
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,IIT Kharagpur)

Mapping of COs with POs:

	P O 1	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	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	1	3	0	0	0	0	0	0	0	1	0	2	2	3

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

COURSE CODE			XEC603	L	T	P	C
COURSE NAME			ANTENNAS AND WAVE PROPAGATION	3	0	1	4
PREREQUISITES			XEC405	L	T	P	H
C	P	A		3	0	2	5
3	0.9	0.1					
COURSE OUTCOMES				Domain		Level	
CO1	Describe, explain, determine, measure and report the parameters of antennas.			Cognitive Psychomotor Affective		Remembering, Understanding, Evaluate Guided Responding Responding	
CO2	Explain, classify, identify, measure and practice dipoles, arrays and loop antennas.			Cognitive Psychomotor Affective		Remembering, Understanding, Analyse Guided Responding Responding	
CO3	Describe, apply, measure and report antennas for wideband applications.			Cognitive Psychomotor Affective		Remembering, Applying Guided Responding Responding	
CO4	Explain, relate, measure and perform the radiation from apertures and lens antennas.			Cognitive Psychomotor Affective		Understanding, Applying Guided Responsding Responding	
CO5	Outlineand explain the methods of wave propagation and associated parameters.			Cognitive		Remembering, Understanding	
UNIT I - WIRE ANTENNAS AND ANTENNA FUNDAMENTALS							9+0+6
Concept of vector potential. Modification for time varying retarded case. Fields associated with Hertzian dipole. Power radiated and radiation resistance of current element. Radiation resistance of elementary dipole with linear current distribution. Definitions: Radiation intensity. Directive gain. Directivity. Power gain. Beam Width. Band Width. Gain and radiation resistance of current element. Half-wave dipole and folded dipole. Reciprocity principle. Effective length and Effective area. Relation between gain effective length and radiation resistance.							
UNIT II - ELECTRIC DIPOLES, ANTENNA ARRAYS AND LOOP ANTENNAS							9+0+9
Radiation from half-wave dipole and quarter-wave monopole. Assumed current distribution for wire antennas. Use of capacity hat and loading coil for short antennas. Antenna Arrays: Electric field from two and three element arrays. Uniform linear array. Method of pattern multiplication. Binomial array. Use of method of images for antennas above ground. Loop Antennas: Radiation from small loop and its radiation resistance. Radiation from a loop with circumference equal to a wavelength and resultant circular polarization on axis. Helical antenna. Normal and axial mode operation.							
UNIT III TRAVELLING WAVE ANTENNAS AND SPECIAL ANTENNAS							9+0+6
Radiation from a travelling wave on a wire. Analysis of Rhombic antenna. Design of Rhombic antennas. Coupled Antennas: Self and mutual impedance of antennas. Yagi antennas. Log periodic antenna. Reason for feeding from end with shorter dipoles and need for transposing the lines.							

Antenna for Special Applications: Sleeve antenna, Turnstile antenna, Spiral antenna, Helical antenna, Reconfigurable antenna, Dielectric antennas, Electronic band gap structures and applications. Microstrip antennas				
UNIT IV APERTURE AND LENS ANTENNAS				9+0+9
Radiation from an elemental area of a plane wave (Huygen's Source). Radiation from the open end of a coaxial line. Radiation from a rectangular aperture treated as an array of Huygen's sources. Equivalence of fields of a slot and complementary dipole. Relation between dipole and slot impedances. Method of feeding slot antennas. Thin slot in an infinite cylinder. Field on the axis of an E-Plane sectoral horn. Radiation from circular aperture. Beam Width and Effective area. Reflector type of antennas (dish antennas). Dielectric lens and metal plane lens antennas. Luneburg lens. Spherical waves and Biconical antenna.				
UNIT V WAVE PROPAGATION				9+0+0
Propagation-Sky wave propagation: Structure of the ionosphere. Effective dielectric constant of ionized region. Mechanism of refraction. Refractive index. Critical frequency. Skip distance. Maximum usable frequency. Fading and Diversity reception. Space wave propagation: Reflection from ground for vertically and horizontally polarized waves. Reflection characteristics of earth. Resultant of direct and reflected ray at the receiver. Duct propagation. Ground wave propagation: Attenuation characteristics for ground wave propagation. Calculation of field strength at a distance.				
LIST OF EXPERIMENTS				
USING ANTENNA TRAINER KITS / MATLAB				
1. Radiation pattern of Monopole, Dipole and half wave dipole antennas. 2. Radiation pattern of Linear array antenna and Circular array antenna. 3. Radiation pattern of Linear array of isotropic antennas. 4. Radiation pattern for End fire antenna array. 5. Radiation pattern for Binomial antenna array. 6. Radiation pattern for Broadside antenna array. 7. Radiation pattern of Loop antenna. 8. Radiation pattern of Yagi-Uda antennas. 9. Radiation pattern of Rectangular aperture antenna. 10. Radiation pattern of Travelling wave antenna. 11. Radiation pattern of a Horn antenna. 12. Design of Microstrip Patch Antenna.				
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	0	30	75
TEXT BOOK				
1. Balanis, "Antenna Theory ", 2nd Edition, John Wiley & Sons, 2003. 2. Edward C.Jordan and Keith G.Balmain, "Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2006				
REFERENCES				
1. John D.Kraus and Ronald Marhefka, "Antennas For All Applications", 3rd Edition, Tata McGrawHill, 2003. 2. R.E.Collins, "Antennas and Radio Propagation ", McGraw-Hill, 1987. 3. Constantine. A.Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 2006. 4. Rajeswari Chatterjee, "Antenna Theory and Practice" Revised Second Edition, New Age International Publishers, 2006.				

5.	S. Drabowitch, "Modern Antennas", 2 nd Edition, Springer Publications, 2007.
6.	Robert S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.
7.	H.Sizun "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint, Springer Publications, 2007.
E- REFERENCES	
1.	http://nptel.ac.in/courses/117101056/48 (NPTEL: Prof R.K.Shevgaonkar, Transmission Lines and E.M. Waves)

Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
CO 1	3	1		2	2							1		1
CO 2	3	1		2	2							1		1
CO 3	3	1		2	2							1		1
CO 4	3	1		2	2							1		1
CO 5	2	1		1	1							1		1
Total	14	5		9	9							5		5
Scaled	3	1		2	2							1		1

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

COURSE CODE			XEC604	L	T	P	C
COURSE NAME			MICROPROCESSORS AND MICROCONTROLLERS	3	1	1	5
PREREQUISITES			XEC303	L	T	P	H
C	P	A		3	2	2	7
3	0.9	0.1					
COURSE OUTCOMES				Domain		Level	
CO1		<i>Describe,understand, show and practicethe</i> concepts of microprocessor 8085.		Cognitive Psychomotor Affective		Remembering Understanding Set Responding	
CO2		<i>Describe,understand ,show and practicethe</i> concepts of microprocessor 8086.		Cognitive Psychomotor Affective		Remembering, Understanding Set Responding	
CO3		<i>Understand, analyze ,integrate ,assemble and report</i> peripherals devices with microprocessors.		Cognitive Psychomotor Affective		Understanding, Analyzing, Create Guided Response Responding	
CO4		<i>Describe,understand ,show and practicethe</i> concepts of microcontroller 8051.		Cognitive Psychomotor Affective		Remembering, Understanding Set Responding	
CO5		<i>Describe ,understand and assemble</i> using PIC microcontroller .		Cognitive		Remembering, Understanding	
UNIT I - 8085 MICROPROCESSOR.							9+6+6
8085 architecture-Instruction set –addressing modes- timing diagram –assembly language programming-counters- time delays- interrupts-memory interfacing I/O devices.							
UNIT II - 8086 MICROPROCESSOR.							9+6+6
8086 architecture- 8086 addressing modes- instruction set – Interrupt-8086 assembly language programming.							
UNIT III -INTERFACING PERIPHERALS PROGRAMMABLE I/O DEVICES APPLICATIONS AND DESIGN.							9+6+6
Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface -Peripheral Devices- Programmable Peripheral Interface (Intel 8255A)- Programmable Interval timer (Intel 8253)-Programmable Interrupt Controller (Intel 8259A)- Programmable Keyboard/Display Interface (Intel 8279)- D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller interface .							
UNIT IV- REAL TIME CONTROL AND APPLICATION.							9+6+6
8051 architecture- instruction set and addressing modes- assembly language programming - I/O pins- port and circuits- Special Function Registers(SFRs) -external memory -counters and timers-serial data I/O interrupts interfacing to external memory and 8255-Interrupts- serial communication-8051 interfacing LCD- ADC & DAC- Stepper motors and keyboard.							

UNIT V - EMBEDDED MICROCONTROLLERS.				9+6+6
Introduction- PIC Microcontroller - Architecture- instruction sets- Timer – PWM – RTC- On chip ADC/DAC.				
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.	Programs for String manipulation operations Using 8086.			
7.	Programming using Arithmetic, Logical and Bit Manipulation Instructions of 8051 microcontroller.			
8.	Interfacing ADC and DAC using 8051.			
9.	Serial Communication between two MP Kits using 8051.			
10.	Communication between 8051 Microcontroller kit and PC.			
11.	Interfacing and Programming of DC Motor using 8051.			
12.	Programming for seven segment display using PIC microcontroller.			
		LECTURE	TUTORIAL	PRACTICAL
HOURS		45	30	30
				TOTAL
				105
TEXT BOOKS				
1.	D. V. Hall, “Micro processors and Interfacing”, 2 nd Edition, Tata McGrawHill, 2006.			
2.	Ramesh S. Goankar, “Microprocessor Architecture, Programming and Applications with 8085”, 5 th Edition, Prentice Hall, 2014.			
3.	Kenneth. J. Ayala. “The 8051 Microcontroller”, 2 nd Edition, Penram International Publishing, 2010.			
4.	Dr. Ramesh Gaonkar, “The Z80 Microprocessor, Architecture, Interfacing, Programming and Design”, 2 nd Edition, Penram International Publishing, 2010.			
5.	A.P.Godse and D.A.Godse, “Microprocessor and Microcontroller”, 1 st Edition, Technical Publications, 2010.			
6.	Muhammad Ali Mazidi, Rolin McKinley, Danny Causey, “PIC Microcontroller and Embedded Systems”, 1 st Edition, Pearson Education, 2015.			
REFERENCES				
1.	A.K.Ray and K.M.Bhurchandani, “Advanced Microprocessors and Peripherals”, 2 nd Edition, TMH, 2006.			
2.	K.UmaRao, Andhe Pallavi, “The 8051 Microcontrollers, Architecture and programming and Applications”, Pearson Education, 2009.			
3.	Liu and G.A.Gibson, “Micro Computer System 8086/8088 Family Architecture. Programming and Design”, 2 nd Edition, PHI, 1986.			
4.	Ajay.V. Deshmukh “Microcontrollers and Applications”, TMGH, 2005.			
E -REFERENCES				
1.	https://www.youtube.com/watch?v=liRPtvj7bFU			
2.	https://inspirit.net.in/books/academic/8085%20Microprocessor%20-%20Ramesh%20Gaonkar.pdf			
3.	https://inspirit.net.in/books/academic/8085%20Microprocessor%20-%20Ramesh%20Gaonkar.pdf			
4.	http://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf			

5. http://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf
6. http://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf
7. http://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf

Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2		2	1	1	1					1		
CO 2	2	2		2	1	1	1					1		
CO 3	3	3		3	2	2	2					1		
CO 4	3	3		2	3	1	1			1		1		
CO 5	3	3		3	3	2	2			1		1		
Total	14	13		12	10	7	7			2		5		
Scaled value	3	3		3	3	1	1			1		1		

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

COURSE CODE			XEC605	L	T	P	C
COURSE NAME			CONTROL SYSTEMS	3	1	0	4
PREREQUISITES			XMA101, XMA201, XBE103, XEC302,XEC402	L	T	P	H
C	P	A	3:0:0	3	2	0	5
3	0	0					
COURSE OUTCOMES				Domain		Level	
CO1	<i>Outline</i> and <i>explain</i> the mathematical modeling of electrical and mechanical systems.			Cognitive		Remembering, Understanding	
CO2	<i>Describe</i> and <i>apply</i> Time domain analysis methods and <i>interpret</i> the stability of the systems.			Cognitive		Remembering, Applying, Understanding	
CO3	<i>Describe</i> and apply Frequency domain analysis methods and <i>interpret</i> the stability of the systems.			Cognitive		Remembering, Applying, Understanding	
CO4	<i>Explain, solve</i> and <i>justify</i> compensation techniques and controllers			Cognitive		Understanding, Applying, Evaluate	
CO5	<i>Outline</i> and <i>illustrate</i> various electrical and mechanical systems through control systems.			Cognitive		Remembering, Understanding	
UNIT I - CONTROL SYSTEM MODELLING							9+6
System concept, differential equations and transfer functions. Modelling of electric systems, translational and rotational mechanical systems, Simple electromechanical systems.Block diagram representation of systems – Block diagram reduction methods – Closed loop transfer function, determination of signal flow graph. Mason’s gain formula – Examples.							
UNIT II - TIME DOMAIN ANALYSIS							9+6
Test signals – time response of first order and second order systems – time domain specifications – types and order of systems – generalised error coefficients – steady state errors – concepts of stability – Routh-Hurwitz stability – root locus.							
UNIT III - FREQUENCY DOMAIN ANALYSIS							9+6
Introduction – correlation between time and frequency response – stability analysis using Bode plots, Polar plots, Nichols chart and Nyquist stability criterion – Gain margin – phase margin.							
UNIT IV - COMPENSATORS							9+6
Realization of basic compensators – cascade compensation in time domain and frequency domain and feedback compensation – design of lag, lead, lag-lead compensator using Bode plot and Root locus. Introduction to P, PI and PID controllers.							
UNIT V - CONTROL SYSTEM COMPONENTS AND APPLICATION OF CONTROL SYSTEMS							9+6
Stepper motors – AC servo motor – DC servo motor – Synchros – sensors and encoders – DC tacho generator – AC tacho generator – Hydraulic controller – Pneumatic controller – Typical application of control system in industry- Aviation- High precision machines- CNC machines - Disk drives							
				LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS				45	30	0	75
TEXT BOOKS							
1. Katsuhiko Ogata, “Modern Control Engineering”, 5 th Edition, Prentice Hall of India, 2009. 2. I.J Nagrath & M. Gopal, “Control System Engineering”, 5 th Edition, New Age International , 2011.							

REFERENCES

1. Benjamin.C.Kuo, "Automatic Control Systems", 7th Edition, Prentice Hall of India, 2010.
2. Richard C. Dorf, Robert H. Bishop, "Modern control systems", 12th Edition, Prentice Hall, 2011.

E - REFERENCES

1. <http://nptel.ac.in/downloads/112104158/>
2. http://webx.ubi.pt/~felippe/texts/contr_systems_ppt07e.pdf
3. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-30-feedback-control-systems-fall-2010/lecture-notes/MIT16_30F10_lec03.pdf
4. <http://www.electrical4u.com/compensation-in-control-system-lag-lead-compensation/>
5. <http://www.electrical4u.com/bode-plot-gain-margin-phase-margin/>
6. https://www.youtube.com/watch?v=zGr_LS60ToE
7. <https://www.youtube.com/watch?v=QJNAZ86rKlk>
8. <https://www.youtube.com/watch?v=RMwSnHRMjOY>
9. [http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Industrial%20Automation%20control/pdf/L\(SS\)%20\(IA&C\)%20\(\(EE\)NPTEL\).pdf](http://nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Industrial%20Automation%20control/pdf/L(SS)%20(IA&C)%20((EE)NPTEL).pdf)
10. http://www.bput.ac.in/lecture_notes/Control_System.pdf

Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 0 1	PS 0 2
CO 1	3	2		1		1	1					1		
CO 2	3	2		1		2	2					2		
CO 3	3	2		1		2	2					2		
CO 4	3	2		1		2	2					2		
CO 5	3	2		1		1	1					1		
Total	15	10		5		8	8					8		
Scaled value	3	2		1		2	2					2		

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

COURSE CODE			XUM607				L	T	P	C
COURSE NAME			ENVIRONMENTAL STUDIES				3	0	0	0
C	P	A					L	T	P	H
2.5	0	0.5					3	0	0	3
COURSE OUTCOMES							DOMAIN		LEVEL	
C01	Describe the significance of natural resources and explain anthropogenic impacts.						Cognitive	Remembering, Understanding		
C02	Illustrate the significance of ecosystem and biodiversity for maintaining ecological balance						Cognitive	Understanding		
C03	Identify the facts , consequences , preventive measures of major pollution and Recognize the disaster phenomenon						Cognitive	Remembering, Affective		
C04	Explain the socio- economics, policy dynamics and practice the control measures of global issues for sustainable development.						Cognitive	Applying		
C05	Recognize the impact of population and apply the concept to develop various welfare programs.						Cognitive	Understanding Applying		
UNIT - I INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY									9	
Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.										
UNIT - II ECOSYSTEMS AND BIODIVERSITY									9	
Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.										
UNIT - III ENVIRONMENTAL POLLUTION									12	
Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide.										

UNIT -IV SOCIAL ISSUES AND THE ENVIRONMENT			9
Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.			
UNIT -V HUMAN POPULATION AND THE ENVIRONMENT			6
Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education - HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies.			
	LECTURE	TUTORIAL	TOTAL
	45	0	45
TEXT BOOKS			
1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000. 2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003 3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003. 4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006. 5. Introduction to International disaster management, Butterworth Heinemann, 2006. 6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.			
REFERENCE BOOKS			
1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009. 2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2001. 3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012. 4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003. 5. Sundar, Disaster Management, Sarup & Sons, New Delhi, 2007. 6. G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006.			
E RESOURCES			
1. Bharat Raj Singh , 2015,Global Warming: Causes, Impacts and Remedies , InTech 2. Richard C. J. Somerville , The Forgiving Air: Understanding Environmental Change , 1998,University of California Press 3. Benny Joseph, Environmental Studies, 2005,Tata McGraw Hill.			

Mapping of COs with POs

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01	3											1
C02	2					2	1			1		1
C03	2	1	3			3	1		2	1		1
C04	1	1	2			3	2	3				1
C05	2	1	1			3						1
	10	3	6			11	4	3	2	2		5
Scaled Value	2	1	2			3	1	1	1	1	1	1

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

COURSE CODE			XGS608	L	T	P	SS	C
COURSE NAME			ACADEMIC WRITING	0	0	0	2	0
C	P	A		L	T	P	SS	H
1.2	0.4	0.4		0	0	0	2	2
COURSE OUTCOMES:								
CO1: C: R: <i>Knowledge</i> on the need for going beyond grammar in writing paragraphs and essays								
CO2: C: U: <i>Integrate</i> all the written language elements into the production of a cohesive whole called a paragraph.								
CO3: C: U: <i>Practice</i> the discourse features that connects sentences and paragraphs.								
CO4: C: GR: <i>Synthesize</i> language and ideas to develop sentences , paragraphs and essays								
CO5: P: A: <i>Produce</i> correct, proper, and fluent pieces of writing								
Unit								Hours
I		TYPES OF PARAGRAPHS Definition of a paragraph, writing different types of paragraphs: definition paragraph, descriptive paragraph, process paragraph, comparison and contrast paragraph etc.						5
II		DISCOURSE FEATURES: Cohesion, coherence (connectives) etc; précis writing, summarizing						5
III		VARIOUS TYPES OF ESSAYS Discursive, argumentative, cause & effect, chronological etc;						5
IV		USE OF LANGUAGE Essays according to the type of essays						5
V		Essay Writing practice						10
		Writing practice (SS): 30 hrs Total : 30 Hrs						
TEXT BOOKS								
1. D. H. Howe and G. MC Arthur, <i>Advance with English</i> , Oxford University Press,1993								
2. Wren and Martine, <i>High School English Grammar and Composition</i> , S, Chand and Company, 1999.								
3. Raymond Murphy, <i>Intermediate English Grammar</i> , 11 Ed., , Cambridge University Press, New Delhi,1994								
4. Bikrim K. Das, <i>Functional Grammar and Spoken and written communication in English</i> , Orient Black swan, Hyderabad.Reprinted 2011,								

Mapping of COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01				2					1	2		3
C02	1									3		
C03		1		2						2		2
C04												1
C05										1	2	
Total	1	1		4					1	8	2	6
Scale	1	1		1					1	2	1	2

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

COURSECODE			XEC609	L	T	P	C
COURSE NAME			PLC and Sensorics	0.5	0	0.5	1
PREREQUISITE			XEC 304				
C	P	A		L	T	P	H
1	0	0		1	0	1	2
COURSE OUTCOMES				DOMAIN	LEVEL		
C01	Describe the role of PLC and sensorics in Industrial Automation and integrate them using Indra logic software.			Cognitive Psychomotor	Remember Complex Overt Response		
UNIT I						5+0+10	
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							
HOURS			LECTURE	TUTORIAL	PRACTICAL		TOTAL
			5	0	10		15
TEXT BOOKS							
1. Kelvin.T.Ericson , “Programmable Logic Controllers:An Emphasis on Design and Application”, 2 nd Edition, 2011							
2. Handbook on PLC and Sensorics –Bosch Rexroth .							
1. krzysztof Iniewski , “Smart Sensors for Industrial applications”, 2017 CRC Press							

VII SEMESTER

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		
C01	Describe, understand, construct and report embedded system design and development			Cognitive Psychomotor Affective		Remembering, Understanding, Applying Mechanism Responding to a phenomena		
C02	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		
C03	Define, select, compare, reproduce and identify the peripherals in embedded systems.			Cognitive Psychomotor Affective		Remembering, Understanding, Evaluate Guided Response Receiving Phenomena		
C04	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		
C05	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/Output Devices using 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.
REFERENCES
1. David Kleidermacher, Mike Kleidermacher, "Embedded Systems Security: Practical Methods for Safe and Secure Software and Systems Development", PHI, 2012. 2. Chattopadhyay, "Embedded System Design", 3rd Edition, 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.
E - REFERENCES
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 Psychomot or	Remembering, Understanding, Analyzing Perception		
CO2	Describe, assemble, demonstrate, measure and analyse the parameters of microwave sources and construct microwave bench.			Cognitive Psychomot or	Remembering, Understanding, Analyzing Perception, Mechanism		
CO3	Outline, assemble and distinguish various semiconductor devices.			Cognitive Psychomot or	Understanding, Remembering, Guided Response		
CO4	Explain, assemble, measure and analyse the transmission characteristics of optical fibers.			Cognitive Psychomot or	Understanding, Analyzing Perception, Mechanism		
CO5	Explain, identify and measure the characteristics of optical sources and detectors.			Cognitive Psychomot or	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”, 3 rd Edition, McGraw Hill, 2000.				
REFERENCES				
1. Robert E.Collin, “Foundations of Microwave Engineering”,Mc Graw 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”, 3 rd Edition, Morgan Kaufmann, 2010.				
6. Govind P. Agrawal, “Fiber Optic Communication Systems”, 3 rd Edition, John Wiley & Sons, 2004.				

E-REFERENCES

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

COURSE CODE			XUM706	L	T	P	C
COURSE NAME			CYBER SECURITY	0	0	0	0
C	P	A		L	T	P	H
3	0	0		3	0	0	3
COURSE OUTCOME:							
CO1: Cog Rem Able to understand the Cyber Security Policy, Laws and Regulations							
CO2: Cog Und Able to discuss the Cyber Security Management Concepts							
CO3: Cog Und Able to understand the Cyber Crime and Cyber welfare							
CO4: Cog Und Able to discuss on issues related to Information Security Concepts							
CO5: Cog Und Able to understand various security threats							
UNIT I INTRODUCTION							9
Cyber Security – Cyber Security policy – Domain of Cyber Security Policy – Laws and Regulations – Enterprise Policy – Technology Operations – Technology Configuration - Strategy Versus Policy – Cyber Security Evolution – Productivity – Internet – E commerce – Counter Measures – Challenges							
UNIT IICYBER SECURITY OBJECTIVES AND GUIDANCE							9
Cyber Security Metrics – Security Management Goals – Counting Vulnerabilities – Security Frameworks – E Commerce Systems – Industrial Control Systems – Personal Mobile Devices – Security Policy Objectives – Guidance for Decision Makers – Tone at the Top – Policy as a Project– Cyber Security Management – Arriving at Goals – Cyber Security Documentation – The Catalog Approach – Catalog Format – Cyber Security Policy Taxonomy.							
UNIT IIICYBER SECURITY POLICY CATALOG							9
Cyber Governance Issues – Net Neutrality – Internet Names and Numbers – Copyright and Trademarks – Email and Messaging - Cyber User Issues - Malvertising - Impersonation – Appropriate Use – Cyber Crime – Geo location – Privacy - Cyber Conflict Issues – Intellectual property Theft – Cyber Espionage – Cyber Sabotage – Cyber Welfare							
UNIT IVINFORMATION SECURITY CONCEPTS							9
Information Security Overview: Background and Current Scenario - Types of Attacks - Goals for Security - E-commerce Security - Computer Forensics – Steganography							
UNIT VSECURITY THREATS AND VULNERABILITIES							9
Overview of Security threats -Weak / Strong Passwords and Password Cracking - Insecure Network connections - Malicious Code - Programming Bugs - Cyber crime and Cyber terrorism - Information Warfare and Surveillance							
			LECTURE	TUTORIAL	TOTAL		
			45	0	45		
REFERENCE BOOKS							
1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss “Cyber Security Policy Guidebook” John Wiley & Sons 2012.							
2. Rick Howard “Cyber Security Essentials” Auerbach Publications 2011.							
3. Richard A. Clarke, Robert Knake “Cyberwar: The Next Threat to National Security & What to Do About It” Ecco 2010							
4. Dan Shoemaker Cyber security The Essential Body Of Knowledge, 1st ed. Cengage Learning 2011							
5. Rhodes-Ousley, Mark, “Information Security: The Complete Reference”, Second Edition, McGraw-Hill, 2013.							

E REFERENCES

1. <https://www.coursera.org/specializations/cyber-security>
2. www.nptel.ac.in
3. <http://professional.mit.edu/programs/short-programs/applied-cybersecurity>

Mapping of COs with GAs:

	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01						2		3				
C02							2		1			
C03	3					2	3		1			
C04										2		
C05	3											
Total	6					4	5	3	2	2		
Scaled value	2					1	1	1	1	1		

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								
How To Write a CV That Really Works: A Concise, Clear and Comprehensive Guide to Writing an Effective CV, Paul McGee Hachette UK, 2014								
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
C01										2		
C02							1			2		
C03				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							

LIST OF ELECTIVES

SEMESTER	COURSE TITLE	L	T	P	C
V Semester (PE-I)					
XEC505A	Medical Electronics	3	0	0	3
XEC505B	Instrumentation and Measurements	3	0	0	3
XEC505C	Power Electronics	3	0	0	3
VI Semester (PE-II)					
XEC606A	Telecommunication Switching and Networks	3	0	0	3
XEC606B	Electromagnetic Interference and Compatibility	3	0	0	3
XEC606C	Speech Processing	3	0	0	3
VII Semester (PE-III)					
XEC704A	DSP Processors and their Applications	3	0	0	3
XEC704B	Digital Image Processing	3	0	0	3
XEC704C	Advanced Microprocessors and Microcontrollers	3	0	0	3
VII Semester (PE- IV)					
XEC705A	Disaster Management	3	0	0	3
XEC705B	Wireless Communication Systems	3	0	0	3
XEC705C	Radar and Navigational Aids	3	0	0	3
VIII Semester (PE- V)					
XEC802A	Optical Networks	3	0	0	3
XEC802B	Wireless Networks	3	0	0	3
XEC802C	Television and Video Engineering	3	0	0	3
VIII Semester (PE- VI)					
XEC803A	Introduction to MEMS	3	0	0	3
XEC803B	Internet of Things	3	0	0	3
XEC803C	Software Defined Radio	3	0	0	3

LIST OF OPEN ELECTIVES

CODE NO.	COURSE TITLE	L	T	P	C
THEORY					
XECOE1	Industrial Electronics	3	0	0	3
XECOE2	Entertainment Electronics and Management	3	0	0	3

COURSE CODE		XEC505A	L	T	P	C
COURSE NAME		MEDICAL ELECTRONICS	3	0	0	3
PREREQUISITES		XEC304	L	T	P	H
C:P:A		3:0:0	3	0	0	3
COURSE OUTCOMES:			Domain		Level	
CO1	<i>Describe</i> and <i>explain</i> the basics of the biomedical signals and associated recording instrumentation		Cognitive		Remembering Understanding	
CO2	<i>Describe</i> and <i>understand</i> the methods of measuring of bio-chemical and non electrical parameters		Cognitive		Remembering, Understanding	
CO3	<i>Describe</i> and <i>discuss</i> the assist devices and bio-telemetry		Cognitive		Remembering Understanding	
CO4	<i>Understand and categorize</i> the principles of radiological equipment		Cognitive		Understanding Analyzing	
CO5	<i>Explain</i> the various diagnostic and therapeutic equipment and electrical safety		Cognitive		Understanding	
UNIT I - ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING						9
The origin of Bio-potentials, bio-potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, EOG, lead systems and recording methods, typical waveforms and signal characteristics.						
UNIT II - BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT						9
PH, PO ₂ , PCO ₂ , PHCO ₃ , Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, and Blood cell counters.						
UNIT III- ASSIST DEVICES AND BIO-TELEMETRY						9
Cardiac pacemakers, DC Defibrillator, Telemetry principles, frequency selection, Bio-telemetry, radio-pill and tele-stimulation.						
UNIT IV - RADIOLOGICAL EQUIPMENTS						9
Ionizing radiation, Diagnostic X-ray equipments, use of Radio Isotope in diagnosis, Radiation Therapy.						
UNIT V - DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS AND ELECTRICAL SAFETY						9
Thermograph, Endoscopy unit, Laser in medicine, Diathermy units, Electrical safety in medical equipment.						
		LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS		45	0	0	45	
TEXT BOOKS						
Leislle Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2002.						
REFERENCES						
R.S.Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 1997. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, 1997.						
E-REFERENCES						
http://mx.nthu.edu.tw/~yucsu/3271/p07.pdf						

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PO 11	PO 12	PS01	PS02
CO 1	2	3	2	1	1							1		
CO 2	2	2	2	1	1							1		
CO 3	2	2	3	1	1							1		
CO 4	2	2	3	1	1							1		
CO 5	2	2	2	1	1							1		
Total	10	11	12	5	5							5		
Scaled value	2	3	3	1	1							1		

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

COURSE CODE			XEC505B		L	T	P	C
COURSE NAME			INSTRUMENTATION AND MEASUREMENTS		3	0	0	3
PREREQUISITES			XMA101,XMA201, XPH104,XBE103		L	T	P	H
C	P	A			3	0	0	3
3	0	0						
COURSE OUTCOMES					Domain		Level	
CO1	Describe, andexplain the concepts of basic electrical and electronic measuring instrument concepts.				Cognitive		Remembering Understanding	
CO2	Apply andanalyze measuring instruments, Measurement bridges and Signal analyzers,				Cognitive		Applying Analyzing	
CO3	Applyandanalyze the signal generators and digital measuring instruments				Cognitive		Applying Analyzing	
CO4	Describe, explainandapply the concepts of the sensors and transducers to choose according to the nature.				Cognitive		Remembering, Understanding, Applying	
CO5	Describeandexplain data acquisition system.				Cognitive		Remembering, Understanding	
UNIT I - BASIC MEASUREMENT CONCEPTS								9
Measurement systems – characteristics – units and standards of measurements – error analysis – moving coil, moving iron meters – multimeters – True RMS meters – Electronic multimeters – Cathode ray oscilloscopes – block schematic – applications – special oscilloscopes .								
UNIT II - BRIDGES & SIGNAL ANALYZERS								9
Bridge measurements – Maxwell, Hay, Schering, Anderson and Wien bridge. Frequency synthesizer – wave analyzer – Harmonic distortion analyzer – spectrum analyzer. Comparison of analog and digital techniques								
UNIT III - GENERATOR AND DIGITAL INSTRUMENTS								9
Function generators – RF signal generators – Sweep generators -Digital voltmeter – multimeters – frequency counters – measurement of frequency and time interval – extension of frequency range – measurement errors.								
UNIT IV - SENSORS AND TRANSDUCERS								9
Sensorics- types, characteristics & its applications, Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT,Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors								
UNIT V - DATA ACQUISITION SYSTEMS								9
Elements of a digital data acquisition system – interfacing of transducers – multiplexing – computer controlled instrumentation – IEEE 488 bus – fiber optic measurements for power and system loss – optical time domains reflectometer.								
				LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS				45	0	0	45	
TEXT BOOKS								
1. Albert D.Helfrick and William D.Cooper “Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 2003.								
2. A.K.Sawhney, “A Course in Electrical and Electronics Measurement and Instrumentation”, 10 th Edition, Dhanpath Rai, 1994.								

REFERENCES

1. Joseph J.Carr, "Elements of Electronics Instrumentation and Measurement", Pearson Education, 2003.
2. Alan. S. Morris, "Principles of Measurements and Instrumentation", 2nd Edition, Prentice Hall of India, 2003.
3. Ernest O. Doebelin, "Measurement Systems-Application and Design", Tata McGrawHill, 2004.
4. Jones, "Instrumentation Measurement and Feedback", Tata McGrawHill, 1986.
5. E.W.Golding, "Electrical Measurement and Measuring Instruments", 3rd Edition, Sir Issac Pitman and Sons, 1960.
6. H.Buckingham, and E.N.Price, "Principles of Electrical Measurements", 1961.
7. Bosch Rexroth Materials and Manuals for Sensorics.

E-REFERENCES

1. <http://www.nptelvideos.in/2012/11/> (Prof.A.K.Jana, Prof.D.Sarkar, Department of Chemical Engineering, IIT Kharagpur).

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS 01	PS 02
CO 1	3	2			3	2						1		
CO 2	2	2			3	2						1		
CO 3	2	2			3	2						1		
CO 4	2	2			2	2						1		
CO 5	2	2			2	2						1		
Total	11	10			13	10						5		
Scaled value	3	2			3	2						1		

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

COURSE CODE			XEC505C	L	T	P	C
COURSE NAME			POWER ELECTRONICS	3	0	0	3
PREREQUISITES			XEC304	L	T	P	H
C	P	A		3	0	0	3
3	0	0					
COURSE OUTCOMES				Domain		Level	
CO1	Describe and explain different types of power semi-conductor devices and their switching characteristics.			Cognitive		Remembering, Understanding	
CO2	Understand and analyze the operation of phase-controlled converters			Cognitive		Understanding, Analyzing	
CO3	Describe and explain the operation, switching techniques and basic topologies of DC-DC converter			Cognitive		Remembering , Understanding	
CO4	Classify and describe inverters.			Cognitive		Understanding, Remembering	
CO5	Describe and explain operation of AC-AC converters.			Cognitive		Remembering, Understanding	
UNIT I - POWER SEMI-CONDUCTOR DEVICES							9
Study of switching devices, - Frame, Driver and snubber circuit of SCR, TRIAC,BJT, IGBT, MOSFET,- Turn-on and turn-off characteristics, switching losses, Commutation circuits for SCR							
UNIT II - PHASE-CONTROLLED CONVERTERS							9
2-pulse, 3-pulse and 6-pulse converters – Effect of source inductance – performance parameters – Reactive power control of converters – Dual converters - Battery charger							
UNIT III - DC TO DC CONVERTER							9
Step-down and step-up chopper - Time ratio control and current limit control – Buck, boost, buck- boost converter, concept of Resonant switching - SMPS.							
UNIT IV - INVERTERS							9
Single phase and three phase (both 120 mode and 180 mode) inverters - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulations - Voltage and harmonic control - Series resonant inverter - Current source inverter							
UNIT V - AC TO AC CONVERTERS							9
Single phase AC voltage controllers – Multistage sequence control - single and three phase cyclo-converters –Introduction to Integral cycle control, Power factor control and Matrix converters.							
			LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS			45	0	0	45	
TEXT BOOKS							
M.H. Rashid, “Power Electronics: Circuits, Devices and Application”, 3 rd Edition, Pearson Education, New Delhi, 2004. Philip T.Krein, “Elements of Power Electronics” Oxford University Press, 2004.							
REFERENCES							
Ashfaq Ahmed, “Power Electronics for Technology”, Pearson Education, Indian Reprint, 2003. P.S.Bimbira, “Power Electronics”, 3 rd Edition, Khanna Publishers, 2003. Ned Mohan, Tore.M.Undeland, William.P.Robbins, “Power Electronics: Converters, Applications and Design”, 3 rd Edition, John Wiley and Sons, 2003.							

E-REFERENCES

<http://nptel.ac.in/video.php?subjectId=108101038> (Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay).

Mapping of COs with POs:

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

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

COURSE CODE			XEC606A		L	T	P	C	
COURSE NAME			TELECOMMUNICATION SWITCHING AND NETWORKS		3	0	0	3	
PREREQUISITES			XEC404		L	T	P	H	
C	P	A				3	0	0	3
3	0	0							
COURSE OUTCOMES					Domain		Level		
C01	Describe the operational characteristics of switching techniques.				Cognitive		Remembering		
C02	Define and explain the working principle of different Switching types and outline the working the SONET Multiplexing				Remember		Remembering, Applying		
C03	Describe and analyze the working concept of Digital Subscriber Access				Remember		Remembering, analyzing		
C04	Compare the operational characteristics of switching techniques.				Remember		Evaluate		
C05	Analyse the working principles of switching networks.				Remember		Analyzing		
UNIT I - MULTIPLEXING								9	
Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing: Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Biphasic, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings.									
UNIT II -DIGITAL SWITCHING								9	
Switching Functions, Space Division Switching, Time Division Switching, two-dimensional Switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Elements of SSN07 signaling.									
UNIT III - NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT								9	
Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.									
UNIT IV - DIGITAL SUBSCRIBER ACCESS								9	
ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems, and Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.									
UNIT V - TRAFFIC ANALYSIS								9	
Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues.									
					LECTURE	TUTORIAL	PRACTICAL		TOTAL
HOURS					30	30	0		60

TEXT BOOK														
1. V.S.Bagad, "Telecommunication Switching and Networks", First Edition, Technical Publications Pune, 2009 2. P. Gnanasivam, "Telecommunication Switching and Networks", New Age International, 2005. 3. T.Viswanathan, Manav Bhatnagar, "Telecommunication Switching Systems and Networks", Prentice Hall of India, 2015. 4. Bellamy John, "Digital Telephony", 3 rd Edition, John Wiley & Sons, 2000.														
REFERENCES														
1. J.E. Flood, "Telecommunication Switching, Traffic and Networks", Second Edition, Pearson Education 2007.														
E-REFERENCES														
1. http://www.nptel.ac.in/downloads/117105076/ 2. http://www.bput.ac.in/lecture_notes/Digital%20switching%20and%20telecom%20network%20PEEC5404_7TH%20SEMESTER_ETC.pdf														

Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
CO 1	3	2		2	2	1	1					1	1	1
CO 2	2	3		2	2	1	1					1	1	1
CO 3	3	3		3	1	1	1					1	1	1
CO 4	3	3		2	2	2	1					1	1	1
CO 5	3	2		3	1	1	1					1	1	1
Total	14	13		12	8	6	5					5	5	5
Scaled value	3	3		2	2	1	1					1	1	1

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

COURSE CODE			XEC606B			L	T	P	C
COURSE NAME			ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY			3	0	0	3
PREREQUISITES						L	T	P	H
C	P	A				3	0	0	3
3	0	0							
COURSE OUTCOMES					Domain	Level			
CO1	Outlineand classify the EMI and EMC concepts.				Cognitive	Remembering, Understanding			
CO2	Understand and explain the principles of EMI measurements.				Cognitive	Understanding, Applying			
CO3	Outline and summarize the EMC standards and associated regulations.				Cognitive	Remembering, Understanding			
CO4	Classify and describe the methods of controlling EMI				Cognitive	Understanding			

			Remembering
C05	<i>Describe</i> and <i>understand</i> the principles of EMC design and interconnection techniques.	Cognitive	Remembering Understanding
UNIT I - BASIC CONCEPTS			9
Definition of EMI and EMC with examples, Classification of EMI/EMC - CE, RE, CS, RS, EMI terminologies, Units of Parameters, Sources of EMI, EMI coupling modes - CM and DM, ESD Phenomena and effects, Transient phenomena and suppression.			
UNIT II - EMI MEASUREMENTS			9
Basic principles of RE, CE, RS and CS measurements, EMI measuring instruments- Open Area Test Site and Antennas, LISN, Feed through capacitor, Current probe, EMC analyzer and detection technique, Anechoic chamber, TEM cell, Giga-Hertz TEM cell.			
UNIT III - EMC STANDARDS AND REGULATIONS			9
Standardizing organizations - FCC, CISPR, ANSI, DOD, IEC, CENECEC, FCC - CE and RE standards, CISPR - CE and RE Standards, IEC/EN, CS standards, FCC Test Procedure, MIL-STD-462 Test Procedure, Frequency assignment - spectrum conservation.			
UNIT IV- EMI CONTROL METHODS AND FIXES			9
Shielding, Grounding, Bonding, Filtering, EMI gasket, Isolation transformer, Opto-isolator.			
UNIT V - EMC DESIGN AND INTERCONNECTION TECHNIQUES			9
Cable routing and connection, Component selection and mounting, PCB design-Trace routing, Impedance control, Decoupling, Zoning and grounding.			
	LECTURE	TUTORIAL	PRACTICAL
HOURS	45	0	0
TEXT BOOKS			
1. V.Prasad Kodali, "Engineering Electromagnetic Compatibility", S.Chand & Co, New Delhi, 2000. 2. Clayton R.Paul, "Introduction to Electromagnetic Compatibility", Wiley & Sons, 1992			
REFERENCES			
1. Bernhard Keiser, "Principles of Electromagnetic Compatibility", 3 rd Edition, Artech House, 1994. 2. Donald R.J.White, "Handbook of EMI / EMC", Don White Consultants, 1985.			
E-REFERENCES			
1. https://standards.ieee.org/findstds/standard/electromagnetic_compatibility.html			

Mapping of COs with POs:

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

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

COURSE CODE			XEC606C		L	T	P	C
COURSE NAME			SPEECH PROCESSING		3	0	0	3
PREREQUISITES			XEC504		L	T	P	H
C	P	A			3	0	0	3
3	0	0						
COURSE OUTCOMES:					Domain		Level	
CO1		Outline and represent the human physiology and anatomy with signal processing paradigms.			Cognitive		Remembering Understanding	
CO2		Represent the speech by various Time Domain (TD) methods, calculate the parameters			Cognitive		Understanding, Applying	
CO3		Represent the speech by various Frequency Domain methods, calculate the parameters analyze their performance.			Cognitive		Understanding, Applying, Analyzing	
CO4		Interpret LPC with various methods, calculate the parameters and justify over TD and FD			Cognitive		Understanding, Applying, Evaluate	
CO5		Create various speech signal estimation, speech recognition & detection models , then conclude the best model.			Cognitive		Create, Evaluate	
UNIT I - NATURE OF SPEECH SIGNAL								9
Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis.								
UNIT II - TIME DOMAIN METHODS FOR SPEECH PROCESSING								9
Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.								
UNIT III- FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING								9
Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems.								
UNIT IV- LINEAR PREDICTIVE CODING OF SPEECH								9
Formulation of linear prediction problem in time domain, solution of normal equations, Interpretation of linear prediction in auto correlation and spectral domains.								
UNIT V - HOMOMORPHIC SPEECH ANALYSIS								9
Central analysis of speech, formant and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification								
					LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS					45	0	0	45
TEXT BOOKS								
1. L.R.Rabiner and R.E.Schafer, "Digital Processing of Speech Signals", Prentice Hall, 2007.								
REFERENCES								
1. J.L.Flanagan," Speech Analysis Synthesis and Perception", 2 nd Edition, Springer- Verlag Berlin Heidelberg GmbH, 1972.								
2. Ian H.Witten, "Principles of Computer Speech", Academic Press, 1983.								

E-REFERENCES

1. <http://www.cs.sfu.ca/CourseCentral/365/li/squeeze/index.html>
2. <http://www.gartner.com/newsroom/id/1759714>.
3. <https://prezi.com/lptazi0rjsbo/final-year-project-voice-recognition-system-using-matlab/>
4. http://www.ifp.illinois.edu/~minhdo/teaching/speaker_recognition/speaker_recognition.html

Mapping of COs with POs:

	P O 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	3	1		0	0							1		
CO 2	2	1		2	1							1		
CO 3	1	2		2	1							1		
CO 4	2	1		3	1							1		
CO 5	1	1		3	1							1		
Total	9	6		10	4							5		
Scaled value	2	2		2	1							1		

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

COURSE CODE			XEC704A		L	T	P	C
COURSE NAME			DIGITAL SIGNAL PROCESSORS AND ITS APPLICATIONS		3	0	0	3
PREREQUISITES			XEC504		L	T	P	H
C	P	A			3	0	0	3
3	0	0						
COURSE OUTCOMES:					Domain		Level	
C01	Understand the DSP architecture and computational accuracies in DSP implementation with other processors.				Cognitive	Understanding		
C02	Understand and remember the TMS 320C 54XX DSP processors				Cognitive	Understanding, Remembering		
C03	Select the TMS 320C 54XX DSP processors for implementation of DSP algorithms				Cognitive	Applying		
C04	Understand the Memory Space Organization of TMS 320C 54XX DSP processors				Cognitive	Understanding		
C05	Apply different interfacing techniques with various I/O peripherals, design and analyze a product on DSP based application using MATLAB DSP toolbox				Cognitive	Applying, Create, Analyzing		
UNIT I - ARCHITECTURES FOR PROGRAMMABLE DIGITAL SIGNAL-PROCESSORS:								9
Introduction- Basic Architectural Features: DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Features for External Interfacing.								
UNIT II - PROGRAMMABLE DIGITAL SIGNAL PROCESSORS:								9
Introduction-Commercial digital Signal-processing Devices: Data Addressing Modes of TMS320C54xx., Memory Space of TMS320C54xx Processors, Program Control, Detail Study of TMS320C54X & 54xx Instructions and Programming, On-Chip peripherals, Interrupts of TMS320C54XX Processors, Pipeline Operation of TMS320C54xx Processor.								
UNIT III - IMPLEMENTATION OF BASIC DSP ALGORITHMS:								9
Introduction -The Q-notation FIR Filters, IIR Filters: Interpolation and Decimation Filters (one example in each case). Introduction, An FFT Algorithm for DFT Computation, Overflow and Scaling, Bit-Reversed Index Generation & Implementation on the TMS320C54xx.								
UNIT IV -INTERFACING MEMORY TO DSP DEVICES:								9
Introduction- Memory Space Organization: External Bus Interfacing Signals. Memory Interface, Parallel I/O Interface, Programmed I/O, Interrupts and I / O Direct Memory Access (DMA).								
UNIT V -INTERFACING PARALLEL I/O PERIPHERALS TO DSP DEVICES:								9
Introduction, Synchronous Serial Interface, A CODEC Interface Circuit. DSP Based Bio-telemetry Receiver, A Speech Processing System, An Image Processing System.								
					LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS					45	0	0	45
TEXT BOOKS								
1. Avatar Singh and Srinivasan.S “Digital Signal Processing”, Thomson Learning, 2004. 2. Phil Lapsley, Jeff Bier, Amit Shoham, Edward A. Lee, “DSP Processor Fundamentals Architectures & Features”, IEEE Press , 1997.								

REFERENCES

1. E. C. Feachor and B.W.Jervis, "Digital Signal Processing: A Practical Approach", Pearson Education, 2002
2. Jonatham Stein, "Digital Signal Processing", 1st Edition, Wiley-Interscience, 2000.
3. B.Venkataramani and M.Bhaskar, "Digital Signal Processors", TMH, 2002.
4. Peter Pirsch, "Architectures for Digital Signal Processing", John Wiley & Sons, 2007.

E-REFERENCES

1. <http://freevideolectures.com/Course/2317/Digital-Signal-Processing-IIT-Delhi>
2. <http://nptel.ac.in/courses/117102060/>
3. <https://www.conted.ox.ac.uk/H600-24>
4. <https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-0>
5. <http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/>
6. https://eeweb.ee.ucla.edu/course_objectives.php?class=ee113

Mapping of COs with POs:

	P O 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	3	2										1		
CO 2	2	3		2	1							1		
CO 3	2	2			3	2						1		
CO 4	1	2	3	2	1	2						1		
CO 5	1	2		2	3	2	1			1		1		
Total	9	11	3	6	8	6	1			1		5		
Scaled	2	3	2	2	2	2	1			1		1		

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

COURSE CODE			XEC704B			L	T	P	C
COURSE NAME			DIGITAL IMAGE PROCESSING			3	0	0	3
PREREQUISITES			XEC504			L	T	P	H
C	P	A				3	0	0	3
3	0	0							
COURSE OUTCOMES						Domain		Level	
C01	Outline and classify basic principles of digital image processing and transforms.					Cognitive		Remembering, Understanding	
C02	Describe, categorise and manipulate images in spatial and frequency domain.					Cognitive		Remembering, Understanding , Analyzing	
C03	Illustrate and determine restoration of images and colour image processing.					Cognitive		Understanding , Evaluate	
C04	Classify and explain image segmentation techniques.					Cognitive		Understanding , Applying	
C05	Distinguish and describe image compression techniques and image descriptors.					Cognitive		Understanding , Remembering	
UNIT I - DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS									9
Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Vidicon camera tube, Digital Camera, Elements of Visual Perception, Image sampling and Quantization, Basic Relationship Between Pixels, Basic geometric transformations. One dimensional and two dimensional Fourier Transform and Discrete Fourier Transform two dimensional Fourier Transform, Properties of Fourier Transform.									
UNIT II -IMAGE ENHANCEMENT METHODS									9
Image Enhancement : Spatial Domain methods, Basic grey level transformation, Histogram processing, Noise models, Image enhancement using arithmetic/ logic operations, Image Subtraction, Image Averaging, Spatial filtering: Smoothing by spatial filtering, Sharpening by spatial filtering, Median filter, Mean filter, Frequency domain filtering and Homomorphic filtering.									
UNIT III - IMAGE RESTORATION COLOR IMAGE PROCESSING									9
Image Restoration : Model of Image Degradation/Restoration Process, Estimating the Degradation function, Inverse filtering, Least Mean Square filtering, Constrained Least Mean Square Filtering, Geometric transformation Colour image processing : Fundamentals, Colour models, Dither- Quantization and Colour image enhancement.									
UNIT IV - IMAGE SEGMENTATION									9
Introduction: Image segmentation, Detection of discontinuities, Point detection, Line detection, Edge Detection, Thres holding, Region Based segmentation, Region growing, Region splitting and merging, Morphological operations, Segmentation by morphological water sheds, Markers									
UNIT V- IMAGE COMPRESSION AND IMAGE DESCRIPTORS									9
Need of data compression, Image Compression Models, Lossless compression: Variable length coding, Huffman coding, Arithmetic coding, LZW coding, Bit plane coding, Lossless predictive coding, Lossy predictive coding, Transform coding, Wavelet coding, Image compression standards : JPEG, MPEG., Boundary representation, Image descriptors : Boundary descriptors and Regional descriptors.									
						LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS						45	0	0	45

TEXT BOOKS														
1. Rafael C. Gonzalez, Richard E.Woods, "Digital Image Processing", 3 rd Edition, Pearson Education, 2007.														
REFERENCES														
1. S.Jayaraman, T.Veerakumar, S.Esakirajan, "Digital Image Processing", Tata McGrawHill, 2013.														
2. Rafael C. Gonzalez, Richard E.Woods, Steven L.Eddins, "Digital Image Processing using MATLAB", 2 nd Edition, Gatesmark Publishing, 2010.														
3. Anil .K.Jain, "Fundamentals of Digital Image Processing", PHI, New Delhi, 2007.														
4. William K Pratt, "Digital Image Processing", 3 rd Edition, John Wiley & Sons, 2001.														
5. Majumdar, "Digital Image Processing and Analysis", Prentice Hall of India, 2003.														
6. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and Machine Vision", 4 th Edition, Cengage Learning, 2013.														
7. B.Chanda, Dutta Majumder, "Digital Image Processing and Analysis ", Prentice Hall of India, 2006.														
E- REFERENCES														
1. http://nptel.ac.in/courses/117105079/# (Prof .P. K. Biswas Department of Electronics and Electrical Communication Engineering Indian Institute of Technology, Kharagpur)														

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2		2	1	1						1		
CO 2	2	3		2	2	1			1	1		2		
CO 3	3	3		2	2	1			1	1		2		
CO 4	3	2		3	2	1			1	1		2		
CO 5	3	3		2	1	1						2		
Total	14	13		11	8	5			3	3		9		
Scaled value	3	3		2	2	1			1	1		2		

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

COURSE CODE			XEC704C		L	T	P	C
COURSE NAME			ADVANCED MICROPROCESSORS AND MICROCONTROLLERS		3	0	0	3
PREREQUISITES			XEC604		L	T	P	H
C	P	A	3:0:0		3	0	0	3
3	0	0						
COURSE OUTCOMES					Domain	Level		
C01	Outline and relate the concepts of High Performance CISC(PENTIUM) Architecture.				Cognitive	Remembering, Analyzing		
C02	Discuss and explain the concepts of RISC (ARM) processor design .				Cognitive	Understanding		
C03	Use and develop the assembly language programming in the ARM based systems.				Cognitive	Applying, Create		
C04	Outline and relate the concepts of Motorola 68HC11Microcontrollers.				Cognitive	Remembering, Analyzing		
C05	Outline and explain the concepts of PIC Microcontroller.				Cognitive	Remembering, Understanding		
UNIT I - HIGH PERFORMANCE CISC ARCHITECTURE –PENTIUM :								9
CPU Architecture- Bus Operations – Pipelining – Branch predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.								
UNIT II - HIGH PERFORMANCE RISC ARCHITECTURE – ARM:								9
Arcon RISC Machine – Architectural Inheritance – Core & Architectures – Registers – Pipeline – Interrupts – ARM organization – ARM processor family – Co-processors – ARM instruction set-Thumb Instruction set – Instruction cycle timings – The ARM Programmer’s model – ARM Development tools – ARM Assembly Language Programming – C programming – Optimizing ARM Assembly Code – Optimized Primitives								
UNIT III - ARM APPLICATION DEVELOPMENT:								9
Introduction to DSP on ARM –FIR filter – IIR filter – Discrete Fourier transform – Exception handling – Interrupts – Interrupt handling schemes- Firmware and boot loader – Embedded Operating systems – Integrated Development Environment- STDIO Libraries – Peripheral Interface – Application of ARM Processor – Caches – Memory protection Units – Memory Management units – Future ARM Technologies								
UNIT IV - MOTOROLA 68HC11 MICROCONTROLLERS:								9
Instruction set – addressing modes – operating modes- Interrupt system- RTC-Serial Communication Interface – A/D Converter PWM and UART.								
UNIT V - PIC MICROCONTROLLER								9
CPU Architecture – Instruction set – interrupts- Timers- I2C Interfacing –UART- A/D Converter – PWM and introduction to C-Compilers.								
			LECTURE	TUTORIAL	PRACTICAL	TOTAL		
HOURS			45	0	0	45		
TEXT BOOKS								
1. Andrew N.Sloss, Dominic Symes and Chris Wright, “ARM System Developer’s Guide : Designing and Optimizing System Software”, 1 st Edition, Morgan Kaufmann Publishers, 2004.								
2. WilliamHohl, Christopher Hinds, “ARM Assembly Language, Fundamentals and Techniques” 2 nd Edition, CRC Press,2015.								

REFERENCES

1. Andrew N.Sloss, Dominic Symes, ChrisWright, "ARM System Developer's Guide" 1st Edition, Morgan Kaufmann, 2004.
2. Steve Furber, "ARM System-on-Chip Architecture" 2nd Edition, Pearson Education, 2001.
3. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, Janice Mazidi "ARM Assembly Language Programming & Architecture" 1st Edition, Kindle Edition, 2014.
4. Steve Furber, "ARM System –on –Chip Architecture", Addison Wesley, 2000.
5. Daniel Tabak, "Advanced Microprocessors", McGraw Hill, 1995.
6. James L.Antonakos, "The Pentium Microprocessor", Pearson Education, 1997.
7. Gene H.Miller, "Micro Computer Engineering", Pearson Education, 2003.
8. John B.Peatman, "Design with PIC Microcontroller", Prentice Hall, 1997.

E - REFERENCES

1. <http://cie-wc.edu/Microprocessor-7-19-2011.pdf?pdf=Microprocessor>
2. <http://slogix.in/ap7103-advanced-microprocessor-and-microcontroller-subject-materials/index.html>
3. https://www.arm.com/files/pdf/ARM_Arch_A8.pdf
4. <http://www.freescale.com/tools/software-and-tools/hardware-development-tools/freedom-developmentboards:FREDEVPLA>

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	3		2	1	1	1					1		
CO 2	2	2		2	2	1	1					1		
CO 3	3	3		3	2	2	2			1		1		
CO 4	3	3		2	3	1	1			1		1		
CO 5	3	3		3	2	2	2			1		1		
Total	14	14		12	10	7	7			3		5		
Scaled value	3	3		3	3	1	1			1		1		

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

COURSE CODE			XEC705A			L	T	P	C
COURSE NAME			DISASTER MANAGEMENT			3	0	0	3
PREREQUISITES						L	T	P	H
C	P	A	2.75:0:0.25			3	0	0	3
2.75	0	0.25							
COURSE OUTCOMES					Domain	Level			
CO1		Understand and Recognize the concepts of disaster			Cognitive	Understanding, Remembering			
CO2		Recognize and describe the causes and effects of disaster			Cognitive	Understanding, Remembering			
CO3		Describe the various approaches of risk reduction			Cognitive	Remembering			
CO4		Demonstrate the inter-relationship between disaster and development			Cognitive	Understanding			
CO5		Discuss hazard and vulnerability profile of India and respond to drills related to relief			Cognitive Affective	Remembering Response			
UNIT I -INTRODUCTION TO DISASTERS									6
Concepts and definitions- Disaster, Hazard, Vulnerability, Resilience, Risks									
UNIT II-DISASTERS: CLASSIFICATION, CAUSES, IMPACTS									12
Differential impacts- in terms of caste, class, gender, age, location, disability Global trends in disasters, urban disasters, pandemics, complex emergencies, Climate change									
UNIT III -APPROACHES TO DISASTER RISK REDUCTION									10
Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders.									
UNIT IV- INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT									6
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources									
UNIT V-DISASTER RISK MANAGEMENT IN INDIA									11
Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation).									
The project / fieldwork to understand vulnerabilities, work on reduction of disaster risk and build a cultural safety.									
					LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS					45	0	0	45	

TEXT BOOKS												
1. Coppola P Damon, "Introduction to International Disaster Management, Butterworth-Heinemann, 2015 2. K. N. Shastri, "Disaster Management in India", Pinnacle Technology, 2012 3. Gupta Anil K, Sreeja S. Nair, "Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011 4. Lee Allyn Davis, "Natural Disasters", Infobase Publishing, 2010 5. Andharia J, "Vulnerability in Disaster Discourse", JTCDM, Tata Institute of Social Sciences Working Paper no. 8, 2008												
REFERENCES												
1. Alexander David, Introduction in 'Confronting Catastrophe', Oxford University Press, 2000 2. Carter, Nick 1991. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.												
E- REFEEENCES												
1. NIDM Publications at http://nidm.gov.in- Official Website of National 2. Institute of Disaster Management (NIDM), Ministry of Home Affairs, 3. http://cwc.gov.in , http://ekdrm.net , http://www.emdat.be , 4. http://www.nws.noaa.gov , http://pubs.usgs.gov , http://nidm.gov.in 5. http://www.imd.gov.in												

Table 1: Mapping of CO with GA												
Course outcomes	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
C01	1					3	2	1				1
C02	1					3	2	1				1
C03	1					3	2	1				1
C04	1					3	2	1				1
C05	1					3	2	1				1
Total	5					15	10	5				5
Scaled	1					3	2	1				1

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

COURSE CODE			XEC705B			L	T	P	C
COURSE NAME			WIRELESS COMMUNICATION SYSTEMS			3	0	0	3
PREREQUISITES			XEC404,XEC602			L	T	P	H
C	P	A				3	0	0	3
3	0	0							
COURSE OUTCOMES						Domain		Level	
C01	<i>Describe</i> various modern wireless communications systems deployments.					Cognitive		Remembering	
C02	<i>Describe</i> and <i>explain</i> cellular engineering concepts and working principles.					Cognitive		Remembering, Understanding	
C03	<i>Describe</i> free space propagation of EM waves.					Cognitive		Remembering	
C04	<i>Distinguish</i> and <i>explain</i> various Multipath effects and fading in wireless communication					Cognitive		Understanding	
C05	<i>Describe</i> multiple input multiple output systems for wireless communication					Cognitive		Remembering	
UNIT I - MODERN WIRELESS COMMUNICATION SYSTEMS									9
Evolution of Mobile Radio Communications -Present Day Mobile Communication - Fundamental Techniques -Radio Transmission Techniques - Cellular Concept -Operational Channels - Making a Call - Future Trends -First Generation Networks 2G: Second Generation Networks - TDMA/FDD Standards -CDMA/FDD Standard -2.5G Mobile Networks - Third Generation Networks -3G Standards and Access Technologies -3G W-CDMA (UMTS) -3G CDMA2000 3G TD-SCDMA- Wireless Transmission Protocols - Wireless Local Loop (WLL) and LMDS –Bluetooth- Wireless Local Area Networks (W-LAN) WiMax - Zigbee -Wibree Beyond 3G Networks									
UNIT IITHE CELLULAR ENGINEERING FUNDAMENTALS									9
Cellular Structure- Frequency Reuse Channel Assignment Strategies - Fixed Channel Assignment (FCA)- Dynamic Channel Assignment (DCA) -Handoff Process Factors Influencing Handoffs Handoffs In Different Generations- Handoff Priority A Few Practical Problems in Handoff Scenario - Interference & System Capacity Co-channel interference (CCI) -Adjacent Channel Interference (ACI) -Enhancing Capacity And Cell Coverage - The Key Trade-off Cell-Splitting Sectoring- Microcell Zone Concept -Trunked Radio System									
UNIT IIIFREE SPACE RADIO WAVE PROPAGATION									9
Free Space Propagation Model -Basic Methods of Propagation Reflection- Diffraction Scattering- Two Ray Reflection Model - Diffraction Knife-Edge -Diffraction Geometry - Fresnel Zones: the Concept of Diffraction Loss -Knife-edge diffraction model- Link Budget Analysis Log-distance Path Loss Model- Log Normal Shadowing -Outdoor Propagation Models- Okumura Model - Hata Model - Indoor Propagation Models - Partition Losses Inside a Floor (Intra-floor) - Partition Losses Between Floors (Inter-floor) - Log-distance Path Loss Model									
UNIT IVMULTIPATH WAVE PROPAGATION AND FADING									9
Multipath Propagation Multipath & Small-Scale Fading -Multipath Fading -Effects -Factors Influencing Fading -Types of Small-Scale Fading Fading- Effects due to Multipath Time Delay Spread - Fading Effects due to Doppler Spread- Doppler Shift Impulse Response Model of a Multipath Channel Relation Between Bandwidth and Received Power - Linear Time Varying Channels (LTV)Small-Scale Multipath Measurements - Multipath Channel Parameters- Time Dispersion Parameters -Frequency Dispersion Parameters - Statistical models for multipath propagation NLoS Propagation: Rayleigh Fading Model - LoS Propagation: Rician Fading Model Generalized Model: Nakagami Distribution - Second Order Statistics									

UNIT V- DIVERSITY AND MIMO SCHEMES				9
Diversity, Time diversity Repetition coding, Time diversity coded design criterion, Time diversity in GSM. Antenna diversity-Receive diversity Transmit diversity, space-time codes MIMO, MIMO schemes Frequency diversity- Multiplexing capability of deterministic MIMO channels- Capacity via singular value decomposition- Physical modeling of MIMO channels- Modeling of MIMO fading channels- MIMO II: capacity and multiplexing architectures- The V-BLAST architecture, Fast fading MIMO channel- Receiver architectures.				
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
	45	0	0	45
TEXT BOOKS				
David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005. Dr. Abhijit Mitra, "Lecture Notes on Mobile Communication", A Curriculum Development Cell Project Under QIP, IIT Guwahati, Department of Electronics and Communication Engineering, Indian Institute of Technology Guwahati, Guwahati – 781039, India, November 2009 Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005. Andreas F. Molisch, "Wireless Communications", Wiley - IEEE, 2011.				
REFERENCES				
T.S. Rappaport, "Wireless Communication", Pearson Education, 2002.				
E REFERENCES				
http://nptel.ac.in/courses/117102062/ (Prof. Dr. Ranjan Bose, "Wireless Communications" Department of Electrical Engineering Indian Institute of Technology, Delhi)				

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	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	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			XEC705C		L	T	P	C
COURSE NAME			RADAR AND NAVIGATIONAL AIDS		3	0	0	3
PREREQUISITES			XEC404,XEC603		L	T	P	H
C	P	A			3	0	0	3
3	0	0						
COURSE OUTCOMES					Domain		Level	
C01	Describe the basics of radar and analyze its operation with equations.				Cognitive		Remembering, Analyzing	
C02	Explain the moving target identification process by different types of radars and describe tracking.				Cognitive		Understanding, Remembering	
C03	Categorize detectors using radars and describe various antennas, transmitters and receivers associated with radars.				Cognitive		Analyzing Remembering	
C04	Classify , discuss direction finding methods using radar and various equipment available for direction finding.				Cognitive		Remembering, Understanding	
C05	Describedistance measuring, landing system and Doppler Navigation.				Cognitive		Remembering	
UNIT I -INTRODUCTION TO RADAR								9
Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar. The Radar Equation: Introduction- Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters-System losses – Other Radar Equation Considerations								
UNIT II - MTI AND PULSE DOPPLER RADAR								9
Introduction to Doppler and MTI Radar- Delay –Line Cancelers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) - Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics -Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).								
UNIT III – SIGNAL PROPAGATION, NOISE AND RADAR SUBSYSTEMS								9
Introduction – Matched –Filter Receiver –Detection Criteria – Detectors --Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters - Frequency-Scan Arrays Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources - Other aspects of Radar Transmitter. Radar Receivers - The Radar Receiver - Receiver noise Figure - Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.								
UNIT IV - INTRODUCTION TO FOUR METHODS OF NAVIGATION								9
Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction								

Finding at Very High Frequencies - Automatic Direction Finders - The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Recent Developments .Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System				
UNIT V -ADVANCED NAVIGATION				9
DME and TACAN - Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment. Aids to Approach and Landing - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS).Doppler Navigation - The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems. Inertial Navigation - Principles of Operation - Navigation Over the Earth - Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems. Satellite Navigation System - The Transit System – Navstar, Global Positioning System (GPS) .				
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	0	0	45
TEXT BOOKS				
1. Merrill I. Skolnik , “Introduction to Radar Systems”, 3 rd Edition, Tata McGraw-Hill,2003. 2. Linda Williams, “Navigational Aids”, Marshall Cavendish, 2007.				
REFERENCES				
1. Peyton Z. Peebles:, “Radar Principles”, John Wiley, 2004. 2. J.C.Toomey, “Principles of Radar”, 2 nd Edition, Prentice Hall of India, 2004.				
E-REFERENCES				
1. https://books.google.com/books?isbn=8126515279 2. http://www.scribd.com/doc/24536892/Radio-Navigation-Aids-Presentation-2-Nav aids-Radar 3. www.nd.edu/~ndpi/current/lessons/Navigationl.ppt . 4. http://www.sailingusa.info/basic_navigation.htm 5. http://www.slideshare.net/J.T.A.JONES/navigation				

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		1								1		
CO 2	3	1		1								1		
CO 3	2	3										2		1
CO 4	3	2		1								2		1
CO 5	3	2		1								1		1
Total	14	11		4								7		3
Scaled value	3	3		1								2		1

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

COURSE CODE			XEC802A		L	T	P	C
COURSE NAME			OPTICAL NETWORKS		3	0	0	3
PREREQUISITES			XEC703		L	T	P	H
C	P	A			3	0	0	3
3	0	0						
COURSE OUTCOMES					Domain		Level	
CO1	Describe and explain the optical network components.				Cognitive		Remembering, Understanding	
CO2	Understand and explain the client layers of optical layer.				Cognitive		Understanding, Applying	
CO3	Outline and summarize the optical network architectures.				Cognitive		Remembering, Understanding	
CO4	Discuss the survivability aspects of optical networks				Cognitive		Understanding	
CO5	Understand the design aspects of WDM networks.				Cognitive		Understanding	
UNIT I - OPTICAL NETWORK COMPONENTS								9
Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength Converters.								
UNIT II - CLIENT LAYERS OF OPTICAL LAYER								9
SONET/SDH, Optical Transport Network, Generic Framing Procedure, Ethernet, IP, Multiprotocol Label Switching.								
UNIT III - OPTICAL NETWORK ARCHITECTURES								9
WDM network elements, Metropolitan-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Test beds for Broadcast & Select WDM; Wavelength Routing Architecture.								
UNIT IV - NETWORK SURVIVABILITY								9
Protection in SONET/SDH, Protection in client layer, Optical layer protection schemes, Interworking between layers.								
UNIT V- WDM NETWORK DESIGN								9
LTD and RWA problems, Dimensioning Wavelength Routing Networks, Statistical Dimensioning models, Maximum load dimensioning models.								
				LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS				45	0	0	45	
TEXT BOOKS								
1. Rajiv Ramaswami, Kumar N. Sivarajan, Galen H.Sasaki, “Optical Networks : A Practical Perspective”, 3 rd Edition, Morgan Kaufmann, 2011.								
REFERENCES								
1. R.Ramaswami and K.Sivarajan, “Optical Networks”, 2 nd Edition, Morgan Kaufmann, 2002.								
2. Martin and Maier, “Optical Switching Networks”, Cambridge University Press, 2008.								
3. C. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks : Concept, Design and Algorithms”, 1 st Edition, Prentice Hall of India, 2002.								
4. P.E. Green, “Fiber Optic Networks”, Prentice Hall, 1993.								
E-REFERENCES								
1. http://www.pdf-search-engine.com/optical-networking-pdf.html								
2. http://www.networktutorials.info/networkhowto/what_is_optical_networking.html								

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
CO 1	2	2	1	1	2							1	2	
CO 2	2	2	1	1	2							1	2	
CO 3	2	2	1	1	2							1	2	
CO 4	2	2	1	1	2							1	2	
CO 5	2	2	1	1	2							1	2	
Total	10	10	5	5	10							5	10	
Scaled value	2	2	1	1	2							1	2	

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

COURSE CODE			XEC802B	L	T	P	C
COURSE NAME			WIRELESS NETWORKS	3	0	0	3
PREREQUISITES			XEC404,XEC602	L	T	P	H
C	P	A		3	0	0	3
3	0	0					
COURSE OUTCOMES				Domain		Level	
CO1	Describe and compare various Multiple Radio Access			Cognitive		Remembering, Evaluate	
CO2	Describe Wide Area Networks.			Cognitive		Remembering	
CO3	Define and explain various Wireless LAN standards			Cognitive		Remembering, Understanding	
CO4	Describe wireless MAN and PAN.			Cognitive		Remembering,	
CO5	Explain the features of 4G and 5G networks			Cognitive		Understanding	
UNIT I - MULTIPLE RADIO ACCESS							9
Medium Access Alternatives: Fixed-Assignment for Voice Oriented Networks Random Access for Data Oriented Networks, Handoff and Roaming Support, Security and Privacy.							
UNIT II - WIRELESS WANS							9
First Generation Analog, Second Generation TDMA – GSM, Short Messaging Service in GSM, Second Generation CDMA – IS-95, GPRS - Third Generation Systems (WCDMA/CDMA 2000)							
UNIT III- WIRELESS LANS							9
Introduction to wireless LANs - IEEE 802.11 WLAN – Architecture and Services, Physical Layer- MAC sublayer- MAC Management Sublayer, Other IEEE 802.11 standards, HIPERLAN, WiMax standard.							
UNIT IV- WIRELESS MANS AND PANS							9
Wireless MANs – Physical and MAC layer details, Wireless PANs – Architecture of Bluetooth Systems, Physical and MAC layer details, Standards.							
UNIT V - 4G NETWORKS							9
LTE -Network Architecture and Interfaces -FDD Air Interface and Radio Networks –Scheduling –Mobility Management and Power Optimization –LTE Security Architecture –Interconnection with UMTS and GSM –LTE Advanced (3GPPP Release 10) -4G Networks and Composite Radio Environment –Protocol Boosters –Hybrid 4G Wireless Networks Protocols –Green Wireless Networks –Physical Layer and Multiple Accesses –Channel Modeling for 4G–Introduction to 5G							
			LECTURE	TUTORIAL	PRACTICAL	TOTAL	
HOURS			45	0	0	45	
TEXT BOOKS							
1. William Stallings, “Wireless Communications and networks”, 2 nd Edition, Pearson / Prentice Hall of India, 2007.							
2. Dharma Prakash Agrawal and Qing-An Zeng, “Introduction to Wireless and Mobile Systems”, 2 nd Edition, Thomson India Edition, 2007.							
3. Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband", Wiley, 2014							
4. Savo G Glisic, “Advanced Wireless Networks –4G Technologies”, John Wiley & Sons, 2007							

REFERENCES BOOKS

1. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.
2. Kaveth Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", Pearson Education Asia, 2002.
3. Gary. S. Rogers and John Edwards, "An Introduction to Wireless Technology", Pearson Education, 2007.
4. Clint Smith, P.E. and Daniel Collins, "3G Wireless Networks", 2nd Edition, Tata McGraw Hill, 2007.
5. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", Wiley, 2015.

E REFERENCES

1. <http://www.ed2go.com/online-courses/wireless-networking>
2. <https://www.cbttuggets.com/it-training/network-administration-engineering/wireless-networking>

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	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								2		6	10	15
Scaled	1	3								1		2	2	3

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

COURSE CODE			XEC802C	L	T	P	C
COURSE NAME			TELEVISION AND VIDEO ENGINEERING	3	0	0	3
PREREQUISITES			XEC302,XEC404	L	T	P	H
C	P	A		3	0	0	3
3	0	0					
COURSE OUTCOMES				Domain	Level		
CO1	<i>Outline</i> composite video signal , <i>describe</i> and <i>classify</i> camera tubes			Cognitive	Remembering, Understanding		
CO2	<i>Describe</i> the operation of various sections of Monochrome TV transmitter and receiver.			Cognitive	Remembering		
CO3	<i>Understand</i> the operation of different types of colour Television systems			Cognitive	Understanding		
CO4	<i>Illustrate</i> the advanced Television systems and display device technologies.			Cognitive	Analyzing		
CO5	<i>Express</i> the concepts of digital video processing			Cognitive	Understanding		
UNIT I - TELEVISION FUNDAMENTALS							9
Aspect ratio-Image continuity-Number of scanning lines-Interlaced scanning- Picture resolution – Camer tubes - Image Orthicon –Vidicon - Plumbicon- Silicon Diode Array Vidicon- Solidstate Image scanners- Monochrome picture tubes- Composite video signal- video signal dimension -horizontal sync. Composition-vertical sync. Details- Functions of vertical pulsetrain Scanning sequence details. Picture signal transmission- positive and negative modulation- VSB transmission- Sound signal transmission- Standard channel bandwidth.							
UNIT II - MONOCHROME TELEVISION TRANSMITTER AND RECEIVER							9
Principles of Monochrome Television Transmitter and Receiver systems. -TV transmitter- TV signal Propagation- Interference- TV Transmission Antennas- Monochrome TV receiver- RF tuner- UHF, VHF tuner-Digital tuning techniques-AFT-IF subsystems- AGC Noise cancellation-Video and Sound inter-carrier detection-Vision IF subsystem- DC re-insertion-Video amplifier circuits-Sync operation-typical sync processing circuits- Deflection current waveforms, Deflection oscillators- Frame deflection circuits- requirements- Line deflection circuits-EHT generation-Receiver antennas.							
UNIT III - ESSENTIALS OF COLOUR TELEVISION							9
Colour Characteristics-Chromaticity diagram-Colour Cameras - NTSC colour TV systems- SECAM system- PAL colour TV systems- Cancellation of phase errors-PAL-D Colour system- PAL coder-PAL-Decoder receiver-Chromo signal amplifier Separation of U and V signals- colour burst separation-Burst phase Discriminator-ACC amplifier-Reference Oscillator- Ident and colour killer circuits-U and V demodulators- Colour signal matrixing- Sound in TV							
UNIT IV -ADVANCED TELEVISION SYSTEMS AND DISPLAY DEVICE TECHNOLOGIES							9
High Definition TV, DVD, Blue Ray, Hard Drives, IPTV (Web TV), On Demand Services, Multimedia Broadcasting, Mobile TV, Video Display Devices, Plasma vs. LCD, and DLP. Satellite TV technology-Geo Stationary Satellites-Satellite Electronics-Domestic Broadcast System- Cable TV-Cable Signal Sources-Cable Signal Processing, Distribution & Scrambling- Video Recording-VCR Electronics-Video Home Formats- Video Disc recording and playback-DVD Players-Tele Text Signal coding and broadcast receiver- Digital television-Transmission and reception –Projection television- flat panel display TV receivers -LCD and Plasma screen receivers-3DTV-EDTV.							

UNIT V - DIGITAL VIDEO PROCESSING				9
Digital and High Definition Television Principles of digital video broadcasting-Digitizing the TV picture-SDTV sampling rate-Video sampling-Sampling structure-The bit rate-HDTV common interface format-Intra-frame (spatial) prediction-Intra-blocks and modes-Size and mode selection-Intra-prediction operation-AVC motion compensation-Motion compensation block sizes-Motion vector prediction.				
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	0	0	45
TEXT BOOKS				
1. R.R.Gulati, "Monochrome Television Practice, Principles, Technology and Servicing", 3 rd Edition, New Age International (P) Publishers, 2006 2. K.F Ibrahim, "Television and Video Technology", 4 th Edition, Newness Publications, 2007. 3. M.Dhake, "Television and Video Engineering", 2 nd Edition, Tata McGraw Hill, 2003.				
REFERENCES				
1. Herve Benoit, "Digital TV for Satellite Broadcasting", 4 th Edition, Elsevier Publication, 2005. 2. Lars Ingemar Lundstrom, "Understanding Digital Television: An introduction to DVB systems with satellite, cable, broadband and terrestrial TV distribution", 1 st Edition, Elsevier Publications, 2006. 3. R.P.Bali, "Color Television, Theory and Practice", Tata McGraw-Hill, 1994. 4. R.R.Gulati, "Modern Television Practice: Transmission, Reception and Application", 5 th Edition, New Age International Publishers, 2015.				
E-REFERENCES				
1. http://textofvideo.nptel.iitm.ac.in/106106090/lec3.pdf 2. http://happy.emu.id.au/lab/lectures/uoc/uocdtv1/				

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS
CO 1	3	1	1								1	2		
CO 2	3	1	1								1	2		
CO 3	3	1	1								1	2		
CO 4	3	1	1			1					1	2		
CO 5	3	1	1	1							1	2		
Total	15	5	5	1		1					5	10		
Scaled value	3	1	1	1		1					1	2		

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

COURSE CODE			XEC803A	L	T	P	C		
COURSE NAME			INTRODUCTION TO MEMS	3	0	0	3		
PREREQUISITES				L	T	P	H		
C	P	A	3:0:0	3	0	0	3		
3	0	0							
COURSE OUTCOMES				Domain		Level			
C01	Describe, classify MEMS and microsystems.			Cognitive		Remembering, Understanding			
C02	Describe and explain the materials for MEMS.			Cognitive		Remembering, Understanding			
C03	Describe and explain the Fabrication Processes.			Cognitive		Remembering, Understanding			
C04	Classify Micro manufacturing and understand the design principles of Microsystems.			Cognitive		Analyzing, Understanding			
C05	Describe, categorize Scaling laws and MEMS packaging.			Cognitive		Understanding, Analyzing			
UNIT I - OVERVIEW OF MEMS AND MICROSYSTEMS							9		
Introduction to MEMS, sensors, transducers, actuators, MEMS and Microsystems, Microsystems and microelectronics, Microsystems and miniaturization, application of micro system in automotive industry, Working principle of- Micro sensors, Micro actuators, MEMS with Micro actuators, Micro accelerometers.									
UNIT II - MATERIALS FOR MEMS							9		
Substrate and wafer, silicon as a substrate material, silicon compound, silicon Piezo- resistors, Gallium Arsenide, quartz, Piezoelectric crystals, polymers and packaging Materials. Clean room lab techniques: clean rooms, gowning procedures; safety, fire, toxicity; acids and bases.									
UNIT III - FABRICATION PROCESS							9		
Photolithography, Ion implantation, Diffusion, Oxidation, Chemical vapor deposition (CVD), Physical vapor deposition (PVD)-sputtering, Deposition by Epitaxy, Etching.									
UNIT IV-MICROMANUFACTURING AND MICROSYSTEM DESIGN							9		
Manufacturing Process: Bulk Micromachining, Surface Micromachining, LIGA Process. Microsystem Design: Design considerations, Process Design, Design of a Silicon Die for micro pressure sensor, Computer Aided Design.									
UNIT V - SCALING LAWS AND MEMS ASSEMBLY							9		
Scaling Laws: Scaling in Geometry, Electrostatic forces, Electromagnetic forces, Electricity, Heat transfer-conduction, convection. MEMS Packaging and Assembly: Overview of mechanical packaging of microelectronics, Microsystem Packaging, Interfaces in Microsystem Packaging, Essential Packaging technologies, 3D packaging, Assembly of Microsystems, Selection of packaging materials, Signal Mapping and Transduction, Design case: Pressure sensor Packaging.									
		LECTURE		TUTORIAL		PRACTICAL		TOTAL	
HOURS		45		0		0		45	

TEXT BOOKS
1. Tai-Ran Hsu, "MEMS and Microsystems Design and Manufacturing", Tata McGraw Hill, 2002. 2. Hector J. De Los Santos, "RF MEMS Circuit Design for wireless communication", Artech House Micromechanical Systems (MEMS) Series, 2002. 3. Vijay K.Varadan, K.J.Vinoy, K.A.Jose "RF MEMS and Their Applications", John Wiley & Sons Ltd, 2003.
REFERENCES
1. Julian W Gardner, "Microsensors MEMS and Smart Devices", John Wiley and Sons, 2001. 2. Chang Liu, "Foundation of MEMS", Pearson International Edition, 2006. 3. Gabriel M Rebeiz, "RF MEMS - Theory Design and Technology", John Wiley and Sons, 2003.
E-REFERENCES
1. http://nptel.ac.in/courses/117105082/# (Prof. Santiram Kal, "MEMS & Microsystems, NPTEL online courses", Department of Electronics & Electrical Communication Engineering, Indian Institute of Technology, Kharagpur) 2. http://freevidelectures.com/Course/2956/Introduction-to-MEMS-Design-Fall-2011# (Prof. Clark Tu-Cuong Nguyen, "Introduction to MEMS Design,UC Berkeley Course online courses", Department of Electrical Engineering, UC Berkeley)

Mapping of COs with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS 01	PS02
CO 1	3	2	3		2	1	1				1	1		1
CO 2	3	1			2	1						1		
CO 3	2				1							1		
CO 4	2	1			2							1		
CO 5	2	3	1		2	2	1				1	1		1
Total	12	7	4		9	4	2				2	5		2
Scaled	3	2	1		2	2	1				1	1		1

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

COURSE CODE			XEC803B		L	T	P	C
COURSE NAME			INTERNET OF THINGS		3	0	0	3
PREREQUISITES					L	T	P	H
C	P	A			3	0	0	3
3	0	0						
COURSE OUTCOMES					Domain	Level		
C01	Describe Internet of Thins (IoT) and explain various IoT related technologies				Cognitive	Remembering, Understanding		
C02	Describe resource management in IoT.				Cognitive	Remembering		
C03	Describe and distinguish various the architecture, platforms, services of IoT.				Cognitive	Remembering, Understanding		
C04	Explain how IoT can be integrated to IP				Cognitive	Understanding		
C05	Describe various IoT applications				Cognitive	Remembering		
UNIT I - INTRODUCTION AND ENABLING TECHNOLOGIES IN IOT								9
IoT, Machine to Machine, Web of Things, Definition- Major components if IoT devices-Control Units-Sensors-Communication Modules-Power Sources Vision- Characteristics - Layered Architecture- Landscape-- IoT Functional View-IoT related Internet Technology-cloud computing-Networks and Communications related to IoT-Processes related to IoT-Data Management related to IoT-Security Privacy and Trust-Devices level energy issues-Standards related to IoT								
UNIT II-RESOURCE MANAGEMENT IN THE INTERNET OF THINGS								9
Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object – Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects								
UNIT III- THE ARCHITECTURE, PLATFORMS, SERVICES								9
The Layering concepts , IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN, Platforms - IBM watson-Intel Platform- Carriot Platform- Webnms-deviceWISE								
UNIT IV- SCALABLE INTEGRATION FRAMEWORK								9
Introduction- IPV6 Potential- IoT6- IPV6 for IoT- Adapting IPV6 to IoT requirement- IoT6 architecture - DigCovery- IoT6 Integration with cloud and EPICS- Enabling Heterogeneous Integration- IoT6 Smart Office use case- Scalability perceptive.								
UNIT V- IOT APPLICATIONS								9
Smart Environments and Smart Space creation - Connected Devices illustration-Industrial IoT- IERC application Domains-SmartEnvironment Monitoring- Smart Energy - Smart building- Smart Transport and mobility-IoT Smart X applications								
					LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS					45	0	0	45
TEXT BOOKS								
Ovidiu Vermesan, Peter Friess, “Internet of Things- From Research and Innovation to market Deployment”, River Publishers, 2014.								
REFERENCES								
Arshdeep Bahga, Vijay Madisetti Internet of Things: A Hands-On Approach Hardcover –								

Madisetti Publishers, 2014
 Samuel Greengard, "The Internet of Things", MIT Press, 2015.

E REFERENCES

<http://postscales.com/internet-of-things-resources/>

Mapping of COs with POs:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	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	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			XEC803C			L	T	P	C
COURSE NAME			SOFTWARE DEFINED RADIO			3	0	0	3
PREREQUISITES			XEC404,XEC502,XEC703			L	T	P	H
C	P	A	3:0:0			3	0	0	3
3	0	0							
COURSE OUTCOMES						Domain		Level	
CO1		Describe and discuss system-level decisions for Software Defined Radio technology and products.				Cognitive		Remembering, Understanding	
CO2		Define and sketch the cognitive networks				Cognitive		Remembering, Applying	
CO3		Understand and develop different CR architectures models, point out its developmental issues and outline its hierarchy				Cognitive		Understanding, Create, Analyzing	
CO4		Understand and design the analog RF components as the front end block in the implementation of SDR				Cognitive		Understanding, Applying	
CO5		Select suitable method and construct the CR along with SDR Architecture.				Cognitive		Remembering, Create	
UNIT I - INTRODUCTION									9
Value of Spectrum, Spectrum Adaptively, Smart Antennas, MIMO, Spectrum Subleasing, Sharing, Local Statistics, Peaking Support, Spectrum Leasing, Spectrum Awareness Databases, Value of Concierge Services, Cognition.									
UNIT II - COGNITIVE NETWORKS									9
Introduction, Definition, Motivation and Requirements. A Simple Example: Foundations and Related Work Cognitive Radio Cross-layer Design. Recent Work: Implementation, User/Application/Resource Requirements, Cognitive Process, Software Adaptable Network.									
UNIT III - COGNITIVE RADIO ARCHITECTURE									9
Introduction, CRA I: Functions, Components and Design Rules, CRA II: The Cognition Cycle, CRA III: The Inference Hierarchy									
UNIT IV- SOFTWARE DEFINED RADIO BASICS									9
The Need for Software Radios. Characteristics and Benefits of a Software Radio – Design Principles of a Software Radio, The Purpose of the RF Front-End. Dynamic Range-The Principal Challenge of Receiver Design-RF Receiver Front-End Topologies- Enhanced Flexibility of the RF Chain with Software Radios-Importance of the Components to Overall Performance-Transmitter Architectures - Noise and Distortion in the RF Chain. ADC and DAC Distortion.									
UNIT V - SOFTWARE DEFINED RADIO ARCHITECTURES FOR COGNITIVE RADIOS									9
Introduction, Software Tunable analog Radio Components, Antenna Systems, Reconfigurable Digital Radio Technologies, Basic Digital Radio Components									
						LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS						45	0	0	45
TEXT BOOKS									
1. Jeffery H.Reed, “Software Radio-A Modern Approach to Radio Engineering”, PHI, 2002.									
2. Tony J. Roupheal, “RF and Digital Signal Processing for Software Defined Radio” Elesiver, 2009.									

REFERENCES	
1.	B.G.Golderg, "Digital Techniques in Frequency Synthesis", McGraw Hill, 1996.
2.	N.J.Fliege, "Multirate Signal Processing", John Wiley and Sons, 1994.
E-REFERENCES	
1.	https://www.researchgate.net/publication/262688697_SoftwareDefined_Radio_A_New_Paradigm_for_Integrated_Curriculum_Delivery
2.	file:///C:/Users/Administrator/Downloads/rtl-sdr.2.pdf
3.	https://media.blackhat.com/bh-dc-11/Perez-Pico/BlackHat_DC_2011_Perez-Pico_Mobile_Attacks-Slides.pdf
4.	http://www.digisatitalia.com/public/65352646_SDR_Guida_rapida.pdf
5.	http://www.digisatitalia.com/public/65352646_SDR_Guida_rapida.pdf
6.	http://darcverlag.de/mediafiles//Sonstiges/HackRF-Artikel1.pdf
7.	http://blog.alexandrecazaux.fr/wp-content/uploads/2012/08/TutorieldutilisationdunRTL2832UavecSDR-2.pdf

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS
CO 1	2	3												
CO 2	1	2		1	2	1						1	1	
CO 3	1	2		2	3	1						1		
CO 4	2	3	1	1	1							1		
CO 5	1	1	1	3	2	1						1	1	
Total	7	11	2	7	8	3						4	2	
Scaled value	2	3	1	2	2	1						1	1	

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

COURSE CODE			XECOE1		L	T	P	C
COURSE NAME			INDUSTRIAL ELECTRONICS		3	0	0	3
PREREQUISITES			XBE103,XPH104		L	T	P	H
C	P	A			3	0	0	3
3	0	0						
COURSE OUTCOMES					DOMAIN		LEVEL	
CO1	Describe and understand Power electronics devices				Cognitive	Remembering Understanding		
CO2	Explainandclassifyvarious convertors, inverters and choppers.				Cognitive	Remembering Understanding		
CO3	Describe and applyDC and AC industrial drives				Cognitive	Remembering Applying		
CO4	Explain and use industrial electronic circuits and integrated circuits				Cognitive	Remembering Applying		
CO5	Explain and understand other applications of electronics in industries				Cognitive	Remembering, Understanding		
UNIT I - POWER DEVICES								9
General purpose Diodes, Power diodes, Power transistors, SCR , triggering circuits, turning-off of a SCR, basics of Gate Turn Off thyristor, TRIAC and DIAC , Applications of TRIAC-DIAC circuit, Power MOSFET,IGBT,GTO and SCS								
UNIT II - CONVERTERS, INVERTER AND CHOPPER								9
Introduction to half wave, full wave and bridge rectifiers – Single phase and three phase Half controlled and fully controlled converters – Dual converters – Introduction to Cyclo converters and AC controllers, – Voltage Source Inverter (VSI) – Series and Parallel inverter – Bridge inverters – Current Source Inverter (CSI) – Choppers – Step up and step down choppers – Chopper classification – Class A,B, C, D, E – AC choppers								
UNIT III - DC AND AC INDUSTRIAL DRIVES								9
Review and comparison of Torque–speed characteristics of DC motors and AC induction motors. Basic principles of speed control of AC/DC motor, Basics of BLDC motor, Stepper motor, Servo Motor. Suitability of each motor for various industrial applications, Selection and sizing of motors for different applications , Applications for pumps, conveyors, machine tools etc								
UNIT IV - INDUSTRIAL ELECTRONIC CIRCUITS AND INTEGRATED CIRUITS								9
Review of Operational amplifiers and 555 Timer, Voltage follower (Buffer), Instrumentation Amplifier, Summing amplifier, Schmitt triggers Active first order filter: Low pass and high pass filter, Power Op Amps Optical Isolation amplifier, Digital counters , Registers, decoders and encoders, Multiplexer and Demultiplexer, Integrated circuits and logic families : Logic Levels, Noise Immunity, Fan Out, Power Dissipation, Propagation Delay								
UNIT V - OTHER INDUSTRIAL ELECTRICAL AND ELECTONIC DEVICES								9
Overview of generic Microprocessor, architecture and functional block diagram- Microprocessor controlled AC and DC Electrical Drives and Communication systems – Voltage regulators – Online and offline ups – Switched mode power supply – Principle and application of induction and dielectric heating								
					LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS					45	0	0	45

TEXT BOOKS														
1. Alok Jain, Power Electronics and Its Applications, Penram International Publishing (India) Pvt. Ltd., 2004, Second Edition. 2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II Edition, New Age, 2003. 3. Anil K. Maini, <i>Digital Electronics. Principles, Devices and Applications</i> . Defence Research and Development Organization (DRDO), India.														
REFERENCES														
1. M.H. Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third edition, New Delhi 2009. 2. P. S. Bimbra; Title of the Book: Power Electronics; Publisher: Khanna Publishers, New Delhi; Year: 2012; 5 th Edition: 3. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003. 4. Philip T.Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition 5. Ned Mohan, Tore M. Undeland, William P. Robbins, 'Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition, 2003. 6. Jain R.P., "Modern Digital Electronic" Tata McGraw Hill, 1984. 7. Fundamentals of Microcontrollers and Embedded System, Ramesh Gaonkar, PENRAM 8. Electrical drives by G K Dubey, Narosa Publications 9. Power Electronics, Ned Mohan, Undeland, Robbins, John Wiley Publication 10. Digital principle and Application, Malvino & Leach, Tata McGraw Hill, 1991. 11. Digital design, Morris M. Mano, Prentice Hall International – 1984. 12. Electronic Devices and Circuits, Robert Boylestad and Louis Nashelsky, Prentice-Hall of India. 13. Electronic Devices and Circuits, Millman and Halkias, Tata McGraw-Hill. 14. MSP430 Microcontroller Basics, John H. Davies, Newnes; 1 edition (September 4, 2008)														
E- REFERENCES														
1. Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay. For more details on NPTEL visit http://nptel.iitm.ac.in														

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO 1	2	1			1							2		
CO 2	2	1			1							2		
CO 3	2	1			1							2		
CO 4	2	1			1							2		
CO 5	2	1			1							2		
Total	10	5			5							10		
Scaled value	2	1			1							2		

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

COURSE CODE			XECO2	L	T	P	C
COURSE NAME			ENTERTAINMENT ELECTRONICS AND MANAGEMENT	3	0	0	3
PREREQUISITES			XBE103	L	T	P	H
C	P	A		3	0	0	3
3	0	0					
COURSE OUTCOMES				DOMAIN		LEVEL	
CO1	Classify and explain the principles of Audio System.			Cognitive		Understanding	
CO2	Discuss the working principles of Monochrome and color TV.			Cognitive		Understanding	
CO3	Understand and discuss Electronic Gadgets and Domestic Home Appliances.			Cognitive		Understanding	
CO4	Outline and explain the office equipments landline and mobile telephony			Cognitive		Remembering, Outline	
CO5	Summarizethe concepts repair, servicing and maintenance of electronic gadgets.			Cognitive		Understanding	
UNIT I - AUDIO SYSTEMS							9
Microphones: construction, working principles and applications of microphones, their types viz: a) Carbon b) moving coil, c) velocity, d) crystal, e) condenser, e) cordless etc. Loud Speaker: Direct radiating, horn loaded woofer, tweeter, mid range, multi-speaker system, baffles and enclosures. Sound recording on magnetic tape and tape transport mechanism. Hi-Fi system, pre-amplifier, amplifier and equalizer system, stereo amplifiers. Audio recording and reproduction – Cassettes, CD and MP3, stereophonic sound system							
UNIT II - MONOCHROME AND COLOUR TV							9
Monochrome TV : Elements of TV communication system, Scanning, Progressive scanning, Interlaced scanning, Construction and working of Monochrome picture tube, Construction and working of camera tube: vidicon and plumbicon, Block diagram of TV camera , Block diagram and function of a TV receiver. Colour TV : Primary colours, concepts of additive and subtracting mixing of colours, concepts of luminance, Hue and Saturation, Block diagram of colour TV camera ,Introduction to PAL, NTSC, SECAM colour TV systems, Video camera .Construction and working principles of colour picture tubes, Block diagram,explanation and working of Colour TV receiver.							
UNIT III - ELECTRONIC GADGETS AND DOMESTIC HOME APPLIANCES							9
Electronic Toys, Data organizers, Video system – VCR/VCD/DVD players, MP4 players ,Set Top box, CATV ,Principle of video recording on magnetic tape, Digital watch, Digital clock, Digital Calculator ,Digital camera, Handicam, Home security system, CCTV, Air conditioners, Refrigerators, Working of Automatic and Semi automatic washing Machine/Dish Washer, Microwave oven, Vacuum cleaners, Set Top box, Block diagram and principles of working of CATV and DTH, cable TV using internet, DTV, LCD, Plasma & LED TV, Projectors ,Home Theatres and Remote Controls							
UNIT IV - OFFICE EQUIPMENTS, LANDLINE AND MOBILE TELEPHONY							9
Scanners – Barcode / Flat bed , Printers , Multifunction units (Print, Scan, fax,copy),Working principles of Cordless telephones, Pager, Working of Photostat machines, Basic idea of Fax system and its applications. Principle of operation and block diagram of modern FAX system. Important features of modern FAX machines, Basic landline equipment – CLI, Cordless Intercom/ EPABX system, Mobile phones – GPRS & Bluetooth, GPS Navigation system, Home automation system							

UNIT V - REPAIR, SERVICING AND MAINTENANCE CONCEPTS				9
Introduction, Modern electronic equipment, Mean time between failures (MTBF), Mean time to repair (MTR), Maintenance policy, potential problems, preventive maintenance, corrective maintenance. Study of basic procedure of service and maintenance, Circuit tracing techniques and Concepts of shielding, grounding and power supply considerations in instruments, Use of digital tools for trouble shooting digital components, Trouble Shooting procedures in the following: Oscilloscope, Power Supplies, Digital multimeters, Signal generator, PA system, Tape recorder, CD player and Stereo amplifier, Fault finding of colour TV.				
	LECTURE	TUTORIAL	PRACTICAL	TOTAL
HOURS	45	0	0	45
TEXT BOOKS				
1.R. P. Bali ,”Consumer Electronics”, Pearson Education ,2008				
2.R. G. Gupta,” Audio and Video systems”, Tata McGraw Hill,2004				
REFERENCES				
1. R.R Gulati ,”Monochrome and Colour Television-principles & practice”, Wiley Eastern Limited, New Delhi, 4th edition ,2011				
2. R.R Gulati , “Composite Satellite & cable Television”, New age International Publisher,2nd edition, 2011				
3. RC Vijay ,”Colour Television Servicing” ,BPB Publication, 4th Edition, 2007, New Delhi				
4. A.K. Maini , “Colour Television & Video Technology” , CSB Publishers,2005				
5. S.P. Sharma , “VCR-principles, maintenance & repair” , Tata Mc Graw Hill, New Delhi				
6. A.Dhake , “Colour TV” ,Tata Mc Graw Hill Publication, 2nd edition,				
8. K. Blair, Benson "Audio Engineering Hand book",2001				
9. S.P. Sharma, "VCR-principles, maintenance & repair", Tata Mc Graw Hill, New Delhi, 2003				
10. “Service Manuals”, BPB Publication, New Delhi, 2000				
E-REFERENCES				
1. http://www.mediacollege.com/audio/01/sound-systems.html				
2. https://books.google.co.in/consumer-electronics/				
3. http://www.circuitstoday.com/working-of-amplifiers				
4. http://www.britannica.com/technology/television-technology/Principles-of-television-systems				

Mapping of COs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PO13
CO 1	3	2					1	1		1		1		
CO 2	3	2				1	1	1				1		
CO 3	2	2					1	1				2		
CO 4	2	2				1		1		1		2		
CO 5	2	2				1	1	1				1		
Total	12	10				3	4	5		2		7		
Scaled value	3	2				1	1	1		1		2		

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