SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E- Electronics and Communication Engineering

CURRICULUM and SYLLABI

[For students admitted in 2018-2019]

B.E / B.Tech Regulation 2015R

Approved by BOS and Academic Council meetings

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / BTech Semester I under Regulations 2015R (CBCS)

Branch: ECE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG101AR	Technical English – I	2	0	2	3	HS
2	U15MAT102CR	Mathematics – I for ECE	3	2	0	4	BS
3	U15PHY103BR	Physics for ECE	4	0	0	4	BS
4	U15CHE104BR	Applied Chemistry	3	0	0	3	BS
5	U15CPR105BR	C Programming	3	0	0	3	ES
6	U15EGR106BR	Engineering Graphics for ECE[1]	2	2	0	3	ES
Practical							
7	U15PCL107CR	Physics and Chemistry Laboratory – I[2]	0	0	4	2	BS
8	U15CPL108BR	C Programming Laboratory	0	0	4	2	ES
9		Library	0	0	2	0	
10		Seminar	0	0	2	0	
					Total Credits	**24**	
Optional Language Elective*							
11	U15OLE1101	French	0	0	2	1	HS
12	U15OLE1102	German					
13	U15OLE1103	Japanese					

*Students may opt for foreign languages *viz.*, German/French/Japanese with additional one credit (over and above the CGPA calculation).

[1] The examination will be conducted for 3 hours through written and practical modes.

[2]Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will beconducted separately for 50 marks each.

Approved by

HOD-First Year Dr. M. Renuga	**Chairperson BOS/ECE & HOD-ECE** Dr. R.S. Sabeenian	**Member Secretary, Academic Council** Dr. R. Shivakumar	**Chairperson, Academic Council & Principal** Dr. S.R.R. Senthilkumar

SONA COLLEGE OF TECHNOLOGY, SALEM – 636 005
(An Autonomous Institution)

Courses of Study for BE / B Tech Semester II under Regulations 2015R (CBCS)

Branch: ECE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG201AR	Technical English –II	2	0	2	3	HS
2	U15MAT202CR	Mathematics – II for ECE	3	2	0	4	BS
3	U15MEC203R	Basic Mechanical Engineering	3	0	0	3	ES
4	U15CHE204BR	Environmental Engineering Science	3	0	0	3	BS
5	U15BEE205R	Basic Electrical Engineering	3	0	0	3	ES
Practical							
6	U15PCL206CR	Physics and Chemistry Laboratory – II[#]	0	0	4	2	BS
7	U15EPL207R	Engineering Practices Laboratory	0	0	4	2	ES
8	U15BEL208R	Basic Electrical Engineering Laboratory	0	0	4	2	ES
9		Library	0	0	2	0	
10		Seminar	0	0	2	0	
Total Credits						**22**	
Optional Language Elective*							
11	U15OLE1201	French	0	0	2	1	HS
12	U15OLE1202	German					
13	U15OLE1203	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (over and above the CGPA calculation).

[#] Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will be conducted separately for 50 marks each.

Approved by

HOD - First Year	**Chairperson BOS/ECE & HOD-ECE**	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr. M. Renuga	Dr. R.S. Sabeenian	Dr. R. Shivakumar	Dr. S.R.R. Senthilkumar

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15MAT301CR	Transforms and Linear Algebra	3	2	0	4
2	U15EC301R	Electronic Devices	3	0	0	3
3	U15EC302R	Network Analysis and Synthesis	3	2	0	4
4	U15EC303R	Digital System Design	3	0	0	3
5	U15EC304R	Signals and Systems	3	2	0	4
Practical						
6	U15EC305R	Electronic Devices Laboratory	0	0	2	1
7	U15EC306R	Digital Laboratory	0	0	2	1
8	U15ENG302R	English Laboratory	0	0	4	2
9	U15GE301R	Soft Skills and Aptitude - I	0	0	2	1
					Total Credits	**23**

Approved By

Chairman, Electronics and Communication Engineering BoS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electronics and Communication Engineering, Third Semester BE ECE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15MAT401CR	Probability and Stochastic Processes	3	2	0	4
2	U15EC401R	Engineering Electromagnetics	3	2	0	4
3	U15EC402R	Electronic Circuits	3	0	0	3
4	U15EC403R	Linear Integrated Circuits	3	0	0	3
5	U15EC404R	Digital Signal Processing	3	2	0	4
6	U15EC405R	Analog Communication Systems	3	0	0	3
Practical						
7	U15EC406R	Linear Integrated Circuits Laboratory	0	0	2	1
8	U15EC407R	Electronic Circuits and Simulation Laboratory	0	0	2	1
9	U15EC408R	Digital Signal Processing Laboratory	0	0	2	1
10	U15GE401R	Soft Skills and Aptitude - II	0	0	2	1
					Total Credits	**25**

Approved By

Chairperson, Electronics and Communication Engineering BoS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electronics and Communication Engineering, Fourth Semester BE ECE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EC501R	Digital Communication	3	0	0	3
2	U15EC502R	Transmission Lines and Waveguides	2	2	0	3
3	U15EC503R	Microprocessors and Microcontroller	3	0	0	3
4	U15CS507R	Data Structures and Object Oriented Programming in C++	2	0	2	3
5	U15EC504R	Control Systems	2	2	0	3
6	U15EC505R	VLSI Design	3	0	0	3
Practical						
7	U15EC506R	Microprocessors and Microcontroller Laboratory	0	0	2	1
8	U15EC507R	VLSI Laboratory	0	0	2	1
9	U15EC508R	Communication Laboratory	0	0	2	1
10	U15GE501R	Soft Skills and Aptitude - III	0	0	2	1
					Total Credits	**22**

Approved By

Chairperson, Electronics and Communication Engineering BoS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electronics and Communication Engineering, Fifth Semester BE ECE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title		Lecture	Tutorial	Practical	Credit
Theory							
1.	U15EC601R	Antenna and Wave Propagation		3	0	0	3
2.	U15EC602R	Digital Image Processing		3	0	0	3
3.	U15EC603R	Embedded Systems		3	0	0	3
4.	U15EC902R	**Professional Elective -**	Wireless Communication	3	0	0	3*
5.	U15EC916R		Measurement and Instrumentation				
6.	U15EC928R		Sensors and IOT				
7.	U15EC926R		Machine Learning and Its Applications	2	0	2	
8.	noc21-cs16	**Professional Elective - NPTEL Course**	Cryptography and Network Security	3	0	0	3*
9.	noc21-cs24		Introduction to Machine Learning				
10.	noc21-ee32		Sensors and Actuators				
11.	noc21-cs45		Data Analytics with Python				
12.	U15CS1003R	**Open Elective**	Internet of Things	3	0	0	3
13.	U15CS1006R		Data Science				
14.	U15IT1004R		Python Programming				
15.	U15IT1003R		Problem Solving Techniques Using Java Programming				
16.	U15IT1005R		Introduction To Database Technology				
17.	U15CS1004R		Mobile Application Development				
18.	U15FT1001R		Fundamentals of Fashion Design				
19.	U15CE1004R		Municipal Solid Waste Management				

Practical						
20.	U15EC604R	Digital Image Processing Laboratory	0	0	2	1
21.	U15EC605R	Embedded Systems Laboratory	0	0	2	1
22.	U15CS606R	Data Structures and Object Oriented Programming in C++ Laboratory	0	0	2	1
23.	U15GE601BR	Soft Skills and Aptitude - IV	0	0	2	1
					Total Credits	**22**

*Any 1 elective to be opted by a student among 4 electives.

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/Electronics and Communication Engineering, Sixth Semester BE ECE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title		Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory								
1	U15EC701R	Microwave Engineering		3	0	0	3	45
2	U15EC702R	Optical Fiber Communication		3	0	0	3	45
3	U15EC703R	Computer Networks		3	0	0	3	45
4	U15EC901R	**Elective –**	Satellite Communication	3	0	0	3*	45
5	U15EC915R		Computer Architecture					
	U15EC917R		Bio-Medical Instrumentation	3	0	0	3*	45
	U15EC924R		Professional Ethics and Human Values					
	U15EC927R		Deep Learning					

***Any 2 electives to be opted by a student among 5 professional electives.**

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

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HOD/Electronics and Communication Engineering, Seventh Semester BE ECE Students and Staff, COE

6	U15CE1003R	**Open Elective –**	Energy Efficiency and Green Building	3	0	0	3	45
	U15CS1004R		Mobile Application Development					
	U15EE1006R		Renewable Energy Systems					
	U15IT1003R		Problem Solving Techniques Using Java Programming					
	U15MC1002R		3D Printing Technology					
	U15ME1002R		Renewable Energy Sources					
	U15ME1004R		Industrial Safety					
	U15ME1005R		Maintenance Engineering					
	U15ME1010R		3D Printing					
Practical								
7	U15EC704R	Microwave and Optical Laboratory		0	0	2	1	30
8	U15EC705R	Mini Project		0	0	4	2	60
9	U15EC706R	Comprehensive Review		0	0	2	1	30
						Total Credits	**22**	

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electronics and Communication Engineering, Seventh Semester BE ECE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U15EC801R	Project Work	0	0	24	12	360
					Total Credits	**12**	

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electronics and Communication Engineering, Eighth Semester BE ECE Students and Staff, COE

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / BTech Semester I under Regulations 2015R (CBCS)

Branch: ECE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG101AR	Technical English – I	2	0	2	3	HS
2	U15MAT102CR	Mathematics – I for ECE	3	2	0	4	BS
3	U15PHY103BR	Physics for ECE	4	0	0	4	BS
4	U15CHE104BR	Applied Chemistry	3	0	0	3	BS
5	U15CPR105BR	C Programming	3	0	0	3	ES
6	U15EGR106BR	Engineering Graphics for ECE[1]	2	2	0	3	ES
Practical							
7	U15PCL107CR	Physics and Chemistry Laboratory – I[2]	0	0	4	2	BS
8	U15CPL108BR	C Programming Laboratory	0	0	4	2	ES
9		Library	0	0	2	0	
10		Seminar	0	0	2	0	
					Total Credits	**24**	
Optional Language Elective*							
11	U15OLE1101	French	0	0	2	1	HS
12	U15OLE1102	German					
13	U15OLE1103	Japanese					

*Students may opt for foreign languages *viz.*, German/French/Japanese with additional one credit (over and above the CGPA calculation).

[1] The examination will be conducted for 3 hours through written and practical modes.

[2]Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will beconducted separately for 50 marks each.

Approved by

HOD-First Year Dr. M. Renuga	**Chairperson BOS/ECE & HOD-ECE** Dr. R.S. Sabeenian	**Member Secretary, Academic Council** Dr. R. Shivakumar	**Chairperson, Academic Council & Principal** Dr. S.R.R. Senthilkumar

U15ENG101AR	TECHNICAL ENGLISH I	L	T	P	C	Marks
		2	0	2	3	100

Course Outcomes

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

1. frame sentences correctly, both in written and spoken forms of language with accuracy and fluency.
2. develop and demonstrate listening skills for academic and professional purposes.
3. draw conclusions on explicit and implicit oral information.
4. develop effective reading skills and reinforce language skills required for using grammar and building vocabulary.
5. read for gathering and understanding information, following directions and giving responses.

UNIT I	**FOCUS ON LANGUAGE** • General Vocabulary • Prefixes and Suffixes • Active and Passive Voices • Adjectives, Comparative Adjectives • Prepositions and Dependent Prepositions • Collocations • Tenses • Modal Verbs and Probability	
UNIT II	**LISTENING -I** • Listening to conversations, welcome speeches, lectures and description of equipment. • Listening to different kinds of interviews (face-to-face, radio, TV and telephone interviews). • Understanding short conversations or monologues. • Taking down phone messages, orders, notes etc. • Listening for gist, identifying topic, context or function.	
UNIT III	**LISTENING – II** • Listening comprehension, entering information in tabular form. • Intensive listening exercises and completing the steps of a process. • Listening exercises to categorise data in tables.	

	• Listening to extended speech for detail and inference.	
UNIT IV	**READING -I** • Understanding notices, messages, timetables, advertisements, graphs, etc. • Reading passages for specific information transfer. • Reading documents for business and general contexts and interpreting graphical representations. • Error correction, editing mistakes in grammar, vocabulary, spelling, etc. • Oral reading – poetry and prose excerpts, general and technical articles, and anecdotes.	
UNIT V	**READING -II** • Reading passage with multiple choice questions, reading for gist and reading for specific information, skimming for comprehending the general idea, meaning and contents of the whole text. • Short reading passage: gap-filling exercise related to grammar, testing the understanding of prepositions, articles, auxiliary verbs, modal verbs, pronouns, relative pronouns and adverbs. • Short reading passage with multiple choice questions, gap-filling exercise testing the knowledge of vocabulary, collocations, dependent prepositions, grammatical structures. • Short reading passages for sentence matching exercises, picking out specific information in a short text.	

Total: 45 Hours

Listening test will be conducted for 20 marks internally and evaluated along with Technical English – I in the End Semester Valuation.

Reading test will be conducted for 20 marks internally and evaluated by internal examiners.

TEXT BOOK	
1.	Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.
EXTENSIVE READING	
1.	The Story of Amazon.com- Sara Gilbert, published by Jaico
2.	The Story of Google – Sara Gilbert, published by Jaico
REFERENCE BOOKS	
1.	Technical English – I & II, Dr. M. Renuga, et al. Sonaversity, Sona College of Technology, Salem, Revised edition, 2016.
2.	A Course in Communication Skills, P. Kiranmai Dutt, Geetha Rajeevan, C. L. N. Prakash, published by Cambridge University Press India Pvt. Ltd.

U15MAT102CR	MATHEMATICS – I FOR ECE	L T P C Marks 3 2 0 4 100

Course Outcomes

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

1. determine eigen values and eigen vectors and reduce matrices from quadratic form to canonical form.
2. interpret curvature and find the radius of curvature, centre of curvature, evolutes, involutes and envelope of curves.
3. explain functions of several variables and find the Taylor's series expansion, Jacobians, maximum and minimum values of functions of several variables.
4. find the area of plane of region, length of the plane curve, area of surface of a solid and volume of solid of revolution.
5. describe the double and triple integrals, discuss the change of order of integration and find the area and volume by multiple integrals.

UNIT I	**MATRICES** Eigen values and Eigen vectors – properties of Eigen values and Eigen vectors – Cayley – Hamilton theorem – real matrices – symmetric – skew – symmetric – orthogonal quadratic form – canonical form or sum of the squares form –reduction of quadratic form to canonical form.	**9+6**
UNIT II	**DIFFERENTIAL CALCULUS** Curvature, centre and radius of curvature – circle of curvature – evolute – envelopes, evolute as the envelope of normals.	**9+6**
UNIT III	**FUNCTIONS OF SEVERAL VARIABLES - MAXIMA AND MINIMA** Functions of several variables – partial differentiation – total derivative – Jacobians – Taylor's theorem for function of two variables – maxima and minima of functions of two variables with and without constraints – Lagrange's method of undetermined multipliers.	**9+6**

UNIT IV	**INTEGRAL CALCULUS** Reduction formulae – area of plane region – quadrature – length of plane curve – rectification – volume of solid of revolution (cylindrical disc method only) – area of the surface of a solid of revolution.	**9+6**
UNIT V	**MULTIPLE INTEGRALS** Double integral – change of order of integration – change of variables between Cartesian and polar coordinates – triple integral – volume as triple integrals in Cartesian, cylindrical and spherical polar coordinates.	**9+6**
		Total: 75 Hours

TEXT BOOKS

1.	B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 30th Reprint, 2017.
2.	T. Veerarajan, "Engineering Mathematics for semesters I and II", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2012.

REFERENCE BOOKS

1.	G. James, Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education 2007.
2.	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
3.	E. Kreyszig, "Advanced Engineering Mathematics", International Student Version, Wiley, 10th Edition, 2015.

U15PHY103BR	PHYSICS FOR ECE	L	T	P	C	Marks
		4	0	0	4	100

Course Outcomes

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

1. explain the theory of crystals, structure of crystals and defects in crystals.
2. discuss lasers and their applications and explain the theory of optoelectronics with applications.
3. explain the concepts of electrodynamics as applicable to engineers.
4. provide an overview of quantum mechanics and basic wave equations in quantum mechanics.
5. analyze types of microscopes and discuss the theory of nanophysics.

UNIT I	**CRYSTAL STRUCTURE** Crystalline and Amorphous Solids – Crystal Structure - Unit and Primitive Cells – Lattice Parameters and Types of Lattices – Introduction to Miller Indices and Crystal Plane – Inter-planar distance – Cubic Systems-SC-BCC-FCC-HCP– Crystal diffraction methods-Laue's method-Rotating crystal method and powder crystal method(qualitative)– Crystal Defects-point defect-line defect and surface defect.	**12**
UNIT II	**LASERS AND OPTOELECTRONICS** Preliminary Idea about Transition – Lasers and their Principle – Properties of Lasers – Types of Lasers –Nd:YAG laser-CO_2 laser-Semiconductor laser– Applications of Lasers – Holography – Introduction to Fiber Optics – Optical Fibers – Acceptance Angle and Cone – Types of Optical Fibers (based on material, mode, refractive index) – Power Loss in Optical Fibers – Endoscope.	**12**

UNIT III	**ELECTRODYNAMICS** Coulomb's law - Gauss's law – dielectric polarization, polarizability and susceptibility- Types of polarization – internal field and Claussius - Mosotti equation -Lorentz force - steady current and equation of continuity - Biot- Savart law(qualitative) - Ampere's law (qualitative) – Faraday's law of induction – generalization of Ampere's law – Maxwell's equation – propagation of EM waves in free space.	**12**
UNIT IV	**QUANTUM MECHANICS** Blackbody Radiation – Quantum of Energy and Planck's Hypothesis – Rayleigh-Jeans Law-Photo electric effect – Compton Effect (qualitative) – X-Rays – Moseley's Law –de-Broglie Hypothesis — Davisson and Germer Experiment– Velocity of de-Broglie Wave and Need of Wave Packet – Wave and Group Velocity (qualitative) - Uncertainty Principle- Applications of Heisenberg Principle -No electron within the nucleus– Strength of nuclear force– Time-Dependent Schrödinger Equation – Time-Independent Schrödinger Equation.	**12**
UNIT V	**CHARACTERIZATION TECHNIQUES AND NANOPHYSICS** Introduction to TEM – Instrument-illumination-lens-imaging– Scanning Electron Microscope – Specimen Preparation –Atomic Force Microscope –Nanophysics – Properties of Nano Particles – Surface Area / Volume Ratio – Quantum Confinement – Electron Confinement – Nano Materials and Their Synthesis- Ball milling method-Chemical vapour deposition method (CVD)– Buck Balls and Fullerenes – Carbon Nanotubes-structure properties and applications.	**12**
		Total: 60 Hours

TEXT BOOKS	
1.	Gurbinder Kaur and Gary R Pickrell, “Modern Physics”, McGraw Hill Education,New Delhi, 2014.
2.	David J. Griffiths, “Introduction to Electrodynamics”, Pearson, Edition: 4, Delhi, 2015.
REFERENCE BOOKS	
1.	Arthur Beiser, Shobhit Mahajan and S Rai Choudhary, “Concepts of Modern Physics’, 7e, McGraw Hill Education 2015.
2.	David Halliday, Robert Resnick and Kenneth S. Krane, “Physics” Vol I, 5e, John Wiley and Sons, 2003.
3.	David Halliday, Robert Resnick and Kenneth S. Krane, “Physics” Vol II, 5e, John Wiley and Sons, 2005.
4.	M. N. Avadhanulu, “Engineering Physics” Vol I, S Chand & Company Ltd, 2010.

U15CHE104BR	APPLIED CHEMISTRY (Common to ECE, CSE & IT branches)	L T P C Marks 3 0 0 3 100

Course Outcomes

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

1.	analyze the types of polymers, polymerization reactions, polymerization techniques and fabrication methods of polymers for engineering applications.
2.	discuss the basic principles of electrochemistry and its applications.
3.	analyze the types of corrosion and the various control methods for corrosion prevention.
4.	describe the construction, working principle and applications of energy storage devices for electronic appliances.
5.	outline the principles, advantages and applications of organic electronic materials used in electronic devices.

UNIT I	**POLYMERS AND COMPOSITES** Nomenclature of Polymers – Functionality – Types of Polymerization – Addition – Condensation and Copolymerization – Classification of Polymers – Free Radical mechanism of Addition Polymerization – Properties of Polymers- glass transition temperature – tacticity – Methods of Polymerization-Bulk-Solution-Emulsion and Suspension – Plastics – Moulding Constituents of Plastic – Moulding of Plastics into Articles-Injection-Compression and Blow Moulding – Thermoplastic and Thermosetting Resins – Engineering Plastics – Nylon 6,6-Polycarbonate and Polyurethane-Preparation-Properties and Applications – Rubbers – Types – Applications – Vulcanization of Rubber – Composites-Constituents of Composites – Types of FRP Composites.	**9**

UNIT II	**ELECTROCHEMISTRY** Conductivity of Electrolytes – Kohlrausch's Law of Independent Migration of Ions and Its Applications – Conductometric Titration (Acid-Base – HCl vs NaOH) – Electrode Potential – Nernst Equation – Derivation and Problems Based on Single Electrode Potential Calculation – Electrochemical Series – Significance – Reference Electrodes - Standard Hydrogen Electrode, Saturated Calomel electrode – Ion selective electrode – glass electrode – determination of pH for unknown solution – Electrochemical Cell – Emf of an Electrochemical Cell – Redox Reactions - Potentiometric Titrations (Redox – Fe^{2+} Vs Dichromate).	**9**
UNIT III	**CORROSION AND CORROSION CONTROL** Dry or Chemical Corrosion – Pilling-Bedworth Rule – Wet or Electrochemical Corrosion – Mechanism of Electrochemical Corrosion – Galvanic Corrosion – Concentration Cell Corrosion – Waterline Corrosion – Pitting Corrosion – Intergranular Corrosion –Stress Corrosion – Passivity – Factors Influencing Corrosion – Corrosion Control – Cathodic Protection-Sacrificial Anodic Protection Method and Impressed Current Cathodic Protection – Protective Coatings – Metallic Coatings – Methods of Cleaning Articles Before Electrodeposition-Electroplating and Electro Less Plating of Nickel – Organic Coatings – Paints-Constituents and Functions.	**9**
UNIT IV	**MODERN ENERGY DEVICES FOR ELECTRONIC APPLIANCES** Reversible and Irreversible Cells – Batteries-Types of Batteries – Battery Characteristics – Voltage-Current – Capacity – Electricity Storage Density – Power – Discharge Rate – Cycle Life-Energy Efficiency and Shelf Life – Fabrication and Working of Alkaline Battery – Lead-Acid Battery – Ni – Cd – Lithium Ion Batteries and Solar Cells – Fuel Cells – Hydrogen-Oxygen fuel cell – Nano Batteries- Construction-Working-Advantages and Applications.	**9**

UNIT V	**CHEMISTRY OF ORGANIC ELECTRONIC MATERIALS** Organic Semiconducting Materials – Working Principle and Advantages Over Inorganic Semiconducting Materials – P-Type and N-Type Organic Semiconducting Materials – Pentacene Fullerenes – C-60 – Organic Dielectric Material-Definition-Working Principle and Examples – Polystyrene – PMMA – Organic Light Emitting Polymer – Structure-Properties and Applications of Polythiopene– Organic Light Emitting Diodes (Oleds) – Construction – Working Principle and Applications – Organic Solar Cells-Working Principle and Applications Organic Transistors – Construction-Working Principle and Applications in Electronic Industries.	**9**
		Total: 45 Hours

TEXT BOOK

1.	P. C. Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P), New Delhi, 15e, 2006.

REFERENCE BOOKS

1.	M. Raja *et al.,* "Applied Chemistry", Sonaversity, Sona College of Technology, Salem, Revised edition 2018.
2.	Joint Contributors, "Engineering Chemistry" John Wiley and Sons, 2e, 2014
3.	H.K. Chopra, A. Parmer, "Chemistry for Engineers", Narosa Publishing House, New Delhi, 110 002, 2016.
4.	Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006.

U15CPR105BR	C PROGRAMMING (Revised Syllabus ECE-2018)	L T P C Marks 3 0 0 3 100

Course Outcomes

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

1. write simple C programs using the basic language constructs
2. write C programs using control statements
3. implement the array concepts and string concepts in C using functions
4. implement pointers, structures and unions in C language
5. write programs to implement file operations in C language

UNIT I	**INTRODUCTION TO PROGRAMMING AND C LANGUAGE BASICS** Introduction to algorithms- Pseudo code- Flow chart- Algorithms C Character Set– Identifiers and Keywords – Data types – Constants – Variables and Arrays – Declarations – Expressions – Statements and Symbolic Constants – Operators – Arithmetic Operators-Unary Operators-Relational and Logical Operators-Assignment Operators-Conditional Operator – Bitwise operators. Managing Data Input and Output Operations	**9**
UNIT II	**CONTROL STATEMENTS** Storage Classes-Automatic Variables –External (Global) Variables-Static Variables - Multifile Programs - Branching and Looping Statements – Nested Control Structures – switch Statement – break Statement – continue Statement – comma Operator – goto Statement	**9**
UNIT III	**ARRAYS AND FUNCTIONS** Defining an Array – Processing an Array – Two-dimensional Arrays – Arrays and Strings -Defining a Function – Accessing a Function – Function Prototypes – Passing Arguments to a Function – Recursion	**9**

UNIT IV	**POINTERS, STRUCTURES AND UNIONS** Pointer Declarations – Operations on Pointers – Passing Pointers to a Function – Pointers and One-dimensional Arrays – Arrays of Pointers – Defining a Structure – Processing a Structure – User-defined Data Types – Structure and Pointers – Passing Structures to Functions – Unions	**9**
UNIT V	**FILES** Data Files – Opening and Closing a Data File – Reading and Writing a Data File – Processing a Data File – Sequential and Random file accessing	**9**
		Total: 45 Hours

TEXT BOOKS	
1.	Yashavant P. Kanetkar. "Let Us C", BPB Publications, 14th edition, 2016.
2.	E. Balagurusamy, "Programming in ANSI C", seventh edition, Tata McGraw Hill, 2016

REFERENCE BOOKS	
1.	Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.
2.	Byron S Gottfried, "Programming with C", Schaum's Outlines, Second Edition, Tata McGraw-Hill, 2006.
3.	Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
4.	Deitel and Deitel, "C How to Program", Pearson Education, New Delhi, 2011.

U15EGR106BR	ENGINEERING GRAPHICS FOR ECE	L	T	P	C	Marks
		2	2	0	3	100

Course Outcomes

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

1. predict the construction of various curves in civil elevation plan and machine components.
2. draw the projection of three dimensional objects representation of machine structure and explain standards of orthographic views by different methods.
3. analyze the principles of projection of various planes by different angle to project points - lines and planes.
4. draw the principles of projection of simple solid by the axis inclined to one reference plane by change of position method.
5. plan the interior components of machinery or buildings by sectioning the solid and to study the development of simple solids for fabrication of sheet metals.

UNIT I	**FUNDAMENTALS OF GRAPHICS AND ENGINEERING CURVES** Importance of Graphics in Engineering Applications – Use of Drafting Instrument – BIS Conventions and Specifications – Size – Layout and Folding of Drawing Sheets – Lettering and Dimensioning – Importance of 2D Drafting – Sketching – Modifying – Transforming and Dimensioning Engineering Curves: Introduction – Conic Section – Ellipse – Parabola – Hyperbola – Tangent and Normal to Conics – Cycloidal Curves – Involutes.	**12**
UNIT II	**ISOMETRIC TO ORTHOGRAPHIC VIEWS** Representation of three dimensional objects, General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.	**12**

UNIT III	**PROJECTION OF POINTS, LINES AND PLANE SURFACES** **Projections of Points:** Introduction – Position of a Point – Notation of a Point – Projection of a Point – SV of the Point **Projection of Lines:** Introduction – Position of a Straight Lines – Terms used in Projection of Lines – Lines Parallel to Both the RPs – Line Perpendicular to Either of the RPs – Line inclined to One RP and Parallel to Other – Line Inclined to both the RPs – Line Parallel to the PP **Projection of Planes:** Introduction – Position of Planes – Terms used in Projection of Planes – Plane to an RP – Plane Inclined to One RP and Perpendicular to the Other RP – Plane Perpendicular to Both the RPs – Use of Auxiliary Plane Projection Method	**12**
UNIT IV	**PROJECTION OF SOLIDS** **Projection of Solids:** Introduction - Basic Solids – Frustums and Truncated Solids – Position of Solids – Solid with Axis perpendicular to an RP – Solid with Axis inclined to One RP and Parallel to the Other – Solid with Axis Parallel to the PP – Solid with Axis Parallel to Both the RPs – Rules for Deciding the Hidden Lines – Projection of Sphere	**12**
UNIT V	**SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** **Section of Solids:** Introduction – Theory of Sectioning – Section of Prisms and Cube – Section of Pyramids – Section of Cylinder – Section of Cones – Section of Spheres. **Theory of Development:** Introduction – Methods of Development – Parallel Line Development – Radial Line Development.	**12**
		Total: 60 Hours

TEXT BOOKS	
1	Dr. P. Suresh et al., "*Engineering Graphics and Drawing*", Revised edition 2012, Sonaversity, Sona College of Technology, Salem.
2.	Dhananjay A. JoIhe, "*Engineering Drawing with an introduction to AutoCAD",* Tata McGraw Hill Publishing Company Limited, 2008
REFERENCE BOOKS	
1.	Basant Agarwal and Agarwal C.M., "*Engineering Drawing*", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008
2.	K. R. Gopalakrishnana, "*Engineering Drawing (Vol. I & II)*", Subhas Publications, 1998
3.	K.V.Nataraajan *"A Text Book of Engineering Drawing"* Dhanalakshmi Publishers, Chennai, 2006.

U15PCL107CR	PHYSICS AND CHEMISTRY LABORATORY - I	L	T	P	C	Marks
		0	0	4	2	100

Course Outcomes

At the end of the course, the student will be able to,

1.	apply the principles of optics, thermal Physics and elasticity to determine the Engineering properties of materials.
2.	Analyze the given water sample to determine the amount of hardness and suggest the quality of water suitable for domestic purpose and determine the molecular weight of a polymer.
3.	determine the thickness of the given copper turn used for house hold applications and evaluate the amount of alkalinity, pH, conductivity and iron content of house hold water sample and suggest the remedial measures for them.

List of Experiments (PHYSICS PART)

1.	Determination of the thickness of a thin wire by forming interference fringes using air wedge apparatus.
2.	Determination of the wavelength and velocity of ultrasonic waves and the compressibility of a given liquid using the ultrasonic interferometer.
3.	Determination of thermal conductivity of a bad conductor using Lee's disc apparatus.
4.	Determination of the angle and dispersive power of a given prism using a spectrometer.
5.	Determination of laser wavelength, particle size (lycopodium powder), acceptance angle and numerical aperture of an optical fibre using a diode laser.
6.	Determination of the Young's modulus of a given material by non-uniform bending method.

List of Experiments (CHEMISTRY PART)

1.	Estimation of hardness of Water by EDTA method.
2.	Determination of molecular weight of a polymer by viscosity measurements.
3.	Estimation of hydrochloric acid by pH metry.
4.	Conductometric titration of strong acid vs strong base (HCl vs NaOH).
5.	Estimation of ferrous iron by potentiometry
6.	Estimation of corrosion by weight loss method.

Total: 60 Hours

<table>
<tr><td>U15CPL108BR</td><td>C PROGRAMMING LAB
(Revised Syllabus ECE-2018)</td><td colspan="2">L T P C Marks
0 0 4 2 100</td></tr>
<tr><td colspan="4">Course Outcomes
At the end of experiments, the students will be able to,</td></tr>
<tr><td colspan="4">1. write, compile and debug programs in C language</td></tr>
<tr><td colspan="4">2. formulate problems and implement algorithms in C</td></tr>
<tr><td colspan="4">3. effectively choose programming components that efficiently solve computing problems in real-world</td></tr>
<tr><td colspan="4">List of Experiments</td></tr>
<tr><td>1.</td><td colspan="3">Write a program to read number of variables based on user choice and output their sum, average and percentage deviation from the mean.</td></tr>
<tr><td>2.</td><td colspan="3">Write a program to perform the calculations based on the condition given by the user.
For example, calculate the salary statement for an employee based on the following conditions.
<table>
<tr><th>Basic pay</th><th>DA</th><th>HRA</th><th>Special pay</th><th>Loan</th></tr>
<tr><td>< 10000</td><td>25%</td><td>15%</td><td>5%</td><td>500</td></tr>
<tr><td>>=10000<=50000</td><td>35%</td><td>20%</td><td>10%</td><td>1000</td></tr>
<tr><td>>50000</td><td>50%</td><td>30%</td><td>20%</td><td>1500</td></tr>
</table></td></tr>
<tr><td>3.</td><td colspan="3">Write a program to generate any series of given numbers, based on user’s choice. For example, Fibonacci series, Armstrong numbers, Prime numbers etc.</td></tr>
<tr><td>4.</td><td colspan="3">Write a program to perform operations on single dimensional matrix. For example, sorting, searching, and extracting unique numbers. Output a beep sound if a number satisfies a given condition, such as divisible by another number, middle digit of a 3-digit number is a given digit.</td></tr>
<tr><td>5.</td><td colspan="3">Write a program to perform operations on multi dimensional matrix. For example, Addition of matrices, Transpose of a matrix, Product of two matrices</td></tr>
<tr><td>6.</td><td colspan="3">Write a program to perform operations on strings. For example, palindrome checking, sorting names, counting occurrence of a given character.</td></tr>
<tr><td>7.</td><td colspan="3">Write a program to generate any pattern using the concept of function.</td></tr>
</table>

	For example, * 342.560 1 ** ---------- 2 2 *#* 987.004 4 3 4 *$*& __ 4 4 4 4 *^* / _* \ 5 4 5 4 5 @* *
8.	Write a program using the concept of call by reference and recursion. For example, swapping two numbers, finding factorial etc.
9.	Write a program to perform different types of arithmetic operations using pointers
10.	Write a program using the concept of structure and union to get and display the content. For example, title of the book, name of the author, no of pages, cost and category of the book
11.	Write a program to get name, register number, marks of five subjects of a class of 60 students. Calculate total and average. Display the mark sheet of students using array of structures.
12.	Write a loop that will examine each character in a character type array called *text.* Write out the ASCII equivalent of each character. Write loop in three different ways – *while, do while* and *for*
13.	Implement the file operations using C programs.
	Total: 60 Hours

SONA COLLEGE OF TECHNOLOGY, SALEM – 636 005
(An Autonomous Institution)

Courses of Study for BE / B Tech Semester II under Regulations 2015R (CBCS)

Branch: ECE

S.No.	Course Code	Course Title	L	T	P	C	Group code
Theory							
1	U15ENG201AR	Technical English –II	2	0	2	3	HS
2	U15MAT202CR	Mathematics – II for ECE	3	2	0	4	BS
3	U15MEC203R	Basic Mechanical Engineering	3	0	0	3	ES
4	U15CHE204BR	Environmental Engineering Science	3	0	0	3	BS
5	U15BEE205R	Basic Electrical Engineering	3	0	0	3	ES
Practical							
6	U15PCL206CR	Physics and Chemistry Laboratory – II[#]	0	0	4	2	BS
7	U15EPL207R	Engineering Practices Laboratory	0	0	4	2	ES
8	U15BEL208R	Basic Electrical Engineering Laboratory	0	0	4	2	ES
9		Library	0	0	2	0	
10		Seminar	0	0	2	0	
Total Credits						**22**	
Optional Language Elective*							
11	U15OLE1201	French	0	0	2	1	HS
12	U15OLE1202	German					
13	U15OLE1203	Japanese					

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (over and above the CGPA calculation).

[#] Laboratory classes on alternate weeks for Physics and Chemistry. The lab examination will be conducted separately for 50 marks each.

Approved by

HOD - First Year	**Chairperson BOS/ECE & HOD-ECE**	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr. M. Renuga	Dr. R.S. Sabeenian	Dr. R. Shivakumar	Dr. S.R.R. Senthilkumar

U15ENG201AR	TECHNICAL ENGLISH – II	L T P C M 2 0 2 3 100

COURSE OUTCOMES

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

1. use grammatical components effectively in both written and spoken communication
2. develop speaking skills for self-introduction, delivering speeches and technical presentation.
3. speak effectively in real time and business situations
4. write emails, formal letters and descriptions of graphics
5. develop skills for writing reports and proposals

UNIT I	**FOCUS ON LANGUAGE** Cause and effect expressions- Concord- If conditionals- Articles- Pronouns-Adverbs-Grammatical structures	
UNIT II	**SPEAKING - I** Self-introduction- personal information-name-home background-study details- area of interest- hobbies- strengths and weaknesses-projects and paper presentations- likes and dislikes in food- travel-clothes- special features of home town. Welcome address- vote of thanks- special address on specific topics.	
UNIT III	**SPEAKING – II** Mini presentation in small groups of two or three regarding- office arrangements- facilities- office functions- sales- purchases-training recruitment- advertising- applying for financial assistance- applying for a job- team work- discussion-presentation Situational role play between examiner and candidate- teacher and student- customer and sales manager- hotel manager and organiser- team leader and team member- bank manager and candidate- interviewer and applicant- car driver and client-industrialist and candidate- receptionist and appointment seeker-new employee and manager- employee and employee- P.A. and manager- schedule for training- asking for directions- seeking help with office equipment- clarifying an error in the bill- job details-	

	buying a product- selling a product- designing a website- cancelling and fixing appointments- hotel accommodation- training facilities- dress code- conference facilities.	
UNIT IV	**WRITING – I** Email, fixing an appointment- Cancelling appointments- conference details- hotel accommodation- order for equipment- training programme details- paper submission for seminars and conferences Letter Writing- Business communication- quotations- placing orders- complaints- replies to queries from business customers- inviting dignitaries- accepting and declining invitations Resume / CV Transcoding: Flow Chart- Pie Chart- Graph- Bar Chart- Tabular Column.	
UNIT V	**WRITING -II** Technical report writing- feasibility reports-accident reports- survey reports- General purpose writing specifications of equipment - description of an object- National and International issues- answering general questions with special emphasis on seeking opinions Technical Writing: recommendations- checklists- instructions- note making and memo Proposal: establishing a lab- introducing a subject in the curriculum- training programme for students	
		Total: 45 Hours

Speaking test will be conducted for 20 marks externally and evaluated along with Technical English –II in the End Semester Valuation.

TEXT BOOK

1.	Norman Whitby, Business Benchmark – Pre-Intermediate to Intermediate, Students Book, Cambridge University Press, 2006.

EXTENSIVE READING	
1.	Who Moved my Cheese? – Spencer Johnson-G. P. Putnam's Sons
2.	"Discover the Diamond in You" – Arindam Chaudhuri – Vikas Publishing House Pvt. Ltd.
REFERENCE BOOKS	
1.	A Course in Communication Skills, P. Kiranmai Dutt, Geetha Rajeevan, C. L. N. Prakash, published by Cambridge University Press India Pvt. Ltd.
2.	Technical English – I & II, Dr. M. Renuga, et al. Sonaversity, Sona College of Technology, Salem, Revised edition, 2016.

U15MAT202CR	MATHEMATICS – II FOR ECE	L T P C M 3 2 0 4 100

Course Outcomes

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

1. solve different types of ordinary differential equations using various methods
2. compute vector functions, operators and use different methods of solving line, surface and volume integrals.
3. describe special features of function of a complex variable, properties and solve the problems involving conformal mapping.
4. find the power series expansion of a complex function and the procedures of evaluating the complex integral.
5. solve problems on Laplace transform and its inverse, properties and solve an ordinary differential equation using Laplace transform.

UNIT I	**LINEAR DIFFERENTIAL EQUATIONS** Second order differential equation with constant coefficients - Linear differential equation of second order with variable coefficients - homogeneous - higher order linear homogeneous differential equations - non-homogenous equations - differential equation with variable coefficients - reducible to equation with constant coefficients - method of variation of parameters - higher order linear equation with variable coefficients.	**9+6**
UNIT II	**VECTOR CALCULUS** Vector differentiation - directional derivative - gradient of scalar function and conservative field - divergence - curl - vector integration - integration of a vector function of a scalar argument. Vector integration - line, surface and volume integrals, statement of Green's, Stoke's and Gauss divergence theorems, simple applications involving squares, rectangles, cubes and rectangular parallelepiped.	**9+6**
UNIT III	**COMPLEX FUNCTION THEORY** Complex function - continuity - differentiability - analyticity - Cauchy- Riemann (C-R) equations: in Cartesian coordinates - harmonic and conjugate harmonic functions - Cauchy-	**9+6**

	Riemann equations: in polar coordinates - elementary functions - conformal mapping: mapping (or transforming or operator) - conformal mapping - conformal mapping by elementary functions - transformation: $w = z^n$ - Mapping: $w = z^2$, bilinear transformation.	
UNIT IV	**COMPLEX INTEGRATION** Line integral in complex plane - Cauchy's integral theorem - Cauchy's integral formula - derivative of analytic functions(statement only) - complex sequences - series and power series - Taylor's series, Laurent series (statement only) - zeros and poles - theory of residues - residue - residue theorem - evaluation of real definite integrals as contour integral (unit circle only).	**9+6**
UNIT V	**LAPLACE TRANSFORM** Laplace transform - application-advantage and sufficient conditions for existence of Laplace transform - general properties of Laplace transform - Laplace transform of periodic function - inverse Laplace transform - general properties of inverse Laplace transform - use of partial fractions to find Laplace transform - convolution - application of Laplace transform to differential equation with constant coefficient.	**9+6**
		Total: 75 Hours

TEXT BOOKS	
1.	T. Veerarajan, "Engineering Mathematics for semesters I and II", 3rd Edition, Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2012.
2.	B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 30th Reprint, 2017.
REFERENCE BOOKS	
1.	G. James, Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education 2007.
2.	B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
3.	E. Kreyszig, "Advanced Engineering Mathematics", International Student Version, Wiley, 10th Edition, 2015.

U15MEC203R	BASIC MECHANICAL ENGINEERING	L	T	P	C	M
		3	0	0	3	100

Course Outcomes

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

1. explain the fundamental principles of thermodynamics, its components and solve simple problems.
2. describe and explain the principles of thermal power plant, IC engines and components.
3. analyse the heat transfer modes, mechanisms of heat transfer and principle of refrigeration.
4. identify engineering materials, their properties, manufacturing methods and explain the functions and operations of machine tools.
5. explain the mechanism of power transfer through belt, rope, chain and gear drive.

UNIT I	**FUNDAMENTALS OF THERMODYNAMICS** Introduction to Thermodynamics – Concept of a System – Types of Systems – Thermodynamic Equilibrium – Properties - State - Process and Cycle – Zeroth Law – Energy Interactions – Heat and Work – Types of Work – Work interactions in a closed System for various processes – First Law: Cycle and Process – Specific Heats (C_p and C_v) – Heat Interactions in a Closed System for Various Processes – Limitations of First Law – Concept of Heat Engine (H.E.) and Reversed H.E. (Heat Pump and Refrigerator) – Efficiency/COP – Second Law: Kelvin-Planck and Clausius Statements – Carnot Cycle – Carnot Efficiency – Statement of Clausius Inequality – Property of Entropy – T-S and P-V Diagrams.	**9**
UNIT II	**THERMAL POWER PLANT AND IC ENGINES** Thermal Power Plant Layout – Four Circuits – Rankine Cycle – Boilers: Fire Tube vs. Water Tube – Babcock & Wilcox – Cochran Boilers – Steam Turbines : Impulse vs. Reaction Turbines – Compounding of Turbines: Pressure Compounding – Velocity Compounding – Pressure Velocity Compounding – Condensers: Types – Jet & Surface Condensers – Cooling Towers – Internal Combustion Engines – 2 stroke and 4 Stroke	**9**

	Engines – S.I. Engine and C.I. Engine: Differences – P-V and T-S Diagrams.	
UNIT III	**REFRIGERATION SYSTEM AND HEAT TRANSFER** Principle and Working of Standard Vapour Compression Refrigeration System and Brief description of Refrigerants – Modes of Heat Transfer – Thermal Resistance Concept – Conduction: Composite Walls and Cylinders – Combined Conduction and Convection: Overall Heat Transfer Co-efficient.	**9**
UNIT IV	**MANUFACTURING PROCESSES, MACHINE TOOLS AND MACHINING PROCESSES** Engineering Materials: Classification – Properties of Materials – Manufacturing Processes: Metal Casting – Moulding – Patterns – Metal Working: Hot Working and Cold Working – Metal Forming: Extrusion – Forging – Rolling – Drawing – Welding: Welding: Gas Welding and Arc Welding – Soldering – Brazing – Lathe Machine – Lathe Operations – Milling Machine-Types – Milling Operations – Shaper and Planer Machines: Differences – Quick-Return Motion Mechanism – Drilling Machine: Operations – Grinding Machine: Operations.	**9**
UNIT V	**POWER TRANSMISSION AND AUTOMOTIVE VEHICLE** Transmission of Mechanical Power: Belt Drives – Simple Numerical Problems – Gear Drives – Simple Numerical Problems – Layout of Automobile Transmission – Brakes – Types – Clutch – Differential.	**9**
		Total: 45 Hours

TEXT BOOKS	
1.	Rudramoorthy R, "*Thermal Engineering*", Tata McGraw Hill Book Company, New Delhi, 2003
2.	Hazra Chowdary, S.K. and Bose, "*Workshop Technology*", Vol. I and II, Media Promoters and Publishers Pvt. Ltd., 2002
REFERENCE BOOKS	
1.	P. L. Ballaney, "*Thermal Engineering: Engineering Thermodynamics and Energy Conversion Techniques*", Khanna Publishers, 5th Edition, 2010.
2.	Roy, K.P., and Hazra Chowdary, S.K.., "*Elements of Mechanical Engineering*", Media Promoters and Publishers Pvt. Ltd., 2002
3.	R S Khurmi, "*Theory Of Machines*", S CHAND, 14th Edition, 2005.
4.	Kirpal Singh, "*Automobile Engineering*", Vol I,II – Standard Publishes Distributors - Delhi 13th Edition, 2012.

U15BEE205R	BASIC ELECTRICAL ENGINEERING	L	T	P	C	M
		2	2	0	3	100

Course Outcomes

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

1. analyze the behavior of circuit elements in electric circuits.
2. explain the principles of operation of magnetics circuits and transformers.
3. analyze the electromagnetic energy conversion and operating principle of three phase induction motors.
4. analyze the construction and working principles of synchronous machines and DC machines.
5. explain the principles of operations of single phase induction and stepper motors.

UNIT I	**Fundamental laws of Electrical Engineering and Circuit Elements** Electric Current – Coulomb's Law – Ohm's Law – Faraday's Law of Electromagnetic Induction – Kirchhoff's Laws – Ideal Independent Current and Voltage Sources – Reference Directions and Symbols – Energy and Power – Resistance Parameter – Inductance Parameter –Capacitance Parameter – Series and Parallel Combinations of Resistances – Series and Parallel Combinations of Capacitances – Series and Parallel Combinations of Inductances –RLC Series-Parallel Circuits– Resonance – Delta-Star and Star-Delta Transformations.	**15**
UNIT II	**Magnetic Circuits and Transformers** Ampere's Law – Basic Definition: Flux, Flux Density, Field Strength, Permeability, Reluctance, Permeance – Theory of Magnetism –Hysteresis and Eddy-Current Losses - Magnetic Circuit -Self Inductance, Mutual inductance, Co-efficient of Coupling- Comparison between Electric and Magnetic Circuits–Transformers – Theory of Operation and Development of Phasor Diagrams – Equivalent Circuit–Parameters from No-Load Tests – Efficiency and Voltage Regulation.	**12**
UNIT III	**Electromagnetic Energy Conversion and Three Phase Induction motor** Introduction-Basic Analysis of Electromagnetic Torque - Three Phase Induction Motor – Revolving Magnetic Field –	**12**

	Construction- Working Principle- Types-Speed-Torque Characteristic – Starting Torque and Maximum Developed Torque – Parameters from No Load and Blocked rotor Tests – Equivalent Circuit – Applications of Three phase Induction Motors.	
UNIT IV	**Three Phase Synchronous Machines and DC Machines** Generation of a Three Phase Voltage– Synchronous Generator-construction and working principle-Phasor Diagram and Equivalent Circuit. DC Machines- DC Generator-construction–working principle- EMF equation-Types of DC Generator, DC motor-working principle –Types of DC Motor-Motor Speed torque Characteristics-starters for DC Motors.	**12**
UNIT V	**Single Phase Induction Motors and stepper Motors** Single Phase Induction Motor-Construction-working principle-Types: capacitor start induction motor-Capacitor start capacitor run induction motor-shaded pole induction motor– Applications – Stepper Motors – Construction- working principle- types: permanent magnet stepper motor-variable reluctance stepper motor and hybrid stepper motor-Applications.	**9**
		Total: 60 Hours

TEXT BOOKS

1.	B.L. Theraja and A. K. Theraja, "A Text Book of Electrical Technology", S.Chand Publication, Vol 2, 2014.
2.	A. Sudhakarand S.P Shyam Mohan, "Circuits, Network Analysis and Synthesis", Tata McGraw Hill, Fifth Edition, 2015.

REFERENCE BOOKS

1.	D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", TataMcGraw Hill, Fourth Edition, 2011.
2.	V.K.Metha, RohitMetha, "Principles of Electrical Engineering and Electronics", Second edition, S.Chand Publication, 2015.
3.	S.K.Bhattacharya "Basic Electrical and Electronics Engineering" Pearson Education India, 2012.
4.	V.N. Mittle and Aravind Mittal "Basic Electrical Engineering", Tata McGraw Hill, Second edition, 2005.

U15CHE204BR	ENVIRONMENTAL ENGINEERING SCIENCE	L T P C M 3 0 0 3 100

Course Outcomes
At the end of the course, the students will be able to,

1. explain the eco system components and the various types of biomes.
2. describe the concepts of ecosystem and Biodiversity.
3. describe about natural resources like food, soil, water and minerals.
4. identify the problems in air, Energy, ozone, global warming and can suggest remedial measures.
5. Analyses the Indian scenario in human population and the environment.

UNIT I	**HUMANS AND SUSTAINABILITY, ECOLOGY AND SUSTAINABILITY, ECOSYSTEMS, EVOLUTION, CLIMATE AND BIODIVERSITY** Living More Sustainability – Population Growth-Economic Growth-Economic Development – Resources – Environmental Problems Causes and Connections. The Nature of Ecology – The Earth Life Support Systems – Ecosystem Components – Energy Flow in Ecosystems – Matter Cycling in Ecosystems. Origin Of Life – Evolution and Adaption – Ecological Niches and Adaption – Speciation – Extinction and Biodiversity. Desert and Grassland Biomes – Forest and Mountain Biomes – Saltwater Life Zones.	**9**
UNIT II	**COMMUNITY ECOLOGY AND SUSTAINING BIODIVERSITY** Community Structure and Species Diversity – Types of Species – Species Interactions – Ecological Succession-Communities in Transition – Population Dynamics and Carrying Capacity – Human Impacts on Ecosystems -Learning from Nature. Human Impacts on Biodiversity – Managing and Sustaining Forests – Forest Resource and Management – Tropical Deforestation – National Parks – National Reserves – Ecological Restoration – Sustaining Aquatic Biodiversity. Introduction to Biodiversity in India – Understanding Biodiversity – India as a Megadiversity Nation – Endangered and Endemic Species – Threats to Biodiversity – Conservation of Biodiversity. The Legal Approach and The Sanctuary Approach – Reconciliation Ecology.	**9**

UNIT III	**FOOD SOIL AND PEST MANAGEMENT, WATER AND WATER POLLUTION AND NON-RENEWABLE MINERALS** Food Production – Nutrition and Environmental Effects – Increasing Food Production – Protecting Food Resources -Pest Management – Solution-Sustainable Agriculture - Soil Erosion and Degradation – Soil Conservation. Water's Importance-Use and Renewal – Supplying More Water – Reducing Water Wastage – Too Much Water – Water Pollution-Types-Effects and Sources – Pollution of Freshwater Streams –Lakes and Aquifers – Mineral resources - Environmental Effects of Using Mineral Resources.	**9**
UNIT IV	**ENERGY, AIR POLLUTION, CLIMATE CHANGE AND OZONE LOSS, SOLID AND HAZARDOUS WASTE** Evaluating Energy Resources – Non-Renewable Fossil Fuels – Non-Renewable Nuclear Energy – Improving Energy Efficiency – Using Renewable Energy to Provide Heat and Electricity – Geothermal Energy – Hydrogen – A Sustainable Energy Strategy. Structure and Science of the Atmosphere – Outdoor Air Pollution – Photochemical and Industrial Smog – Regional Outdoor Air Pollution from Acid Deposition – Indoor Air Pollution – Harmful Effects of Air Pollution – Preventing and Reducing Air Pollution. Past Climate Change and The Natural Greenhouse Effect – Climate Change and Human Activities – Factors Affecting the Earth's Temperature – Possible Effects of a Warmer World – Dealing With the Threat of Global Warming – Ozone Depletion in the Stratosphere – Protecting the Ozone Layer. Wasting Resources – Producing Less Waste – The Eco-industrial Revolution and Selling Services Instead of Things – Reuse – Recycling – Burning and Burying Solid Waste.	**9**
UNIT V	**SUSTAINABILITY: THE INDIAN SCENARIO, HUMAN POPULATION AND THE ENVIRONMENT** Environmental Ethics – The Population Scenario-India and The World – Variation of Population Among Nations – Population Control – Environment and Human Health – Human Rights – Value Education – HIV/AIDS – Woman and Child Welfare.	**9**
		Total: 45 Hours

TEXT BOOK	
1.	G .Tyler Miller,Jr.., "*Environmental science*" , Thomson south-western, 11th Edition , 2007
REFERENCE BOOKS	
1.	Mackenzie l. Davis, Susan J.Masten, *"Environmental engineering and science*", Mc-Graw Hill Education (India) Pvt. Ltd., New Delhi, 2013
2.	William W Nazarof and Lisa Alvarez-Cohen, *"Environmental Engineering Science",* John wiley, 2014
3.	Anubha Kaushik – C.P. Kaushik, "*Environmental Science and engineering*", New age international (p) Ltd. Publishers, 2006

U15BEE205R	BASIC ELECTRICAL ENGINEERING	L T P C Marks 3 0 0 3 100

Course Outcomes

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

1. analyze the behavior of circuit elements in electric circuits.
2. explain the principles of operation of magnetics circuits and transformers
3. analyze the electromagnetic energy conversion and operating principle of three phase induction motors.
4. analyze the construction and working principles of synchronous machines and DC machines.
5. explain the principles of operations of single phase induction and stepper motors.

UNIT I	**FUNDAMENTAL LAWS OF ELECTRICAL ENGINEERING AND CIRCUIT ELEMENTS** Electric Current – Coulomb's Law – Ohm's Law – Faraday's Law of Electromagnetic Induction – Kirchhoff's Laws – Ideal Independent Current and Voltage Sources – Reference Directions and Symbols – Energy and Power – Resistance Parameter – Inductance Parameter –Capacitance Parameter – Series and Parallel Combinations of Resistances – Series and Parallel Combinations of Capacitances – Series and Parallel Combinations of Inductances –RLC Series-Parallel Circuits– Resonance – Delta-Star and Star-Delta Transformations.	**15**
UNIT II	**MAGNETIC CIRCUITS AND TRANSFORMERS** Ampere's Law – Basic Definition: Flux, Flux Density, Field Strength, Permeability, Reluctance, Permeance – Theory of Magnetism –Hysteresis and Eddy-Current Losses - Magnetic Circuit -Self Inductance, Mutual inductance, Co-efficient of Coupling- Comparison between Electric and Magnetic Circuits–Transformers – Theory of Operation and Development of Phasor Diagrams – Equivalent Circuit–Parameters from No-Load Tests – Efficiency and Voltage Regulation.	**12**

UNIT III	**ELECTROMAGNETIC ENERGY CONVERSION AND THREE PHASE INDUCTION MOTOR** Introduction-Basic Analysis of Electromagnetic Torque - Three Phase Induction Motor – Revolving Magnetic Field – Construction- Working Principle- Types-Speed-Torque Characteristic – Starting Torque and Maximum Developed Torque – Parameters from No Load and Blocked rotor Tests – Equivalent Circuit – Applications of Three phase Induction Motors.	**12**
UNIT IV	**THREE PHASE SYNCHRONOUS MACHINES AND DC MACHINES** Generation of a Three Phase Voltage– Synchronous Generator-construction and working principle-Phasor Diagram and Equivalent Circuit. DC Machines- DC Generator-construction–working principle- EMF equation-Types of DC Generator, DC motor-working principle –Types of DC Motor-Motor Speed torque Characteristics-starters for DC Motors.	**12**
UNIT V	**SINGLE PHASE INDUCTION MOTORS AND STEPPER MOTORS** Single Phase Induction Motor-Construction-working principle-Types: capacitor start induction motor-Capacitor start capacitor run induction motor-shaded pole induction motor– Applications – Stepper Motors – Construction- working principle- types: permanent magnet stepper motor-variable reluctance stepper motor and hybrid stepper motor-Applications.	**9**
		Total: 60 Hours

TEXT BOOKS	
1.	B.L. Theraja and A. K. Theraja, “A Text Book of Electrical Technology”, S.Chand Publication, Vol 2, 2014.
2.	A. Sudhakarand S.P Shyam Mohan, “Circuits, Network Analysis and Synthesis”, Tata McGraw Hill, Fifth Edition, 2015.
REFERENCE BOOKS	
1.	D.P. Kothari and I.J. Nagrath, “Basic Electrical Engineering”, TataMcGraw Hill, Fourth Edition, 2011.
2.	V.K.Metha, RohitMetha, “Principles of Electrical Engineering and Electronics”, Second edition, S.Chand Publication, 2015.
3.	S.K.Bhattacharya “Basic Electrical and Electronics Engineering” Pearson Education India, 2012.
4.	V.N. Mittle and Aravind Mittal “Basic Electrical Engineering”, Tata McGraw Hill, Second edition, 2005.

U15PCL206CR	PHYSICS AND CHEMISTRY LABORATORY - II	L T P C M 0 0 4 2 100

Course Outcomes

At the end of the course, the student will be able to,

1. apply the principles of optics, electricity and elasticity to determine the engineering properties of materials.
2. evaluate the amount of iron content in the given sample using spectrophotometry, analyze the amount of chloride in a domestic water sample and analyse the quality of brass by estimating copper.
3. determine the resistivity of the given fuse wire used for house hold applications and determine the dissolved oxygen in two different water samples collected from the students residential areas.

List of Experiments (PHYSICS PART)

1.	Determination of rigidity modulus of the material using torsion pendulum.
2.	Determination of coefficient of viscosity of the given liquid using Poiseuille's method
3.	Determination of specific resistance of a given wire using Carey-Fosters bridge.
4.	Determination of Young's modulus of the material by uniform bending method.
5.	Determination of wavelength of the spectral lines using a spectrometer.
6.	Determination of band gap energy of a semiconductor diode

List of Experiments (CHEMISTRY LAB)

1.	Determination of dissolved oxygen in water by Winkler's method.
2.	Estimation of chromium in waste water.
3.	Determination of fluoride in water.
4.	Estimation of iron in water by spectrophotometric method.
5.	Estimation of chloride in water by argentometric method.
6.	Estimation of copper in brass solution by EDTA method.

Total:60 Hours

U15EPL207R	ENGINEERING PRACTICES LABORATORY	L	T	P	C	M
		0	0	4	2	100

Course Outcomes

Civil Lab

At the end of experiments, the students will be able to,

1. plan the pipe connections using PVC, G.I pipes
2. analyze the process of wood separation with proper types of joints using tools and machines

COURSE OUTCOMES

Mechanical Lab

At the end of experiments, the students will be able to,

1. Demonstrate the method of material removal from metal components and assemble the components using sheet metals.

COURSE OUTCOMES

Electrical and Electronics Lab

At the end of experiments, the students will be able to -

1. Measure and draw basic wave forms using function generator & CRO.
2. Make simple electronics circuit using passive components and general purpose PCB.
3. Connecting electrical devices and verifying their practical application.

List of Experiments:

	Civil Lab
	Plumbing work
1.	Basic pipe connections (PVC) involving the fittings like valves, taps, and bends.
2.	Mixed pipe (PVC and G.I) connections involving the fitting like valves, taps, and bends.
	Carpentry work
3.	Planning, lap joint and cross lap joint.
	Mechanical Lab
	Sheet metal work

1.	Design of square tray and funnel.
	Fitting work
2.	L-joint, V-joint
3.	Demonstration of welding classes
	Electrical and Electronics Lab
1.	Study of passive components.
2.	Measurement of waveform using CRO.
3.	Verification of truth tables of logic gates.
4.	Soldering practice using general purpose PCB.
5.	Residential house electrical wiring. 1. Stair case wiring 2. Doorbell Wiring
6.	Measurement of power factor using fluorescent lamp.
7.	Measurement of energy using energy meter for single phase system resistive load.

U15BEEL208R	BASIC ELECTRICAL ENGINEERING LABORATORY	L	T	P	C	M
		0	0	4	2	100

Course Outcomes

At the end of experiments, the students will be able to,

1. apply basic circuit laws for calculating electric parameters of DC circuits.
2. determine and draw the mechanical, electrical and performance characteristics of DC Machines.
3. determine the efficiency and regulation of transformer under load and no load conditions.

List of Experiments:

1.	Verification of Kirchhoff's laws.
2.	Verification of mesh analysis.
3.	Measurement of RLC series and parallel parameters.
4.	Measurement of RLC series and parallel resonance parameters.
5.	Open circuit and load characteristics on separately excited DC shunt generator.
6.	Load characteristics on DC shunt motor.
7.	Speed control of DC shunt motor.
8.	Load test on 3 phase induction motor.
9.	Speed control of 3 phase induction motor.
10.	Open circuit and short circuit test on single phase transformer.
11.	Load test on single phase transformer.
	Total: 60 Hours

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15MAT301CR	Transforms and Linear Algebra	3	2	0	4
2	U15EC301R	Electronic Devices	3	0	0	3
3	U15EC302R	Network Analysis and Synthesis	3	2	0	4
4	U15EC303R	Digital System Design	3	0	0	3
5	U15EC304R	Signals and Systems	3	2	0	4
Practical						
6	U15EC305R	Electronic Devices Laboratory	0	0	2	1
7	U15EC306R	Digital Laboratory	0	0	2	1
8	U15ENG302R	English Laboratory	0	0	4	2
9	U15GE301R	Soft Skills and Aptitude - I	0	0	2	1
					Total Credits	**23**

Approved By

Chairman, Electronics and Communication Engineering BoS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electronics and Communication Engineering, Third Semester BE ECE Students and Staff, COE

U15MAT301CR **TRANSFORMS AND LINEAR ALGEBRA** **L T P C**
3 2 0 4

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Explain the concepts of Fourier series and generation of Fourier series for different mathematical functions
2. Form partial differential equations and solve standard types of first order PDE and linear PDE of second order with constant coefficients
3. State Z – transform, discuss its properties, state and apply convolution theorem of Z-transform to various functions, form and solve the difference equations.
4. Define and explain vector spaces, linear independence and dependence of vectors and dimension of vector spaces
5. Describe linear operator, state rank-nullity theorem and apply the same to solve problems

UNIT I **FOURIER SERIES** **15**

Dirichlet's Conditions – General Fourier Series – Fourier Series of Odd and Even Functions – Fourier Series for Functions of Period 2L – Half Range Sine and Cosine Series – Practical Harmonic Analysis.

UNIT II **PARTIAL DIFFERENTIAL EQUATIONS** **15**

Formation of Partial Differential Equations – Partial Differential Equations of First Order - Linear Partial Differential Equations of First Order - Non-Linear Partial Differential Equations of First Order – Homogeneous Linear Partial Differential Equations with Constant Coefficients – Non-Homogeneous Linear Partial Differential Equations with Constant Coefficients – Solution of Second Order Partial Differential Equation.

UNIT III **LINEAR DIFFERENCE EQUATIONS AND Z-TRANSFORMS** **15**

Linear Difference Equations - Homogeneous Equations – Second Order Linear Homogeneous Difference Equations with Constant Coefficients – Non-Homogeneous Equations – Z-Transforms – Inverse Z-Transforms – Properties of Z-Transforms with worked out Examples.

UNIT IV **VECTOR SPACES** **15**

Vector Spaces – Linear Combinations – Subspaces - Union of subspaces - Sums of Subspaces - Distributive Subspaces – Spans - Equality of Spans - Special Spans – Dependence and Independence of Vectors – Basis of a Vector Spaces – Dimensions of Vector Spaces

UNIT V **LINEAR TRANSFORMATIONS** **15**

Linear Transformations - Domain and Range - Kernel - Composition - Range Inclusion and Factorization – Transformations as Vectors – Invertibility – Determinants-2x2 - nxn - Zero-One Matrices – Invertible Matrix Bases – Finite-Dimensional Invertibility – Matrices – Diagonal Matrices – Rank Nullity Theorem – Matrix Representation of Linear Operator, Change of Basis Matrix

Total 75

TEXT BOOKS

1. Ramana B.V, *"Higher Engineering Mathematics*", McGraw Hill Education (India) Pvt., Ltd., New Delhi, 2007
2. Seymour Lipschitz, Marc Lipson, "*Linear Algebra Schaum's outline series*", 4th Edition, 2005

REFERENCE BOOKS

1. Veerarajan.T., "*Engineering Mathematics*" 3rd Edition, Tata McGraw Hill, 2008
2. Erwin Kreysizig, "*Advanced Engineering Mathematics*", John Wiley and Sons, 10 e, 2010
3. Sharma J.N., Vasistha, "*Linear Algebra*", 11th Edition, Krishna Prakashan Media Pvt., Ltd., 2010
4. Paul R. Halmos, "*Finite Dimensional Vector Spaces*", Springer-Verlag, New York, 1958

U15EC301R **ELECTRONIC DEVICES** **L T P C**

3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Study and analyze the behavior of semiconductor devices
2. Characterize the current flow of a bipolar transistor in CB,CE and CC configurations
3. Bias the transistors and FETs for amplifier applications
4. Study and analyze amplifier circuits using MOSFETs
5. Design BJT amplifiers with h- parameters

UNIT I **SEMICONDUCTOR THEORY AND SEMICONDUCTOR DIODES** **9**

Energy Band Theory of Crystals – Insulators – Semiconductors – Metals – Mobility and Conductivity – Electrons and Holes in an Intrinsic Semiconductor – Donor and Acceptance Impurities – Charge Densities in a Semiconductor –The Hall Effect – Diffusion & Drift Current – The Continuity Equation–PNJunction –Forward and Reverse Bias of PN Diode – The Current Components in a *PN* Diode – The Volt–Ampere Characteristic – The Temperature Dependence of the *V/I* Characteristic – Diode Resistance – Space Charge or Transition Capacitance C_T – Charge-Control Description of a Diode – Diffusion Capacitance.

UNIT II **SPECIAL DIODES AND BJT** **9**

Breakdown Diodes – The Tunnel Diode – The Semiconductor Photodiode – The Photovoltaic Effect – Light Emitting Diode – The Junction Transistor – Transistor Current Components – The Transistor as an Amplifier – Transistor Construction – The Common base Configuration – The Common Emitter Configuration – The CE Cut-off Region – The CE Saturation Region – Common Emitter Current Gain – The Common Collector Configuration – Analytical Expressions for Transistor Characteristics –The Phototransistor.

UNIT III **TRANSISTOR BIASING AND THERMAL STABILIZATION** **9**

The Operating Point – Bias Stability – Fixed Bias – Collector to Base Bias and Voltage Divider Bias – Stability Factor– Stabilization Against Variations in I_{CO}– V_{BE} and β –Bias Compensation — Thermistor and Sensistor Compensation –Thermal Runaway – Thermal Stability –The Junction Field effect Transistor – The Pinch off Voltage V_P – The JFET Volt–ampere Characteristics –The FET Small signal Model.

UNIT IV **MOSFET AND SPECIAL DEVICES** **9**

The Metal-oxide-semiconductor FET (MOSFET) – The Low–frequency Common Source and Common Drain Amplifiers – Biasing the FET – The FET as a Voltage Variable Resistor (VVR) – The Common Source Amplifier at High Frequencies – The Common Drain Amplifier at High Frequencies - Construction & Characteristics of UJT- SCR- TRIAC- DIAC.

UNIT V **LOW AND HIGH FREQUENCY ANALYSIS OF BJT** **9**

Two–port Devices and the Hybrid Model – Transistor Hybrid Model– The *h* Parameters – Conversion Formulas for the Parameters of the Three Transistor Configurations – Analysis of a Transistor Amplifier Circuit Using *h* Parameters – Linear Analysis of a Transistor Circuit–Miller's Theorem and Its Dual – The Hybrid–pi (p) Common – emitter Transistor Mode – Hybrid–*p* Conductance – The Hybrid–*p* Capacitances – Validity of Hybrid–*pi* Model – Variation of Hybrid–*pi* Parameters – The CE Short circuit Current Gain–Single stage CE Transistor Amplifier Response – The Gain–bandwidth Product – Emitter Follower at High Frequencies.

Total 45

TEXT BOOKS

1 Millman and Halkias, "*Integrated Electronics*", 2nd Edition, Tata Mc Graw Hill, 2010.

2 Anil K. Maini and Varsha Agrawal, "*Electronics Devices and Circuits"*, First Edition, Wiley Publications, 2009.

REFERENCE BOOKS

1 Y.N. Bapat, "*Electronic devices and circuits, Discrete and Integrated*", 3rd Edition, Tata Mc Graw Hill, 2011

2 S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, *"Electronic Devices and Circuits*", 2nd Edition, TMH, 2007.

U15EC302R	NETWORK ANALYSIS AND SYNTHESIS	L	T	P	C
		3	2	0	4

COURSE OUTCOMES

At the end of each unit, the students will be able to –

1. Solve network problems using mesh current and node voltage equations
2. Formulate and solve network equations using differential equations and thus, to design resonant circuits
3. Compute responses of first order and second order networks using time domain analysis and Laplace transforms
4. Analyze the circuits using network theorems
5. Synthesize one port and two port networks using transfer functions

UNIT I **NETWORK CONVENTIONS AND NETWORK EQUATIONS** **15**

Reference Directions for Current and Voltage – Active Element Conventions – The Dot Convention for Coupled Circuits – Topological Description of Networks — Kirchhoff's Laws –Source Transformations – Loop Variable in DC Analysis – Node Variable in DC Analysis –Star to Delta and Delta to Star Transformations- Duality – State Variable Analysis.

UNIT II **TIME DOMAIN DC ANALYSIS AND INITIAL CONDITIONS IN NETWORKS** **15**

General and Particular Solution using Differential Equations – Time Constants –The Integrating Factor – Initial Conditions in Elements – Geometrical Interpretation of Derivatives – A Procedure for Evaluating Initial Conditions – Initial State of a Network – Second Order Differential Equations for Internal Excitation.

UNIT III **APPLICATIONS OF LAPLACE TRANSFORMS IN CIRCUIT THEORY** **15**

The Laplace Transformation –Basic Theorems for the Laplace Transform –Examples of the Solution of Problems using Laplace Transformation – Partial Fraction Expansion – Heaviside's Expansion Theorem –The Shifted Unit Step Function –The Ramp and Impulse Functions – Waveform Synthesis – The Initial and Final Values of *f(t) and F(s)* – The Convolution Integral – Convolution as a Summation.

UNIT IV **IMPEDANCE FUNCTIONS AND NETWORK THEOREMS** **15**

The Concept of Complex Frequency – Transform Impedance and Transform Circuits – Series and Parallel Combinations of Elements – Superposition and Reciprocity Theorem.– Thevenin's and Norton's Theorem – Maximum Power Transfer Theorem – Tellegen's Theorem.

UNIT V **SYNTHESIS OF ONE PORT AND TWO PORT NETWORKS** **15**

Properties of L-C Immittance Functions – Synthesis of L-C Driving-Point Immittances– Properties of R-C Driving Point Impedances – Synthesis of R-C Impedance or R-L Admittances – Properties of R-L Impedances and R-C Admittances – Properties of Transfer Functions – Zeros of Transmission.

Total **75**

TEXT BOOKS

1. M.E.VanValkenberg, "*Network Analysis*", Prentice Hall India, 3rd E, 2002
2. A. Sudhakar, Shyammohan S Palli, *"Circuits and networks Analysis &Synthesi"*, 4ndE,Tata McGraw Hill, 2010.

REFERENCE BOOKS

1. B. Somanathan Nair, S. R. Deepa, "*Network Analysis and Synthesis*", Reed Elsevier India Pvt. Ltd., 2012
2. F. F. Kuo, "*Network Analysis and Synthesis*", 2nd E, John Wiley, 2005
3. Charles A Desoer, Ernest S Kuh, "*Basic Circuit Theory*", McGraw Hill, 1969

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Explain number systems, logic gates, logic functions and simplify Boolean functions
2. Design and analyze combinational and sequential logic circuits through HDL models
3. Optimize combinational and sequential logic circuits
4. Design and implement shift registers and counters digital circuits
5. Design and Implement a memory cell and programmable logic devices

UNIT I **NUMBER SYSTEM, BOOLEAN ALGEBRA AND LOGIC GATES** **9**

Review of Number Systems – Boolean Algebra – Basic Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Digital Logic Gates – Integrated Circuits – Map Method – Four Variable K-map – POS Simplification – Don't Care Conditions – Tabulation method - NAND and NOR Implementation – XOR Functions – TTL – ECL – CMOS Logic Circuits – Fan-in – Fan-out.

UNIT II **COMBINATIONAL CIRCUIT DESIGN** **9**

Combinational Circuits – Analysis Procedures – Design Procedures – BCD to Excess-3 – Binary Adders and Subtractors – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – Demultiplexers-Introduction to Verilog – HDL Models for Combinational Circuits.

UNIT III **SYNCHRONOUS SEQUENTIAL LOGIC** **9**

Sequential Circuits – SR Latch – D-Latch – D-JK-T Flip-Flops – Master Slave JK Flip-Flop – Conversion of Flip Flops – Analysis of Clocked Sequential Circuits – State Diagram – State Table – State Reduction and Assignment – Verilog HDL Models for Synchronous Sequential Circuits.

UNIT IV **REGISTERS AND COUNTERS** **9**

Registers – Shift Registers – SISO – SIPO – PIPO — Synchronous Counters – Up-down Binary Counter – Ring Counter – Johnson Counters – Asynchronous Counters – Asynchronous Design Procedure – Race Free State Assignment – Hazards – Verilog HDL Models for Registers and Counters.

UNIT V **MEMORY AND PROGRAMMABLE LOGIC** **9**

Classification of memories: RAM-ROM-PROM-EPROM-EEPROM - Memory Decoding –Implementation of combinational logic using PROM - Programmable Logic Array – Programmable Array Logic – HDL Implementation of Simple Test Bench for 4-bit Binary Adder .

Total 45

TEXT BOOK

1. M. Morris Mano and Michael D. Ciletti – '*Digital Design with an Introduction to the Verilog HDL*', 5th E, Pearson Education, 2013

REFERENCE BOOKS

1. John F Wakerly – '*Digital Design Principles and Practices*', 3rd Edition, Prentice Hall India, 2001.

2. ZviKohavi, '*Switching and Finite Automata Theory'*, Princeton University, New Jersey, 3rd E, 2009.

3. Schilling, Herbert Taub and Donald, 'Digital Integrated Electronics', Tata McGraw-Hill, 2008.

4. JayaramBhasker, '*A Verilog HDL Primer'*, 2nd E, BS publications, 2001

U15EC304R	SIGNALS AND SYSTEMS	L T P C 3 2 0 4

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Classify the signals as continuous time and discrete time signals and classify systems based on their properties
2. Determine the response of LTI system using convolution sum for DT system and Convolution Integral for CT system
3. Apply Fourier series and Fourier Transform for periodic Signals
4. Analyze system using Laplace transform and realize the structure for CT system
5. Analyze system using Z transform and realize the structure for DT system

UNIT I **CLASSIFICATION OF SIGNALS AND SYSTEMS** **15**

Continuous-Time and Discrete-Time signals–The Unit Impulse Unit Step, Unit Ramp Signals and other Basic Signals – Operation of Signals -Time Shifting – Time Reversal – Amplitude Scaling – Time Scaling – Signal Addition – Multiplications – Continuous-Time and Discrete-Time Systems– Basic System Properties - Systems With and Without Memory – Causality – Stability – Time Invariance – Linearity.

UNIT II **LINEAR TIME- INVARIANT SYSTEMS** **15**

Discrete-Time LTI system: TheConvolution sum-tabulation method-matrix multiplication method-graphical and analytical approach – Solution of Difference Equations.

Continuous-Time LTI Systems: The Convolution Integral - graphical and analytical approach – Properties of Linear Time-Invariant Systems – Solution of Differential Equations.

UNIT III **ANALYSIS OF CT SIGNALS USING FOURIER SERIES & FOURIER TRANSFORM** **15**

Fourier Series Representation(Trigonometric and Exponential) of Continuous-Time Periodic Signals – Properties of Continuous-Time Fourier Series – Representation of Aperiodic Signals: The Continuous-Time Fourier Transform – The Fourier Transform for Periodic Signals – Properties of the Continuous-Time Fourier Transform – The Convolution Property – The Multiplication Property

UNIT IV **ANALYSIS OF SIGNALS AND SYSTEMS USING LAPLACE TRANSFORM** **15**

The Laplace Transform – The Region of Convergence for Laplace Transform– The Inverse Laplace Transform using Partial fraction– Properties of the Laplace Transform– System Function and Block Diagram Representations-Direct Form I and Direct Form II.

UNIT V **ANALYSIS OF SIGNALS AND SYSTEMS USING Z-TRANSFORM** **15**

The Z-Transform – The Region of Convergence for the Z-Transform –The Inverse Z-Transform using Partial fraction and Long division method– Properties of the Z-Transform – System Function and Block Diagram Representations-Direct Form I and Direct Form II.

Total 75

TEXT BOOKS

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, "*Signals and Systems*", 2nd E, Prentice Hall India, 2010
2. A.Anand Kumar, "*Signals and Systems*", 3rd Edition, Prentice Hall India,2013

REFERENCE BOOKS

1. M .J. Roberts, "*Signals & Systems Analysis using Transform Methods & MATLAB*", Tata McGraw Hill, 2007
2. A. NagoorKani, "*Signals & Systems*", Tata McGraw Hill, 2010
3. John G. Proakis, Dimitris G. Manolakis, "*Digital Signal Processing, Principles, Algorithms, and Applications*", 4th E, PHI, 2007
4. Robert A. Gable, Richard A. Roberts, "*Signals & Linear Systems*", 3rd E, John Wiley, 1995
5. Edward W Kamen& Bonnie's Heck, "*Fundamentals of Signals and Systems*", Pearson Education, 2007

U15EC305R **ELECTRONIC DEVICES LABORATORY**

L	T	P	C
0	0	2	1

COURSE OUTCOMES

At the end of each experiment, the students will be able to -

1. Operate electronic test equipment and hardware tools and to use the same for conducting experiments.
2. Draw and analyze VI characteristics of various diodes.
3. Analyze the input and output characteristics of various transistors and plot the frequency response of amplifier circuits.

Exp.No List of Experiments:

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1. Study of
    i. Cathode Ray Oscilloscope and DSO
    ii. Regulated Power Supply, Single and Dual Mode
    iii. Sine, Square, and Triangular Waves Function Generator
    iv. Bread Board – Connection Conventions
2. To draw and analyze V-I Characteristics of given Si and Ge Diodes
3. To draw and analyze V-I Characteristics of Zener Diode and Prove that the output voltage gets regulated after the breakdown voltage for variable input voltage in the range of 0.5 V to 8 V of a given Zener Diode
4. To draw and analyze the Input and Output Characteristics of BJT (NPN)
5. To draw and AnalyzeFrequency Response of BJT (CE) using Fixed Bias Amplifier Circuit
6. To draw and analyze Frequency Response of BJT (CE) using Voltage Divider Bias (self-bias) with and without bypassed Emitter Resistor (CE)
7. To draw and analyze the Characteristics of N-channel JFET
8. To draw and analyze the Characteristics of N-channel MOSFET
9. To draw and analyze Characteristics of the following Special Diodes
    i. Tunnel diode
    ii. Photo diode
    iii. Light emitting diode

Total Hours:30

U15EC306R **DIGITAL LABORATORY**

L	T	P	C
0	0	2	1

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Design and implement combinational circuits using logic gates and breadboards
2. Design and implement sequential circuits using logic gates and breadboards
3. Write programs in Verilog HDL for structural, behavioral and data flow models for combinational and sequential circuits

Exp. No. List of Experiments:

1. Design and implementation of
   (a) Half Adder and Full Adder, Half Subtractor and Full Subtractor
   (b) 4-bit Parallel Adder cum Subtractor
   (c) Magnitude Comparator
2. Design and implementation of
   (a) Code Converters – Binary to Gray and Gray to Binary
   b) BCD to Excess 3 and Excess 3 to BCD
3. Design and implementation of
   (a) Multiplexer and Demultiplexer
   (b) Decoder
   (c) Encoder
   (d) Parity Generator and Checker
4. Design and implementation of
   (a) Asynchronous Counter
   (b) Synchronous Counter
5. Design and implementation of
   (a) Shift Registers – SISO, SIPO and PIPO
6. Write a Verilog HDL program for combinational circuits
   (a) Basic gates – AND, OR, NOT, NAND, NOR, EXOR
   (b) Half Adder and Full Adder, Half Subtractor and Full Subtractor
   (c) Magnitude Comparator
7. Write a Verilog HDL program for sequential circuits
   a) Flip Flops – SR, JK, T and D
   b) Asynchronous Counter
   c) Synchronous Counter

Total Hours:30

U15ENG302R	ENGLISH LABORATORY	L	T	P	C
		0	0	4	2

COURSE OUTCOMES

At the end of each experiment, the students will be able to -

1. Demonstrate active listening skills
2. Read fluently and comprehend the given texts.
3. Make power point presentations and perform effectively in interviews and group discussions

List of Experiments:

1. Listening comprehension

   A pre-recorded audio for 7 minutes is to be played twice and a passage with blanks in it is to be given to the students. The students have to fill in the blanks by typing appropriate words based on the audio.

2. Reading comprehension

   Based on a given passage, the students have to read and do the following exercises:

   a. Sentence completion with one word substitution is to be given to students, according to the passage the students have to click the correct option.
   b. Multiple choice questions are to be given and the students have to click the correct option.
   c. Vocabulary in the form of synonyms and antonyms is to be given and the students have to click the correct option

3. Face to face conversations and role play activities

   A situation is to be given and the students have to take up roles and engage in conversations. The students are to be assessed on the following areas -

   a. Justification to the role given
   b. Clarity, audibility and fluency
   c. The contents of the conversation
   d. Body language

4. Making presentations

   Students need to make individual presentation for 5 to 10 minutes approximately by using power point (ppts).

   Marks are to be awarded based on the following criteria:

   a. Body language (facial expression, gestures and posture)
   b. Content (the subject matter, introduction and conclusion)
   c. Language (fluency, grammatical accuracy)
   d. Effective use of the power point (style of designing the slides, space, font size and focus on contents)

5. Job application and covering letter

   Students have to write covering letter and resume. Students are to be assessed based on whether they have included all the following points in letter and application.

   a. The objective (career objective)
   b. Educational qualification (in the reverse order)
   c. Skills and assets
   d. Paper presentations and conferences attended
   e. Personal profile
   f. declaration

6. Group Discussion (GD)

   Students in a group of 4 to 5 are to be given a topic for discussion amongst themselves for about 10 to 15 minutes. The following points are to be assessed.

a. Initiation
b. Content
c. Language
d. Use of connectives
e. Team cooperation
f. Leadership quality
g. Use of illustrations
h. Conclusion

7. Project proposals writing

Students are asked to write a project proposal on a topic of research/engineering solution within their discipline for funding from outside. The following points are to be assessed.

a. Collection, analysis and interpretation of data
b. Correlating the particular data to proposal
c. Presenting the facts in proper sequence and relevance
d. Proposed technical solution to the engineering problem
e. Budget preparation and justification
f. Time lines of project progress

8. Technical report writing

Students are asked to write a technical report on a given research work recently published in reputed journals (ideally, IEEE transaction research paper is to be given to the students for writing a report on it). The following points are to be assessed.

a. Interpretation of results of research work
b. Critical and significant outcome of the research work
c. Presenting the results in concise and focused bulleted points
d. Future scope discussion
e. One suggestion to improve the research work

9. Interview skills

Interview practices are to be conducted. The students are to be assessed on the following criteria

a. Dress code
b. Body language
c. Confidence level
d. Handling stress
e. Language quality / content
f. Answers / relevant discussion

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Total Hours: 60

Semester-III	U15GE301R:SOFT SKILLS AND APTITUDE – I	L T P C Marks 0 0 2 1 100

Course Outcomes

At the end of the course the student will be able to:

1. Demonstrate capabilities in specific soft-skill areas using hands-on and/or case-study approaches
2. Solve problems of greater intricacy than those in BA-I and II in stated areas of quantitative aptitude and logical reasoning
3. Demonstrate higher than BA-I and II levels of verbal aptitude skills in English with regard to specific topics

1.Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics**: a. Attitude building b. Dealing with criticism c. Innovation and creativity d. Problem solving and decision making e. Public speaking f. Group discussions
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Numbers: Finding units digit, Power rule b. Base system – Progressions: Arithmetic, geometric and harmonic c. HCF and LCM d. Averages e. Percentages f. Ratio and proportion g. Ages h. Partnership i. Profit and loss j. Mensuration: Area, perimeter, volume and Surface area k. Coding and Decoding: Numbers, alphabet, alphanumeric coding and Artificial language l. Direction Sense m. Symbols and series: Numbers, alphabet, symbols, pictures and alphanumeric n. Seating arrangement
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Verbal analogy b. Tenses c. Prepositions d. Reading comprehension e. Choosing correct / incorrect sentences f. Describing pictures

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester IV under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15MAT401CR	Probability and Stochastic Processes	3	2	0	4
2	U15EC401R	Engineering Electromagnetics	3	2	0	4
3	U15EC402R	Electronic Circuits	3	0	0	3
4	U15EC403R	Linear Integrated Circuits	3	0	0	3
5	U15EC404R	Digital Signal Processing	3	2	0	4
6	U15EC405R	Analog Communication Systems	3	0	0	3
Practical						
7	U15EC406R	Linear Integrated Circuits Laboratory	0	0	2	1
8	U15EC407R	Electronic Circuits and Simulation Laboratory	0	0	2	1
9	U15EC408R	Digital Signal Processing Laboratory	0	0	2	1
10	U15GE401R	Soft Skills and Aptitude - II	0	0	2	1
					Total Credits	**25**

Approved By

Chairperson, Electronics and Communication Engineering BoS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electronics and Communication Engineering, Fourth Semester BE ECE Students and Staff, COE

U15MAT401CR	PROBABILITY AND STOCHASTIC PROCESSES	L T P C 3 2 0 4

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Work out problems on random variables and distinguish between random and stochastic processes.
2. Model communication system as a stochastic process.
3. Characterize LTI systems driven by a stationary random process using autocorrelation and power spectral density functions.
4. Measure and analyze correlation functions and distribution functions.
5. Analyze the probability distribution functions of noise in a communication link.

UNIT I	**RANDOM VARIABLE** Random Variable Concept – Distribution Function – Density Function – Gaussian Random Variable – Other Distributions-Binomial-Poisson-Uniform-Exponential and Density Examples – Conditional Distribution and Density Functions – Expectation – Moments – Functions That Give Moments-Moment Generating Function only – Transformations of a Random Variable.	**15**
UNIT II	**MULTIPLE RANDOM VARIABLES** Vector Random Variables – Joint Distribution and its Properties – Conditional Distribution and Density – Statistical Independence – Distribution and Density of a Sum of Random Variables – Central Limit Theorem-equal and unequal distributions statement only – Expected Value of a Function of Random Variables – Jointly Gaussian Random Variables – Transformation of Two Dimensional Random Variables.	**15**
UNIT III	**RANDOM PROCESSES –TEMPORAL CHARACTERISTICS** Random Process Concept – Stationarity and Independence – Correlation Functions – Measurement of Correlation Functions – Gaussian Random Processes – Poisson Random Process.	**15**
UNIT IV	**RANDOM PROCESSES –SPECTRAL CHARACTERISTIC** Power Density Spectrum and its Properties – Relationship Between Power Spectrum and Autocorrelation Function – Cross-Power Density Spectrum and its Properties – Relationship between Cross-Power Spectrum and Cross-Correlation Function – Power Spectrums for Discrete-Time Processes and Sequences – White Noise Definition.	**15**
UNIT V	**LINEAR SYSTEMS WITH RANDOM INPUTS** Linear System Fundamentals – Random Signal Response of Linear Systems – System Evaluation Using Random Noise – Spectral Characteristics of System Response.	**15**
	Total	**75**

TEXT BOOKS

1. Peebles Jr. P. Z., "*Probability Random Variables and Random Signal Principles*", Tata McGraw-Hill Publishers, New Delhi, 4th Edition, 37th Reprint Edition, 2016.
2. Veerarajan. T., "Probabilitiy, Statistics and Random process", Tata McGraw-Hill Publications, Second Edition, New Delhi, 2002.

REFERENCE BOOKS

1. A. Papoulis, "*Probability, Random variables and Stochastic Processes",* McGraw Hill, 4th Edition, 2002.
2. John J. Shynk, "*Probability, Random Variables, and Random Processes: Theory and Signal Processing Applications*", John Wiley, 2012.
3. Roy D. Yates and David J. Goodman, "*Probability and stochastic processes*", John Wiley, 1999.
4. Miller S. L. and Childers S. L., "*Probability and Random Processes with applications to Signal Processing and Communications*", Elsevier Inc., First Indian Reprint 2007.

U15EC401R	ENGINEERING ELECTROMAGNETICS	L	T	P	C
		3	2	0	4

COURSE OUTCOMES

At the end of each unit, the students will be able to

1. Apply vector calculus to solve static electric and magnetic field problems for different engineering applications.
2. Solve Maxwell's equations using vector calculus by using three standard coordinate systems.
3. Analyse electromagnetic wave propagation in guiding media under various matching conditions.
4. Analyse and compute the power flow mechanisms in bounded and unbounded medium.
5. Deduce EM wave propagation in free space and dielectric medium.

UNIT I	**INTRODUCTION TO ELECTROSTATICS** Scalars and Vectors – Vector Algebra – Rectangular Co-ordinate System – Vector Components and Unit Vector – Vector Field – Circular Cylindrical Coordinate System – Spherical Coordinate System – Conversion of Coordinates from One System to Other System – The experimental law of Coulomb – Electric Field Intensity – Field due to a Continuous line-Surface and Volume Charge Distribution – Field of a Line Charge-Finite-Infinite – Field of a Infinite Sheet of Charge – Electric Flux Density – Gauss Law – Applications of Gauss's Law – Divergence – The Vector Operator and The Divergence Theorem.	**15**
UNIT II	**ELECTROSTATIC POTENTIAL AND DIELECTRICS** Energy Expended in Moving a Point Charge in an Electric Field – Line Integral – Definition of Potential Difference and Potential – Potential Field of a Point Charge – Potential Gradient – The Dipole – Boundary Conditions for Perfect Dielectric Material – Capacitance – Examples of Capacitance – Capacitance of Two Wire Lines – Derivation of Poisson's and Laplace's Equations – Examples of Poisson's and Laplace's	**15**
UNIT III	**STEADY MAGNETIC FIELD AND ITS FORCES** The Biot-Savart Law – Ampere's Circuital Law – Curl – Stokes Theorem – Magnetic Flux and Magnetic Flux Density – The Scalar and Vector Magnetic Potential – Force on a Moving Charge (Lorentz Force Equation) – Force on a Differential Current Element – Force Between Differential Current Element – Force and Torque on a Closed Circuit.	**15**
UNIT IV	**TIME VARYING FIELDS AND PLANE WAVE** Faraday's Law – Displacement Current – Maxwell's Equation in Point Form – Maxwell's Equation in Integral Form – Wave Propagation in Free Space – Wave Propagation in Dielectric – Poynting's Theorem and Wave Power – Propagation in Good Conductors-Skin Effects – Wave Polarization	**15**
UNIT V	**ELECTROMAGNETIC WAVE REFLECTION** Reflection of Uniform Plane Waves at Normal Incidents – Definition of Standing Wave Ratio – Wave Reflection from Multi-interfaces– Plane Wave Reflection at Oblique Incidence Angles – Total Reflection and Total Transmission of Obliquely Incident Waves Horizontal and Vertical polarization-Brewster's Angle.	**15**
	Total	**75**

TEXT BOOK

1. W. H. Hayt and J. A. Buck, "*Engineering Electromagnetics*", TATA McGraw-Hill, 8th Edition, 2014.

REFERENCE BOOKS

1. Matthew N. O. Sadiku and S. V. Kulkarani, "*Principles of Electromagnetics*", 6th Edition Oxford University Press, 2015
2. John D. Kraus and Daniel A. Fleisch, "*Electromagnetics with Applications*", 5th Edition, McGraw Hill InternationalEditon, 1999.
3. E. C. Jordan and K. G. Balmain, "*Electromagnetic waves and Radiating Systems"*, Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1968.

U15EC402R	ELECTRONIC CIRCUITS	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to

1. Describe and analyze negative feedback amplifier circuits.
2. Design and analyze stability and different types of oscillator circuits.
3. Design and analyze different types of waveshaping and multivibrator circuits
4. Describe and analyze the operation of power circuits and systems.
5. Analyze and design multistage amplifiers with given conditions

UNIT I	**FEEDBACK AMPLIFIERS** Classification of Feedback Amplifiers – Feedback Concept – Transfer Gain with Feedback – General Characteristics of Negative Feedback Amplifiers – Input Resistance – Output Resistance – Effect of Feedback on Amplifier Bandwidth- Method of Analysis of Feedback Amplifier – Voltage Series Feedback – Voltage Series Feedback Pair – Current Series Feedback – Current Shunt Feedback – Voltage Shunt Feedback — Nyquist Criterion for Stability of Feedback Amplifiers.	**9**
UNIT II	**STABILITY AND OSCILLATORS** Stability – Gain and Phase Margins – Compensation – Dominant Pole Compensation – Pole Zero-Lead-Lag Compensation – Compensation by Modification of the β Network – Sinusoidal Oscillators – Phase Shift Oscillator – Resonant Circuit Oscillator – General Form of Oscillator Circuit – Wien Bridge Oscillators – Crystal Oscillators – Frequency Stability.	**9**
UNIT III	**WAVE SHAPING AND MULTIVIBRATOR CIRCUITS** Integrator and Differentiator Circuits – Diode Clippers – Clampers and Slicers – Collector Coupled and Emitter Coupled – Astable Multivibrator – Monostable Multivibrator – Bistable Multivibrator – Triggering Methods – Schmitt Trigger Circuit.	**9**
UNIT IV	**POWER CIRCUITS AND SYSTEMS** Class Large Signal Amplifiers – Second Harmonic Distortion – Higher Order Harmonic Generation – Transformer Coupled Audio Power Amplifier – Efficiency – Push-Pull Amplifiers – Class B Amplifiers – Class AB Operation – Regulated Power Supplies – Series Voltage Regulator – Monolithic Regulators – Four Layer Diode – p-n-p-n Characteristics – Silicon Controlled Rectifier.	**9**
UNIT V	**MULTISTAGE AMPLIFIERS** Classification of Amplifiers – Distortion in Amplifiers – Frequency Response of an Amplifier – Bode Plots – Step Response of an Amplifier – Bandpass of Cascaded Stages – RC Coupled Amplifier – Low Frequency Response of RC Coupled Stage – Effect of an Emitter Bypass Capacitor on Low Frequency Response – High Frequency Response of Two Cascaded CE Transistor Stages – Multistage CE Amplifier Cascade at High Frequencies – Noise – Differential Amplifier.	**9**
	Total	**45**

TEXT BOOK

1.	J. Millman and Halkias, "*Integrated Electronics- Analog and Digital Circuits and Systems*", Tata McGraw Hill, 2nd Edition, 2010

REFERENCE BOOKS

1.	Sanjay Sharma, "*Electronic Principles*"- S. K. Kataria and Sons, 3rd Edition, 2014.
2.	J. Millman and A. Grabel, "*Micro Electronics*", 2nd Edition, 2009.
3.	A. S. Sedra and K.C. Smith, "*Micro Electronic Circuits*", Oxford Press, 4th Edition, 1998..

U15EC403R	LINEAR INTEGRATED CIRCUITS	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Analyze and understand the fundamental operations of Analog ICs.
2. Design analog circuits using Op-Amps.
3. Describe the working of Signal Generators.
4. Explain the working of Voltage Reference and Regulator circuits.
5. Analyze the operation of analog to digital and digital to analog conversion.

UNIT I	**OPERATIONAL AMPLIFIER FUNDAMENTALS AND APPLICATIONS** Amplifier Fundamentals – The Operational Amplifier – Ideal Op Amp – Basic Op Amp Configurations – Non inverting Amplifier – Voltage follower – Inverting Amplifier – Ideal Op Amp circuit Analysis – Summing Amplifier – Difference Amplifier – Differentiator – Integrator– Negative Feedback – Feedback in Op Amp circuits – The Loop Gain – Circuits with Resistive Feedback – Current to Voltage Converters – Voltage to Current Converters – Differential Amplifiers, Instrumentation Amplifiers.	**9**
UNIT II	**STATIC AND DYNAMIC OP AMP LIMITATIONS.** Simplified Op Amp Circuit Diagram – Constant Current Source-Current Mirror –Widlar Current Source–Wilson Current Source– Input Bias and Offset Currents – Input Offset Voltage–Input Offset Error Compensation – Open loop response – Closed Loop Response – Input and output Impedances – Internal Frequency Compensation– External Frequency Compensation. Active filters – The Transfer Function – First-Order Active Filters – Standard Second Order Responses.	**9**
UNIT III	**OPAMP NONLINEAR CIRCUITS AND SIGNAL GENERATORS.** Voltage Comparators – Comparator Applications – Schmitt Trigger – Precision Rectifiers – Analog Switches – Peak Detectors – Sample-and-Hold Amplifiers – Log / Antilog Amplifiers – Signal Generators – Sine Wave Generators – Multivibrators – Astable Multivibrators – Monostable Multivibrators – Monolithic Timers(555) – 555 Timer as an Astable Multivibrator – 555 Timer as an Monostable Multivibrator – Triangular Wave Generators – Saw Tooth Wave Generators.	**9**
UNIT IV	**VOLTAGE REFERENCES, REGULATORS AND ANALOG MULTIPLIERS.** Performance Specifications – Voltage References – Band Gap Voltage References – Voltage Reference Applications – Linear Regulators – Protections – Monolithic Voltage Regulators – Linear Regulator Applications – Switching Regulators – Basic Topologies – Efficiency – Monolithic Switching Regulator – Voltage Mode Control – Current Mode Control – Analog Multiplier – Variable Transconductance Multiplier.	**9**
UNIT V	**D-A AND A-D CONVERTERS, PHASE LOCKED LOOP.** Performance Specifications – D-A Conversion Techniques – Weighted Resistor DACs – R-2R Ladders – Current Mode R-2R Ladder – Voltage Mode R-2R Ladder – Multiplying DAC Applications – A-D Conversion Techniques – Successive Approximation Converters – Flash Converters – Integrating Type Converters – Over Sampling Converters – Phase Locked Loops, Monolithic PLL.	**9**
	Total	**45**

TEXT BOOKS

1. Sergio Franco –"*Design with Operational Amplifiers and Analog Integrated Circuits*"-Tata Mc Graw –Hill, -3rd Edition,2002.
2. D.Roy Choudhry,Shail jain –"*Linear Integrated circuits*"-New age Pub,4th Edition,2010.

REFERENCE BOOKS

1. S.Salivahanan and V.S.Kanchana Bhaskaran-"*Linear Integrated circuits* "-Tata Mc Graw –Hill -2rd Edition.
2. Ramakant A.Gayakwad,"*Op-Amp and Linear ICs*"- Prentice Hall/Pearson Education-4th Edition.
3. Gray and Meyer-"*Analysis and Design of Analog integrated circuits*", Wiley international ,2005

U15EC404R	DIGITAL SIGNAL PROCESSING	L T P C 3 2 0 4

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Describe DFT , FFT and to perform its computations
2. Introduce the design techniques for FIR digital filters
3. Introduce the design techniques for IIR digital filters
4. Introduce the finite word length effects in signal processing & Multirate signal processing.
5. Describe the fundamentals of digital signal processors

UNIT I	**DISCRETE FOURIER TRANSFORM AND FFT** Introduction to DFT – Efficient Computation of DFT- Properties of DFT – FFT Algorithms – Radix-2 FFT Algorithms – Decimation in Time – Decimation in Frequency Algorithms – Fast Convolution - Overlap Save Method and Overlap Add Method.	**15**
UNIT II	**FINITE IMPULSE RESPONSE DIGITAL FILTERS** Amplitude and Phase Responses of FIR Filters – Linear Phase Filters – Windowing Techniques for Design of Linear Phase FIR filters-Rectangular- Hamming- Hanning and Blackman Windows - Gibbs Phenomenon – Principle of Frequency Sampling Technique – Realization of FIR Filters-Linear and Cascade Form.	**15**
UNIT III	**INFINITE IMPULSE RESPONSE DIGITAL FILTERS** Review of Design of Analog Butterworth and Chebychev Filters – Design of IIR Digital Filters using Impulse Invariance Technique – Design of IIR Digital Filters using Bilinear Transformation – Pre Warping – Frequency Transformation in Digital Domain – Realization Cascade and Parallel Form.	**15**
UNIT IV	**FINITE WORD LENGTH EFFECTS and MULTI RATE SIGNAL PROCESSING** Quantization Noise – Derivation for Quantization Noise Power- Comparison – Truncation and Rounding Error – Input Quantization Error-Coefficient Quantization Error – Limit Cycle Oscillations-Dead Band- Overflow Error-Signal Scaling – Multi Rate Signal Processing – Interpolation and Decimation.	**15**
UNIT V	**DIGITAL SIGNAL PROCESSORS** Architectural Features – Von Neumann Architecture – Harvard Architecture – Bus Architecture and Memory – Multiplier – Shifter – MAC Unit – ALU – Addressing Modes – Address Generation Unit – Pipelining – Overview of Instruction Set of TMS320C54XX.	**15**
	Total	**75**

TEXT BOOKS

1. John G Proakis- Dimtris G Manolakis,“ *Digital Signal Processing Principles-Algorithms and Application”*, Pearson/PHI, 4th Edition, 2007
2. B.Venkataramani & M-Bhaskar, “*Digital Signal Processor Architecture- Programming and Application”*, TMH, 2003

REFERENCE BOOKS

1. P.Ramesh Babu, **“***Digital Signal Processing*”, Scitech, 2016.
2. S.K.Mitra, “*Digital Signal Processing- A Computer based approach*”, Tata McGraw-Hill, 2006.
3. S.Salivahanan, A.Vallavaraj, Gnanapriya, “*Digital Signal processing”*, McGraw Hill / TMH, 2015.
4. Allan V.Openheim, Ronald W.Sehafer & John R.Buck, “*Discrete Time Signal Processing”,* second editionPearson, Prentice Hall.

U15EC405R	ANALOG COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Describe the generation and detection methods of various AM systems.
2. Explain the transmission and demodulation methods of FM systems.
3. Analyze the noise performance of various analog modulation systems
4. Illustrate the effect of noise and their various types.
5. Evaluate the basic information theory with source coding theorem.

UNIT I	**AMPLITUDE MODULATION SYSTEMS** Principles of Amplitude Modulation – Mathematical Expression for Single Tone AM – Power Relations in AM – Types of AM – DSBSC-SSBSC and VSB – Generation and Detection Methods – Comparison of Various AM Systems – AM transmitters - Low Level and High Level Modulation – AM Super-heterodyne Radio Receiver.	**9**
UNIT II	**ANGLE MODULATION SYSTEMS** Phase and Frequency Modulation – Principles of FM – Expression for Single Tone FM – Frequency Analysis of FM – Transmission Bandwidth of FM – NBFM and WBFM Generation Methods – Direct Method and Indirect (Armstrong) Method of FM Generation –FM Demodulators – FM Transmitters and Receivers.	**9**
UNIT III	**NOISE THEORY** Noise – Thermal Noise and Shot Noise – Narrow Band Noise and its Representation using In-Phase and Quadrature Components – Noise Figure and its Expression in Terms of SNR – Overall Noise Figure Calculation for Cascaded Amplifiers – Friss Formula – Noise Temperature – Noise Bandwidth – Equivalent Noise Resistance.	**9**
UNIT IV	**PERFORMANCE OF CW MODULATION SYSTEMS** Channel SNR – Output SNR – Figure of Merit – Noise in DSBSC and SSBSC Systems using Coherent Detection – Noise in AM System using Envelope Detection – Noise Performance Analysis in FM System – FM Threshold Effect – Threshold Improvement in Discriminators – Pre-Emphasis and De-Emphasis in FM – Noise Performance Comparison Between CW Modulation Systems.	**9**
UNIT V	**INFORMATION THEORY AND CODING** Amount of Information – Entropy – Information Rate – Source Coding to Increase Average Information Per Bit – Shannon-Fano Coding – Huffman Coding – BEC – BSC – Shannon's Theorem – Channel Capacity – Bandwidth – SNR Trade-Off – Mutual Information.	**9**
	Total	**45**

TEXT BOOKS

1. Simon Haykins, "*Communication Systems"*, John Wiley & Sons, 4th Edition, 2016.
2. R.P. Singh and S.D. Sapre, "*Communication Systems– Analog and Digital*", Tata McGrawHill, 3rd Edition, 2014.

REFERENCE BOOKS

3. Wayne Tomasi, "*Electronic Communication Systems*", 5/e, Pearson Education, 2011.
4. H.Taub, D L Schilling, G Saha, "*Principles of Communication*", 3/e, 2011.
5. Dr. Sanjay Sharma, "*Analog Communication systems*", S.K. Kataria & sons, 6th edition, 2013.

U15EC406R	LINEAR INTEGRATED CIRCUITS LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each unit, the students will be able to

1. Perform mathematical operations using IC 741 Op-amp
2. Generate different types of waveforms using Op amp
3. Design analog filters using Op-amp
4. Design monostable and Astable multivibrators using IC 555.
5. Design voltage regulators using IC 723

Exp. No.	List of Experiments:
1.	Design of Inverting and Non-Inverting amplifier using Opamp (IC 741)
2.	Design of Integrator and Differentiator using Opamp (IC 741)
3.	Design of Differential amplifier to find CMRR using Opamp (IC 741).
4.	Design of Astable and Monostable multivibrator using Opamp IC 741
5.	Design of Schmitt trigger using Opamp (IC 741)
6.	Design of Low pass and High pass filters using Opamp (IC 741)
7.	Design of Band pass filters using Opamp (IC 741)
8.	Design of RC phase shift and Wein bridge oscillators using Opamp(IC 741)
9.	Design of Monostable and Astable multivibrators using IC 555
10.	Design of high voltage regulator using IC 723.
11.	Design of low voltage regulator using IC 723

Total: 30 Hours

U15EC407R	ELECTRONIC CIRCUITS AND SIMULATION LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each unit, the students will be able to

1	Measure the frequency response of a given amplifiers.
2	Synthesize and evaluate single stage and two stage amplifiers
3	Realize the given performance using feedback amplifiers
4	Design and test oscillator circuits using BJT.
5	Simulate the performance of the amplifiers and oscillators using PSPICE and C-language

Exp. No.	List of Experiments
1	Design and analyze the frequency response of a two stage BJT amplifier with frequency as an input in the range of 50Hz to 500 KHz and plot the frequency Vs gain graph for the given transistor.
2	Design and analyze the frequency response of a differential amplifier in common mode and differential mode and plot the frequency Vs gain graph for the given pair of transistors.
3	Design and analyze the frequency response of a voltage shunt feedback amplifier and plot the frequency Vs gain graph for the given transistor.
4	Design and analyze the frequency response of a current series feedback amplifier and plot the frequency Vs gain graph for the given transistor.
5	Design the RC phase shift oscillator to oscillate at 1 KHz which gives 600 phase shift at each RC network and plot the output.
6	Design the Wien bridge oscillator to oscillate at 1.5 KHz which gives 00 phase shift and plot the output.
7	Design the LC oscillator (Hartley and Colpitts) to obtain 5 KHz output and plot the graph for the same output.
8	Design Astable, Monostable and Bistable multivibrators.
9	Design and analyze Class A amplifier and plot the output response.
10	Simulate the given circuits using PSPICE and verify the output: i) RC phase shift oscillators ii) Hartley oscillators iii) Colpitt's oscillators iv) Astable, Monostable and Bistable multivibrators v) Characteristics of SCR.

Total: 30 Hours

U15EC408R	DIGITAL SIGNAL PROCESSING LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each experiment, the students will be able to

1. Generate different types of signals using MATLAB and DSP Processor
2. Perform convolution and sampling using MATLAB and DSP Processor
3. Design FIR and IIR filters using MATLAB and DSP Processor
4. Perform DFT and FFT operation using MATLAB and DSP Processor
5. Perform arithmetic operations using DSP Processor

Exp. No.	List of Experiments
	Using MATLAB
1.	Generation of Discrete time signals
2.	Linear and Circular convolution
3.	Auto and Cross Correlation
4.	Sampling and effect of Aliasing
5.	Design of FIR Filters
6.	Design of IIR Filters
7.	DFT and FFT
8.	Up sampling and Down sampling
	Using TMS320C54 Processor
9.	Arithmetic operations
10.	Sampling of input signal and display
11.	Implementation of FIR Filters
12.	Implementation of IIR Filters
13.	Linear convolution
14.	Generation of Signals
15.	Calculation of FFT

Total: 30 Hours

Semester – IV	U15 GE 401R: SOFT SKILLS AND APTITUDE – II	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

At the end of the course the student will be able to:

1. Demonstrate capabilities in additional soft-skill areas using hands-on and/or case-study approaches
2. Solve problems of increasing difficulty than those in SSA-I* in given areas of quantitative aptitude and logical reasoning and score 65-70% marks in company-specific internal tests
3. Demonstrate greater than SSA-I level of verbal aptitude skills in English with regard to given topics and score 65-70% marks in company-specific internal tests

1. Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics:** a. SWOT b. Goal setting c. Time management d. Stress management e. Interpersonal skills and Intrapersonal skills f. Presentation skills g. Group discussions
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Allegation and mixture b. Time, speed and distance: Unit conversion, Average speed, Relative speed, two objects crossing each other in the same direction and opposite direction, Boats and streams, Races and games c. Clocks d. Calendars e. Blood relations f. Cubes and Dices g. Syllogism ($\leq$3 statements) h. Ranking and order i. Company specific aptitude questions
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Critical reasoning b. Theme detection c. Verbal analogy d. Prepositions e. Articles f. Cloze test g. Company specific aptitude questions

Dr.S.Anita

Department of Placement Training
Sona College of Technology,
Salem-636 005.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester V under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit
Theory						
1	U15EC501R	Digital Communication	3	0	0	3
2	U15EC502R	Transmission Lines and Waveguides	2	2	0	3
3	U15EC503R	Microprocessors and Microcontroller	3	0	0	3
4	U15CS507R	Data Structures and Object Oriented Programming in C++	2	0	2	3
5	U15EC504R	Control Systems	2	2	0	3
6	U15EC505R	VLSI Design	3	0	0	3
Practical						
7	U15EC506R	Microprocessors and Microcontroller Laboratory	0	0	2	1
8	U15EC507R	VLSI Laboratory	0	0	2	1
9	U15EC508R	Communication Laboratory	0	0	2	1
10	U15GE501R	Soft Skills and Aptitude - III	0	0	2	1
					Total Credits	**22**

Approved By

Chairperson, Electronics and Communication Engineering BoS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/Electronics and Communication Engineering, Fifth Semester BE ECE Students and Staff, COE

U15EC501R	DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Analyze the sampling process and different types of digital pulse modulation techniques.
2. Describe the baseband pulse transmission and ISI and to construct the duo-binary coding.
3. Compare the performance of various digital modulation systems for the pass-band data transmission.
4. Apply the different types of error control coding techniques.
5. Illustrate the methods of spread spectrum modulation and its performance parameters.

UNIT I	**PULSE MODULATION** Sampling Process – Signal Distortion and Recovery – PAM - PWM – PPM - Pulse Code Modulation – Noise Considerations in PCM Systems – Delta Modulation – Differential Pulse Code Modulation – Adaptive DPCM – Adaptive DM – TDM - Digital Multiplexers.	**9**
UNIT II	**BASEBAND PULSE TRANSMISSION** Matched Filter – Error Rate Due to Noise – Line Coding Formats – Inter -Symbol Interference – Nyquist's Criterion for Distortion Less Base Band Binary Transmission - Correlative Level Coding – Base Band M- ary PAM – Adaptive Equalization – Eye Patterns.	**9**
UNIT III	**PASS BAND DATA TRANSMISSION** Introduction – Pass Band Transmission Model – Generation and Detection – Signal Space Diagram – Bit Error Probability – Power Spectra of ASK- FSK- PSK – DPSK – QAM - QPSK and MSK Schemes – Comparison of Digital Modulation Systems using a Single Carrier – Carrier and Symbol Synchronization.	**9**
UNIT IV	**ERROR CONTROL CODING** Linear Block Codes – Cyclic Codes – Generator Polynomial – Encoder for Cyclic Codes – Convolutional Codes – Time Domain and Transform Domain Approach – Maximum Likelihood Decoding of Convolutional Codes – Viterbi Algorithm.	**9**
UNIT V	**SPREAD SPECTRUM MODULATION** Pseudo- Noise Sequences – Properties of Maximum Length Sequence – Direct Sequence Spread Spectrum with Coherent BPSK– Processing Gain –Probability of Error – Jamming Margin – Frequency – Hop Spread Spectrum – Gold Codes.	**9**
		Total: 45

TEXT BOOKS

1. Simon Haykin, "*Digital Communications*", Wiley India Pvt.Ltd, 2015.

REFERENCE BOOKS

1. John G. Proakis, "*Digital Communication*" 5th Edition, McGraw Hill, 2014
2. B. P. Lathi, Zhi Ding, '*Modern Digital and Analog Communication Systems",* Oxford University Press, 2017.
3. Taub and Schilling, *"Principles of Digital Communication*", 4th edition, Tata McGraw-Hill, 2013.
4. Sanjay Sharma," *Digital Communication*," 6th edition, S.K.Kataria & son's publication, 2014.

U15EC502R	TRANSMISSION LINES AND WAVEGUIDES	L T P C 2 2 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Analyse electromagnetic wave propagation in generic transmission line geometries.
2. Design impedance matching transmission line and calculate the reflection coefficient, SWR, using smith chart.
3. Analyze guided waves and their field pattern between parallel planes of perfect conductors.
4. Design and measure the various propagating modes of rectangular wave guides.
5. Derive the field equation of circular waveguides and resonators.

UNIT I	**TRANSMISSION LINE THEORY** Different Types of Transmission Lines – Characteristic Impedance – Propagation Constant-T and ∏ Section Equivalent to Lines – General Solution of the Transmission Line – Standard Forms for Voltage and Current of a Line Terminated by an Impedance – Physical Significance of the Equation and the Infinite Line – Standard Forms for the Input Impedance of a Transmission Line Terminated by an Impedance – Reflection Coefficient – Wavelength and Velocity of Propagation - Waveform Distortion – Distortion Less Transmission Line – The Telephone Cable – Line Loading - Campbell's Equation - Input Impedance of Lossless Lines – Reflection on a Line Not Terminated By Z_0 – Transfer Impedance – Reflection Factor and Reflection Loss – Insertion Loss	**12**
UNIT II	**TRANSMISSION LINE AT RADIO FREQUENCIES** 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 Circle 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.	**12**
UNIT III	**GUIDED WAVES BETWEEN PARALLEL PLANES** Waves Between Parallel Planes of Perfect Conductors – Transverse Electric and Transverse Magnetic Waves – Characteristics of TE And TM Waves – Transverse Electromagnetic Waves – Velocities of Propagation – Component Uniform Plane Waves Between Parallel Planes – Attenuation of TE And TM Waves of Parallel Plane Guides – Wave Impedances.	**12**
UNIT IV	**RECTANGULAR WAVEGUIDES** Transverse Magnetic Waves in Rectangular Waveguides – Transverse Electric Waves in Rectangular Waveguides – Characteristic of TE And TM Waves – Cutoff Wavelength and Phase Velocity – Impossibility of TEM Waves in Waveguides – Dominant Mode in Rectangular Waveguide – Attenuation of TE And TM Modes in Rectangular Waveguides – Wave Impedances – Characteristic Impedance – Excitation of Modes.	**12**
UNIT V	**CIRCULAR WAVE GUIDES AND RESONATORS** Bessel Functions – Solution of Field Equations in Cylindrical Co-Ordinates – TM and TE Waves in Circular Guides – Wave Impedances and Characteristic Impedance – Dominant Mode in Circular Waveguide – Excitation of Modes – Microwave Cavities – Rectangular Cavity Resonators – Circular Cavity Resonator – Q Factor of a Cavity Resonator for TE_{101} Mode.	**12**
		Total: 60

TEXT BOOKS

1. J.D.Ryder, *"Networks, Lines and Fields",* 2e,Pearson, 2015
2. E.C. Jordan and K.G.Balmain *, "Electro Magnetic Waves and Radiating System",* 2e,Pearson, 2015.

REFERENCE BOOKS

1. David M.Pozar, *"Microwave Engineering",* 4th Edition, John Wiley, 2013.
2. Ramo,Whineery and Van Duzer, *"Fields and Waves in Communication Electronics"* , 3e,John Wiley, 2011.
3. R.S. Sabeenian, *"Transmission Line and Waveguides",*Sonaversity.
4. G.S.Raju, *"Electromagnetic Field Theory and Transmission Lines",* 3/e, Pearson Education India, 2012.

U15EC503R	MICROPROCESSORS AND MICROCONTROLLER	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Develop assembly language program to solve mathematical problems using 8bit and 16 bit microprocessors.
2. Create a multiprocessor system with 8086 microprocessor.
3. Interface I/O and memory devices with 8086 microprocessor.
4. Analyze the architecture and signals of 8051 microcontroller.
5. Develop a real time system using 8051 microcontroller.

UNIT I	**8 BIT AND 16 BIT MICROPROCESSORS** 8085 Microprocessor Architecture – Instruction Set – Addressing Modes – Assembly Language Programming. 8086 Microprocessor Architecture – Addressing Modes – Instruction Set – Assembly Language Programming.	**9**
UNIT II	**MULTIPROCESSOR CONFIGURATION** Introduction to Assembler Directives – Stacks – Procedures – Macros – Interrupts and Interrupt Service Routines – Multiprocessor Configurations – Coprocessor – Closely Coupled and Loosely Coupled Configurations.	**9**
UNIT III	**INTERFACING WITH 8086µP** Memory Interfacing and I/O Interfacing – Parallel Communication Interface – Serial Communication Interface – D/A and A/D Interface – Timer – Keyboard /Display Controller – Interrupt Controller – DMA Controller – Programming and Applications.	**9**
UNIT IV	**8051 MICROCONTROLLER** Introduction – Evolution of Microcontroller - Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction Set - Addressing Modes - Assembly Language Programming – RS232 Bus – Inter Integrated Circuit.	**9**
UNIT V	**INTERFACING WITH MICROCONTROLLER** Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD and Keyboard Interfacing – ADC- DAC and Sensor Interfacing – External Memory Interface – Stepper Motor and Waveform generation.	**9**
		Total: 45

TEXT BOOKS

1. Douglas V Hall, *"Microprocessor and Interfacing : Programming and Interfacing",* Edition-3Tata McGrawHill Companies, ,2012.
2. Soumitra Kumar Mandal , *"Microprocessors and Microcontrollers, Architecture, Programming and Interfacing using 8085, 8086 and 8051"*, McGrawHill Companies,2012.

REFERENCE BOOKS

1. A.K. Ray and K.M.Burchandi, *"Intel Microprocessors Architecture Programming and Interfacing",* McGraw Hill International Edition, 2006.
2. Kenneth J Ayala, *"The 8051 Microcontroller Architecture Programming and Application",* Edition-3,Penram International Publishers (India), New Delhi, 2007,.
3. Ramesh S Gaonkar, *"Microprocessor Architecture, Programming and application with 8085",* 4th Edition, Penram International Publishing, New Delhi, 2002.
4. M. Rafi Quazzaman, *"Microprocessors Theory and Applications: Intel and Motorola",* Prentice Hall of India, Pvt. Ltd., New Delhi, 2003.
5. Mohammed Ali Mazidi and Janice Gillispie Mazidi, *"The 8051 Microcontroller and Embedded Systems",* Edition-2, Pearson Education Asia, New Delhi, 2008.

U15CS507R	DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING IN C++	L T P C 2 0 2 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Understand the basic concepts of object oriented programming.
2. Design program for real time applications using inheritance and polymorphism.
3. Apply various linear tree data structures in real time applications.
4. Implement the operations of tree traversals and hashing techniques
5. Develop and apply algorithms for real time applications using graphs

UNIT I	**PRINCIPLES OF OOP** Basic Concepts of Object Oriented Programming – Expressions – Control Structures – Functions – Classes and Objects – Class Members – Access Control – Pointers – Constructors and Destructors – Parameter Passing Methods – Inline Functions – Static Class Members – This Pointer –Friend Functions – Dynamic Memory Allocation (new and delete).	**9**
UNIT II	**INHERITANCE AND POLYMORPHISM** **9** Inheritance Basics – Types of Inheritance – Base Class Access Control –Compile Time Polymorphism –Runtime Polymorphism using Virtual Functions – Abstract Class –Exception Handling.	**9**
UNIT III	**DATA STRUCTURES** Basic Data Structures –Abstract Data Type – Linear Data Structures – List ADT – Single – Double and Circular – Stack ADT – Queue ADT.	**9**
UNIT IV	**TREES AND GRAPHS** Basic Terminologies –Tree Traversals – Binary Trees – Binary Search Tree ADT – Graph Traversals –Shortest Path Algorithm – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm – Kruskal's Algorithm.	**9**
UNIT V	**SEARCHING TECHNIQUES** Searching Techniques – Linear Search – Binary Search – Sorting Techniques – Insertion – Bubble and Merge Sort.	**9**
	Total	**45**

TEXT BOOKS

1. Mark Allen Weiss, *"Data structures and Algorithms Analysis in C++"*, 4th Edition, Prentice Hall, 2013.
2. E. Balagurusamy, *"Object-Oriented Programming With C++"*, 3rd Edition, Tata McGraw Hill, 2006.

REFERENCE BOOKS

1. Adam Drozdek, "*Data structures and algorithms in C++*", 3rd Edition, Cengage Learning, 2013.
2. Langsam, Augenstein and Tanenbaum "*Data structures using C and C++",* 2nd Edition, Prentice Hall of India, 1998.
3. Micheal T. Goodrich, Roberto Tamassia, David Mount, "*Data Structures and Algorithms in C++",* Wiley Student edition, John Wiley and Sons, 2009.

U15EC504R	CONTROL SYSTEMS	L T P C 2 2 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Derive the transfer function of a given system using mathematical models.
2. Determine the time response of systems and analyze the steady state error.
3. Calculate the frequency domain specifications using frequency response plots.
4. Determine and analyze the stability of given system.
5. Solve the state equations using state space model and obtain the Controllability and Observability of the given system.

UNIT I	**BASIC CONCEPTS AND SYSTEM REPRESENTATION** Introduction - Open Loop and Closed Loop Systems - Mathematical Model of Control Systems - Transfer Functions - Mechanical Translational System - Mechanical Rotational Systems - Block Diagram Algebra - Signal Flow Graph - Mason's Gain Formula.	**12**
UNIT II	**TIME RESPONSE ANALYSIS** Time Response - Standard Test Signals - Type and Order of Control System - Time Response of First Order System for Unit Step - Unit Ramp and Impulse Input - Time Response of Second Order System for Unit Step Input - Time Domain Specifications - Steady State Error and Static Error Constants - Controllers – P - PI and PID.	**12**
UNIT III	**FREQUENCY RESPONSE ANALYSIS** Frequency Response - Frequency Domain Specifications - Resonant Peak - Resonant Frequency - Bandwidth- Cut-Off Rate - Gain Margin and Phase Margin - Frequency Response Plots - Polar Plot - Bode Plot - M and N Circles - Nichol's Chart.	**12**
UNIT IV	**STABILITY ANALYSIS** The Concepts of Stability - Necessary Conditions for Stability - Relative Stability - Routh Hurwitz Stability Criterion - Root Locus - Effect of Addition of Poles - Effect of Addition of Zeros - Nyquist Stability Criterion.	**12**
UNIT V	**COMPENSATORS AND STATE SPACE ANALYSIS** **Compensators:** Introduction - Types – Lag - Lead and Lag-Lead Design using Bode Plots. **State Space Analysis:** Concepts of State - State Variables and State Model for Linear Continuous Time Systems - Controllability and Observability.	**12**
		Total: 60

TEXT BOOKS

1. Samarajit Gosh, *"Control Systems Theory and Applications",* 2nd New Edition, Pearson publications, 2017.
2. I.J.Nagrath and M.Gopal, *"Control Systems Engineering",* 6th Edition, New Age International (P) Ltd,Publishers, 2017.

REFERENCE BOOKS

1. M.Gopal, *"Control Systems, Principles and Design",* 4th Edition, Tata McGraw Hill, New Delhi, 2014.
2. A.Nagoorkani, *"Control Systems Engineering",* 3rd Edition, RBA Publications, 2017.
3. S.Palani, *"Control Systems Engineering",* 3rd Edition, Tata McGraw Hill, 2015.

U15EC505R	VLSI DESIGN	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Design VHDL code for combinational circuits and sequential circuits
2. Analyze MOS and CMOS transistor characteristics
3. Illustrate the fabrication processes of CMOS
4. Design CMOS combinational circuit.
5. Design sequential circuits and test CMOS circuits.

UNIT I	**VHDL** Introduction to VHDL – Tutorial – Entity Declaration – Architecture Body – Configuration Declaration – Package Declaration – Package Body – Identifiers – Operators – Behavioral Modelling – Process Statement – Wait Statement – If Statement – Loop Statement – Data Flow Modelling – Structural Modelling – Component Declaration – Component Instantiation.	**11**
UNIT II	**MOS TRANSISTOR THEORY** Introduction – MOS Transistors – CMOS Logic – Inverter – NAND gate – CMOS Logic Gates – Compound - MOS Transistor Theory – MOS Structure - nMOS and pMOS Transistor Operation –Long Channel V-I Characteristics – C-V Characteristics – Nonideal I-V Effects – DC Transfer Characteristics CMOS Inveter.	**9**
UNIT III	**CMOS PROCESSING TECHNOLOGY** Introduction – CMOS Technologies – Wafer Formation – Photolithography – Well and Channel Formation – Silicon Dioxide –Isolation – Gate Oxide – Gate and Source/Drain Formations – Contacts and Metallization – Passivation– nMOS Fabrication – n-well Process – p-well Process – Twin Well Process - Layout Design Rules – CMOS Process Enhancement - Stick Diagram – Inverter – CMOS NAND – CMOS NOR.	**9**
UNIT IV	**COMBINATIONAL CIRCUIT DESIGN** Static CMOS – Ratioed Circuits – Cascode Voltage Switch Logic – Dynamic Circuits – Domino Logic – Dual-Rail Domino Logic – Pass-Transistor Circuits – CMOS with Transmission Gates – Source of Power Dissiption.	**8**
UNIT V	**CMOS TESTING** Introduction – Testers – Text Fixtures and Test Programs – Logic Verification Principles - Silicon Debug Principles – Manufacturing Test – Design for Testability – Boundary Scan.	**8**
	Total	**45**

TEXT BOOKS

1. Neil H. E Weste and David Money Harris, "*CMOS VLSI Design a circuits and systems perspective*", 4th Edition, Pearson, 2015.
2. J. Bhasker, *"A VHDL Primer",* Pearson Education, 3rd edition, 2015.

REFERENCE BOOKS

1. Jan M. Rabaey, Anantha Chandrakasan ,Borivoje Nikolic, "Digital Integrated Circuits a design perspective", Pearson Education, 2nd edition, 2016.
2. Charles H. Roth, Jr., Lizy Kurian John,"Digital System Design using VHDL", Cengage, 3rd edition, 2018.
3. Pucknell D.A and Eshraghian K., *"Basic VLSI Design",* Third Edition, PHI, 2003.

U15EC506R	MICROPROCESSORS AND MICROCONTROLLER LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Write the assembly language programs to perform various arithmetic and logical operations using microprocessors.
2. Interface various peripheral ICs' and I/O devices with 8086 microprocessor.
3. Write the assembly language programs to generate time delay and to establish the data communications using 8051 microcontroller.

Exp. No.	List of Experiments
1	Study of 8085, 8086 and 8051 Trainer Kits.
2	8- bit Addition and Subtraction using 8085µP.
3	16-bit Manipulation (addition and subtraction) 8085µP.
4	8-bit Multiplication and Division 8085µP.
5	16-bit Multiplication and Division 8085µP.
6	Code Conversion 8085µP.
7	16 – bit Addition and Subtraction using 8086µP.
8	16 - bit Multiplication and Division using 8086µP.
9	String Manipulation using 8086µP.
10	Array Manipulation using 8086µP.
11	Experiments with 8255 in Mode 0 using 8086µP.
12	8279 Keyboard/Display Interface with the 8086µP.
13	Timer Interface 8253 with the 8086µP.
14	Stepper Motor Interface 8086µP.
15	8-bit Manipulations using 8051 Microcontroller.
16	16-bit Manipulations using 8051 Microcontroller.
17	Array Operations-Sum of N Elements using 8051 Microcontroller
18	Generation of Time Delay using 8051 Microcontroller.
19	Data Communications using Parallel and Serial Ports.

Total Hours: 30

U15EC507R	VLSI LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of experiments, the students will be able to -

1. Design and simulation of Combinational logic circuits and Sequential logic circuits using VHDL
2. Design CMOS circuit using SPICE
3. FPGA Implementation

Exp. No.	List of Experiments
	Design and Implementation of Combinational logic circuits using VHDL
1.	Adder and Subtractor
2.	Multiplexer and Demultiplexer
3.	Encoder and Decoder
4.	Comparator
	Design and Implementation of Sequential logic circuits using VHDL
5.	Flipflops
6.	Ripple Counter
7.	Synchronous Counter
8.	Shift Register
9.	Sequence Detector using FSM
	Design CMOS circuits
10.	CMOS Inverter
11.	Logic Gates
	FPGA Implementation
12.	4 bit Adder
13.	4 bit Multiplier
14.	Traffic Light Controller

Total Hours: 30

U15EC508R	COMMUNICATION LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each experiment, the students will be able to -

1. Design and construct signal generator and demodulator for AM and FM
2. Construct the sampling process of a signal and its recovery using the sampled version.
3. Generate and detect the signals using analog and digital pulse modulation techniques.

Exp. No.	List of Experiments
1	Amplitude Modulation and Demodulation.
2	Frequency Modulation and Demodulation.
3	Characteristics of AM Receiver (Selectivity and Sensitivity).
4	Sampling of an Analog Signal and Reconstruction.
5	Pulse Modulation Techniques - PAM, PWM, PPM.
6	Study of Line Coding Formats and Decoding.
7	Time Division Multiplexing using PAM.
8	Pulse Code Modulation.
9	Delta Modulation and Demodulation.
10	Differential Pulse Code Modulation.
11	Digital Modulation -ASK, FSK, PSK, QPSK.
12	Analysis of Filters using Network Analyzer.
13	RF Signal Analysis using Spectrum Analyzer.

Total Hours: 30

Semester –V	U15 GE 501R:SOFT SKILLS AND APTITUDE - III	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

At the end of the course the student will be able to:

1. Demonstrate capabilities in supplementary areas of soft-skills and job-related selection processes using hands-on and/or case-study approaches
2. Solve problems of advanced levels than those in SSA-II in specified areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests
3. Demonstrate greater than SSA-II level of verbal aptitude skills in English with regard to given topics and score 70-75% marks in company-specific internal tests

1.Soft Skills	**Demonstrating soft-skill capabilities with reference to the following topics:** a. Career planning b. Resume writing c. Group discussion d. Teamwork e. Leadership skills f. Interview skills g. Mock interview **h.** Mock GDs
2.Quantitative Aptitude and Logical Reasoning Topics	**Solving problems with reference to the following topics :** a. Numbers: Remainder concept b. Time and work: Fraction technique, Efficiency technique, Pipes and cisterns and Chain rule c. Simple interest d. Compound interest e. Set theory: Venn diagram f. Puzzles g. Mathematical operators h. Syllogism (≥4 Statements) i. Data sufficiency j. Statement and assumptions k. Statement and conclusions **l.** Company specific aptitude questions
3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Subject verb agreement b. Selecting the best alternative for the stated parts of given sentences c. Reading comprehension d. Contextual synonyms e. Sentence fillers f. Writing a story for a given picture **g.** Company specific aptitude questions

Department of Placement Training

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI under Regulations 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title		Lecture	Tutorial	Practical	Credit
Theory							
1.	U15EC601R	Antenna and Wave Propagation		3	0	0	3
2.	U15EC602R	Digital Image Processing		3	0	0	3
3.	U15EC603R	Embedded Systems		3	0	0	3
4.	U15EC902R	**Professional Elective -**	Wireless Communication	3	0	0	3*
5.	U15EC916R		Measurement and Instrumentation				
6.	U15EC928R		Sensors and IOT				
7.	U15EC926R		Machine Learning and Its Applications	2	0	2	
8.	noc21-cs16	**Professional Elective - NPTEL Course**	Cryptography and Network Security	3	0	0	3*
9.	noc21-cs24		Introduction to Machine Learning				
10.	noc21-ee32		Sensors and Actuators				
11.	noc21-cs45		Data Analytics with Python				
12.	U15CS1003R	**Open Elective**	Internet of Things	3	0	0	3
13.	U15CS1006R		Data Science				
14.	U15IT1004R		Python Programming				
15.	U15IT1003R		Problem Solving Techniques Using Java Programming				
16.	U15IT1005R		Introduction To Database Technology				
17.	U15CS1004R		Mobile Application Development				
18.	U15FT1001R		Fundamentals of Fashion Design				
19.	U15CE1004R		Municipal Solid Waste Management				

Practical						
20.	U15EC604R	Digital Image Processing Laboratory	0	0	2	1
21.	U15EC605R	Embedded Systems Laboratory	0	0	2	1
22.	U15CS606R	Data Structures and Object Oriented Programming in C++ Laboratory	0	0	2	1
23.	U15GE601BR	Soft Skills and Aptitude - IV	0	0	2	1
					Total Credits	**22**

*Any 1 elective to be opted by a student among 4 electives.

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

Copy to:-

HOD/Electronics and Communication Engineering, Sixth Semester BE ECE Students and Staff, COE

U15EC601R	ANTENNA AND WAVE PROPAGATION	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Analyze the antenna fundamentals and Radiation pattern.
2. Evaluate the different parameters of antenna arrays.
3. Design microwave antennas for the given specifications.
4. Analyze the different measurement techniques of antenna parameters and special antennas.
5. Analyze the atmospheric and terrestrial effects on radio wave propagation.

UNIT I	ANTENNA FUNDAMENTALS Basic Antenna Parameters – Reciprocity Principle – Friis Transmission Formula – Retarded Vector Potential – Power Radiated and Radiation Resistance of Current Element – Radiation from Half-wave Dipole Antennas – Folded Dipole – Loop Antenna.	9
UNIT II	ANTENNA ARRAYS Antenna Arrays – Broad-side Array – End-Fire Array – Collinear Array and Parasitic Array- Pattern Multiplication – Binomial Array – Chebyshev Array – Taylor Series.	9
UNIT III	MICROWAVE ANTENNAS Helical Antenna – Normal Mode and Axial Mode Operation – Yagi Uda – Antenna- Log Periodic Antenna – Spiral Antenna – Rhombic Antenna – Horn Antenna – Reflector Antenna - Micro Strip Antenna.	9
UNIT IV	ANTENNA MEASUREMENTS AND SPECIAL ANTENNAS Measurement of Different Antenna Parameters – Radiation Pattern – Gain – Phase – Polarization – Impedance – Efficiency – Antennas for Special Applications – Antenna on Cellular Handsets – GPR – Embedded Antennas – UWB – Plasma Antenna.	9
UNIT V	RADIO WAVE PROPAGATION Ground Wave Propagation- Attenuation Characteristics for Ground Wave Propagation – Calculation of Field Strength at a Distance – Space Wave Propagation – Duct Propagation – Calculation of Field Strength at a Distance – Sky Wave Propagation – Structure of the Ionosphere – Mechanism of Refraction – Refractive Index – Critical Frequency- Skip Distance – Effect of Earth's Magnetic Field – Attenuation Factor for Ionosphere Propagation – Maximum Usable Frequency – Fading and Diversity Reception.	9
		Total: 45

TEXT BOOKS

1. John D. Kraus and Ronald Marhefka, "*Antennas*", Tata McGraw-Hill Book Company, Reprint 2016.
2. C.A.Ballanis, "*Antenna Theory* Analysis *and Design*", Wiley inter science, 2006.

REFERENCE BOOKS

1. Prasad K.D., "*Antennas and Wave Propagation*", Satya Prakashan, Reprint 2018.
2. Jordan E.C and Balmain, "*Electro Magnetic Waves and Radiating Systems*", PHI, 2015.
3. Collins R.E., "*Antennas and Radio Propagation*", McGraw-Hill, 1987.

U15EC602R	DIGITAL IMAGE PROCESSING	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Describe the fundamentals of monochrome and color image processing and analyse the basic relations between pixels, connectivity and distance measures.
2. Apply DFT DCT, DST, Walsh, Hadamard, Haar, wavelet and SVD transform for images.
3. Apply image enhancement techniques in spatial and frequency domain.
4. Analyze image restoration using constrained and unconstrained filters and image segmentation approaches.
5. Appraise the need for image compression using lossy and lossless techniques and Morphological operations.

UNIT I	DIGITAL IMAGE FUNDAMENTALS AND TRANSFORMS Fundamental Steps in Digital Image Processing – Elements of Visual Perception – Some Basic Relationship Between Pixels – Connectivity – Distance Measure – Brightness – Contrast – Hue- Saturation – Mach Band Effect – Image Sampling – Quantization – Dither – Colour Image Fundamentals RGB – HSI Models – Conversion from RGB to HSI.	9
UNIT II	IMAGE TRANSFORMS 1D DFT – 2D Transforms – DFT – DCT – DST – Walsh – Hadamard – Haar Transform – Discrete Wavelet Transform – Multi Resolution Analysis – SVD	9
UNIT III	IMAGE ENHANCEMENT Spatial Domain Approach – Point Processing – Image Negative – Contrast Stretching – Gray Level Slicing – Histogram Equalization – Image Addition – Subtraction – Averaging – Smoothing Filters – Spatial LPF – Median Filter – Sharpening Filters – Spatial HPF – High Boost Filter – Derivative Filters Frequency Domain Filters – Homomorphic Filter.	9
UNIT IV	IMAGE RESTORATION AND SEGMENTATION Degradation Model – Noise Models – Types of Restoration – Inverse Filtering – Least Mean Square (wiener–parametric wiener) Filter – Image Segmentation – Point – Line and Edge Detection – Region Based Segmentation – Region Splitting and Merging – Thresholding.	9
UNIT V	IMAGE COMPRESSION AND MORPHOLOPGICAL OPERATIONS Image Compression – Lossless Compression – Huffman Coding – Minimum Variance Huffman Coding – Arithmetic Coding – LZW Coding – Lossy Compression – Transform Coding – Compression Standards – JPEG Image Compression Standards – MPEG Video Compression Standards-Block Diagram Approach. Standard Binary Morphological operations-Dilation and Erosion based Operations.	9
	Total	45

TEXT BOOKS

1. Rafael C- Gonzalez- Richard E-Woods, "*Digital Image Processing*", Pearson Education, Eleventh Impression, 2013.
2. Jayaraman S., Esakkirajan and Verrakumar, "*Digital Image Processing*", TMH New Delhi, 2011.

REFERENCE BOOKS

1. Annadurai S., R. Shanmugalakshmi, "*Fundamentals of Digital Image Processing*", Pearson Education India, 2007.
2. Anil K- Jain, "*Fundamentals of Digital Image Processing*", Pearson/Prentice Hall of India, 2002.
3. Sridhar.S, "*Digital Image Processing*", Oxford University Press, First Edition, 2011.
4. Sabeenian R.S., "*Digital Image Processing*", Sonaversity publication, Second Edition reprint, 2014.
5. Kenneth R. Castleman, "*Digital Image Processing*", Pearson, 2009.

U15EC603R	EMBEDDED SYSTEMS	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Obtain a broad knowledge on hardware and software architectures of an embedded system.
2. Get the various design process and parameter analysis of the embedded system.
3. Gain the familiarity on PIC microcontroller.
4. Provide an in depth exposure on real time operating system.
5. Design the software and hardware architecture of real time applications.

UNIT I	ARCHITECTURE OF EMBEDDED SYSTEMS Introduction – Application Areas – Categories of Embedded System – Specialties of Embedded System – Recent Trends in Embedded System – Overview of Embedded System Architecture – Hardware Architecture – Software Architecture – Communication Software –Process of Generation of Executable Image – Development-Testing.	9
UNIT II	DESIGN AND ANALYSIS OF EMBEDDED SYSTEMS Embedded System Design Process – Formalism for System Design – Memory System Mechanism – CPU Performance – CPU Power Consumption – CPU Buses – Memory Devices – I/O Devices – Program Design – Model of Programs – Analysis and Optimization of Execution Time – Power – Energy – Program Size – Program Validation and Testing.	9
UNIT III	PIC MICROCONTROLLER PIC 16C61 / 71 Microcontroller Architecture – FSR – Reset Action – Oscillatory Connections – Memory Organizations – Instructions – Addressing Modes – I/O Ports-Interrupts – Timers – ADC.	9
UNIT IV	REAL-TIME OPERATING SYSTEM CONCEPTS Architecture of the Kernel – Task and Task Scheduler – Interrupt Service Routines – Semaphores – Mutex – Mailboxes – Message – Queues – Event Registers – Pipes – Signals – Timers – Memory Management – Priority Inversion Problem.	9
UNIT V	REAL-TIME OPERATING SYSTEM TOOLS AND CASE STUDIES Case Study of an Automatic Chocolate Vending Machine using MUCOS RTOS – Case Study of an Embedded System for Set-top Boxes – Case Study of an Embedded System for a PDA.	9
	Total	45

TEXT BOOK

1. Marilyn Wolf, *"Computers as Components - Principles of Embedded Computer System Design"*, 4th Edition, Morgan Kaufmann Publisher, (An Imprint from Elsevier), 2016.

REFERENCE BOOKS

1. Ajay V Deshmukh, *"Microcontrollers Theory and Applications"*, 3rd Edition Paper back, Tata McGraw Hill education, 2017.
2. Shibu K V, *"Introduction to Embedded Systems"*, 2nd Edition, McGraw Hill, 2016.
3. Raj Kamal, *"Embedded Systems Architecture Programming and Design"*, 3rd Edition, TMH, 2014.
4. Xiaocong Fan, *"Real-Time Embedded Systems: Design Prinicple and engineering practices"*, SCI-Tech Connect, Elsevier, 2016.

U15EC604R	DIGITAL IMAGE PROCESSING LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each experiment ,the students will be able to -

1. Write a MATLAB code to demonstrate and perform various operations related to image processing.
2. Generate a LABVIEW code to demonstrate and perform various operations related to image processing.
3. Write a MATLAB code or Generate a LABVIEW code to extract features from Images.

Exp.No	List of Experiments
	Using Lab VIEW
1.	Displaying the Image Properties and Pixel Distance
2.	Re-Sample a given image
3.	Extraction of planes from a given image - RGB and HSI
4.	Image Arithmetic (Addition, Subtraction, Multiplication and division of two image)
5.	Scalar processing of an image (Addition, Subtraction, Multiplication and division of a scalar quantity on an image)
6.	Computing the DWT of an image and displaying the LL, LH, HL and HL images
7.	Computing Discrete Fourier Transform of a given image
8.	Extracting 1st Order statistical features of an image (Mean and Standard Deviation alone)
9.	Computing the Image Histogram and Histogram equalization for the given image.
	Using MATLAB
10.	Demonstrating False Contour Effect
11.	Extraction and display of each bits as an image for a given 8 bit gray scale image
12.	Computing Fourier Transform and reconstruction of original image from Fourier Transform a. Without Zero-padding b. With Zero-padding
13.	Frequency Domain Image Enhancement a. Low Pass Filter b. High Pass Filter c. Band Pass Filter
14.	Spatial Domain Image Enhancement d. Average Filter e. Median Filter f. Edge Enhancement
15.	Demonstrating JPEG Compression using DCT
16.	Creating a degradation model for a given image and applying Wiener Filter
17.	Edge Detection Algorithms

U15EC605R	EMBEDDED SYSTEMS LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each experiment ,the students will be able to -

1. Design an embedded system to get input from and to display using microcontrollers. (8951 Microcontroller, Arduino UNO board and TI MSP430 microcontroller)
2. Design a system by interfacing analog and digital sensors with microcontrollers using various communication protocols. (8951 Microcontroller, Arduino UNO board and TI MSP430 microcontroller)
3. Design a system by interfacing with latest microcontrollers like Intel Galileo Gen 2 board and Raspberry Pi 3.

Exp.No	List of Experiments
The interfacing, programming and simulation of the following 1 to 8 experiments are done with 8951 Microcontroller, Arduino UNO board and TI MSP430 microcontroller using Keil software, Arduino IDE and Code Composer Studio IDE respectively.	
1	LED Control using toggle switches and pushbuttons.
2	Interfacing matrix keypad ,16 X 2 LCD and 8 X 8 LED Dot Matrix
3	Interfacing Relay and Buzzer.
4	PWM Based Speed Control of Servo Motor by Potentiometer.
5	Interfacing analog and digital sensors with microcontrollers based on serial/parallel communication. (UART)
6	Interfacing analog and digital sensors with microcontrollers based on I^2C and SPI protocol.
7	Study of interrupts using IR obstacle sensor and developing a visitor counter
8	Interfacing of microcontrollers with MATLAB.
9	Study of Intel Galileo Gen 2 board and its programming.
10	Study of Raspberry Pi 3 board, Programming & Simulation in Python Simulators/Tools.
11	Real time case study involving design of IOT data logger, WiFi applications by interfacing with microcontrollers.

U15CS606R	DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING IN C++ LABORATORY	L T P C 0 0 2 1

COURSE OUTCOMES

At the end of each experiment, the students will be able to

1. Design and develop simple programs using basic concepts of C++
2. Develop programs using the concept of classes, static members and constructors
3. Develop programs using Polymorphism and inheritance.

Exp. No.	List of Experiments:
1.	Functions with call by value, call by reference, default arguments and function overloading.
2.	Design of classes with static and non static members, friend functions and creating array of objects.
3.	Implementation of inheritance and polymorphism.
4.	Array implementation of list ADT.
5.	Linked list implementation of list ADT.
6.	Implementation of stack ADT using linked list.
7.	Conversion of infix to postfix expression.
8.	Implementation of queue ADT using array.
9.	Implementation linear search & binary search.
10.	Implementation of sorting algorithms.
11.	Implementation of breadth first and depth first traversals.

U15EC902R	WIRELESS COMMUNICATION	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Apply the knowledge of basic communication systems and its principles, describe the Wireless Systems and analyze the Spectrum Allocation.
2. Mathematically analyze mobile radio propagation mechanisms and diversity Techniques.
3. Analyze the Path loss models, Design Base Station (BS) parameters and analyze the antenna configurations.
4. Analyze and examine the multiple access techniques and its application.
5. Assess the latest wireless technologies.

UNIT I	INTRODUCTION TO COMMUNICATION SYSTEMS History of Wireless Communication – Wireless Vision – Technical Issues – Current Wireless Systems – Cellular Telephone Systems – Cordless Phones – Wireless LANs – Wide Area Wireless Data Service – Broadband Wireless Access – Paging Systems – Satellite Networks – Low-Cost Low Power Radios – Ultra Wideband Radios – The Wireless Spectrum –Methods for Spectrum Allocation – Spectrum Allocations for Existing Systems.	9
UNIT II	MOBILE RADIO PROPAGATION,FADING AND DIVERSITY TECHNIQUES Mobile Radio Propagation – Reflection – Reflection from Dielectrics – Brewster Angle – Reflection from Perfect Conductors – Ground Reflection (Two-Ray) model – Diffraction – Fresnel Zone Geometry – Knife - Edge Diffraction Model – Multiple Knife - Edge Diffraction – Scattering – Diversity Techniques.	9
UNIT III	PATH LOSS MODELS AND BASICS OF ANTENNA Path Loss Prediction over Hilly Terrain – Practical Link Budget Design using Path Loss Models – Log-Distance Path Loss Model – Log - Normal Shadowing – Determination of Percentage of Coverage Area – Design Parameters at Base Station – Antenna Location – Spacing – Heights and Configurations.	9
UNIT IV	MULTIPLE ACCESS TECHNIQUES Introduction to Multiple Access Techniques – Frequency Division Multiple Access (FDMA) – Time Division Multiple Access (TDMA) – Code Division Multiple Access (CDMA) – Spread Spectrum Multiple Access – Power Control –WCDMA – CDMA Network Design OFDM and MC-CDMA.	9
UNIT V	LATEST WIRELESS TECHNOLOGIES Global System for Mobile (GSM) – GSM Services and Features – GSM System Architecture – GSM Radio Subsystems and Channel Types – 3G and 4G(LTE) – NFC Systems – WLAN Technology – HiperLAN – Ad hoc Networks – Bluetooth.	9
		Total: 45

TEXT BOOKS

1. T.S.Rappaport, *"Wireless Communication Principles",* (2/e), Pearson, 2013.
2. Andrea Goldsmith, *"Wireless Communication",* Cambridge University Press, 2012.

REFERENCE BOOKS

1. A.F.Molisch, *"Wireless Communications",* Wiley, 2013.
2. P .Muthu Chidambara Nathan*, "Wireless Communications",* PHI, 2013.
3. W .C.Y.Lee, *"Mobile Communication Engineering",* (2/e), McGraw- Hill, 1998.

U15EC916R	MEASUREMENT AND INSTRUMENTATION	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Discuss the basics of measurement and to study the various digital and analog instruments
2. Examine the fundamentals of signal generators and analyzers
3. Analyze the working of cathode ray oscilloscope and digital storage oscilloscope.
4. Explain the various storage and display devices
5. Explain basics of virtual instrumentation with the basic programming technique

UNIT I	DIGITAL & ANALOG INSTRUMENTS Digital method for measuring frequency, period, Time interval - Digital voltmeter - Microprocessor based DMM - IEEE 488 bus - D.C, A.C voltmeters – Ammeters – Multimeter – True RMS meter.	9
UNIT II	SIGNAL GENERATORS AND ANALYZERS Sine wave generator – Frequency synthesized sine wave generator – Sweep frequency generator, pulse and square wave generator – Function generator – Wave analyzer – Applications – Harmonic distortion analyzer – Spectrum analyzer – Applications.	9
UNIT III	CATHODE RAY OSCILLOSCOPE General purpose oscilloscope – Vertical and horizontal deflection systems – Delay line – Multiple trace – Dual beam and dual trace – Probes – Oscilloscope techniques – Special oscilloscopes – Storage oscilloscopes – Sampling oscilloscope.	9
UNIT IV	DISPLAY AND RECORDING DEVICES Bar graph display – Segmental and dot matrix display – X–Y recorders – magnetic tape recorders – Digital recording – Data loggers. Interference and screening – Electrostatic and electromagnetic interference and earth loops.	9
UNIT V	VIRTUAL INSTRUMENTATION Historical perspective – Need of VI – Advantages of VI – Define VI – Block diagram & Architecture of VI – Data flow techniques – Graphical programming in data flow – Comparison with conventional programming	9
		Total: 45

TEXT BOOKS

1. Albert D. Helfrick and William D. Cooper, *"Modern Electronic Instrumentation and Measurement Techniques",* 2nd edition, Prentice Hall of India, 2008.
2. Sanjay Gupta & Joseph John, "Virtual Instrumentation using LabVIEW", 2nd edition, McGraw Hill, 2017.

REFERENCE BOOKS

1. Oliver, B.M. and Cage. J.M., *"Electronic Measurements and Instrumentation",* 1st edition McGraw Hill, 2008.
2. Joseph J. Carr, *"Elements of Electronic Instrumentation and Measurements",* 3rd Edition,Pearson Education, 2003.
3. Bell, D.A., *"Electronic Instrumentation and Measurements"*, 3rd edition, Prentice Hall of India, 2013
4. Rajendra Prasad, *"Electronic Measurements and Instrumentation*", 4th edition, Khanna Publishers, 2012.
5. Gupta, B.R., *"Electronics and Instrumentation",* S. Chand Co. (P) Ltd., 2003.

U15EC926R	MACHINE LEARNING AND ITS APPLICATIONS	L T P C 2 0 2 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Realize the significance of machine learning techniques and its parameters
2. Implement basic machine learning algorithms in Python and Pandas.
3. Inscribe a python program for supervised learning and its applications
4. Solve basic classification problems using ANN and unsupervised classification
5. Design an architecture for CNNs and its applications

UNIT I	INTRODUCTION TO MACHINE LEARNING AND ITS PARAMETERS Basics of Vectors and Matrices -Machine learning – Application of Machine learning- Types of Machine learning – Representation of Model- Cost function Notation – Gradient Descent Algorithm – Measuring Accuracy of Hypothesis Function – Confusion Matrix - Sensitivity – Specificity – Precision – Accuracy-False Negative Rate-False Positive Rate & F1 Score.	12
UNIT II	DATA PRE-PROCESSING USING PANDAS & PYHTON Introduction about Python – Basic Syntax- Python identifiers- Basic Operations of Python – Python Decision Making- Looping – Functions – NumPy -Matplotlib – Introduction to Pandas and Scikit Learn & programming -Data cleaning – Data Integration – Data Reduction -Standard Deviation-Variance-Covariance-Eigen Values & Vectors-PCA.	12
UNIT III	SUPERVISED LEARNING ALGORITHMS Introduction to supervised learning and regression - Statistical Relation between Two Variables and Scatter Plots – steps to establish a Linear Regression using Python– Evaluation of Model Estimators -Introduction and scenarios of Logistic Regression – Building Logistic Regression Model using Python and Pandas - Maximal Likelihood Estimation using python- Steps to construct a Decision Tree.	12
UNIT IV	BASICS OF ANN, SVM & UNSUPERVISED LEARNING ALGORITHMS Introduction to ANN – Biological Neuron – Basic of ANN Architectures – Activation Functions – McCulloch Pitts Model – K-NN – Linear SVM with examples (Vectors) using python – Non-Linear SVM with examples (Vectors) using SVM - Introduction to clustering – Types of Clustering – K- Means Algorithm theory and programs.	12
UNIT V	CONVOLUTIONAL NEURAL NETWORKS (CNNs DEEP LEARNING) 1D & 2D-Convolution – Convolution layer and its types – Pooling layer and its types-Rectified linear units' layer-Architecture design procedure for CNN- LeNET and AlexNET CNN architecture-DIGITS-Procedure and Programs for Image classifications.	12
		Total: 60

TEXT BOOK

1. Anuradha Srinivasaraghavan, Vincy Joseph , Machine Learning, Wiley-2019.

REFERENCE BOOKS

1. Dr. Soman K. P., Loganathan, R., and Ajay, V., Machine Learning with SVM and other Kernel methods. PHI Learning Pvt. Ltd., 2009.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning -Springer -2010

U15EC928R **SENSORS AND IOT** **L T P C**

3 0 0 3

COURSE OUTCOMES:

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

1. Analyze the suitable sensor to design an IOT based system
2. Enhance the knowledge on communication modules and network models
3. Develop the IOT protocol for designing sensor based applications
4. Understand the various embedded hardware platform for designing IOT applications
5. Design and develop the complete embedded and IOT application modules

UNIT I: SENSORS AND ACTUATORS 09

Introduction – Sensor Technology – Analog Sensors- Digital sensors - Temperature, Humidity, Distance, Light and sound, position tracking, Sound, Sensing the Things, Motion sensor for Moving Objects, Pressure Sensors, Environmental monitoring sensor, Location – Actuators.

UNIT II: FUNDAMENTALS OF NETWORKING AND COMMUNICATION MODULES 09

Components – Direction of Data Flow – Networks – Components and Categories – Types of Connections – Topologies – Protocols and Standards – ISO / OSI Model – TCP/IP Model. Router, Switch, Hub, Bridge.

Communication modules – Zigbee - LoRa - RFID - Bluetooth, Wi-Fi -MQTT, CoAP,

UNIT III: FUNDAMENTALS of IOT 09

Introduction - Definition and Characteristics of IoT - Physical design - IoT Protocols - Logical design - IoT communication models, IoT Communication APIs - Enabling technologies - Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain specific IoTs - IoT Architectural view.

UNIT IV: M2M and IOT EMBEDDED PLATFORMS 09

Introduction – M2M – Difference between IOT and M2M- Software defined networking – Network Function Virtualization – Embedded platforms for prototyping: Arduino, Intel Galileo, Intel Edison, Raspberry Pi- Introduction to BeagleBone, mBED

UNIT V: Real Time Applications of IOT 09

Case study on Home automation - smart parking system - Weather monitoring system – smart agriculture irrigation system

Lecture: 45, Tutorial: 00, Total: 45 Hours

TEXT BOOKS

1. **Arshdee**p Bahga, Vijay Madisetti, "Internet of Things-A hands-on approach", Universities Press,2015
2. Raj Kamal, “Internet of Things – Architecture and Design Principles”, Mc Graw H ill Education Pvt.Ltd., 2017.

REFERENCE BOOKS

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press

3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, “From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence”, Elsevier, 2014
4. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, “Introduction to Internet of Things: A practical Approach”, ETI Labs

noc21-cs16 Cryptography and Network Security 3 0 0 3

Week 1: Introduction to cryptography, Classical Cryptosystem, Block Cipher.
Week 2: Data Encryption Standard (DES), Triple DES, Modes of Operation, Stream Cipher.
Week 3: LFSR based Stream Cipher, Mathematical background, Abstract algebra, Number Theory.
Week 4: Modular Inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem.
Week 5: Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem.
Week 6: Primarily Testing, ElGamal Cryptosystem, Elliptic Curve over the Reals, Elliptic curve Modulo a Prime.
Week 7: Generalized ElGamal Public Key Cryptosystem, Rabin Cryptosystem.
Week 8 : Message Authentication, Digital Signature, Key Management, Key Exchange, Hash Function.
Week 9 : Cryptographic Hash Function, Secure Hash Algorithm (SHA), Digital Signature Standard (DSS).
Week 10: Cryptanalysis, Time-Memory Trade-off Attack, Differential and Linear Cryptanalysis.
Week 11: Cryptanalysis on Stream Cipher, Modern Stream Ciphers, Shamir's secret sharing and BE, Identity-based Encryption (IBE), Attribute-based Encryption (ABE).
Week 12: Side-channel attack, The Secure Sockets Layer (SSL), Pretty Good Privacy (PGP), Introduction to Quantum Cryptography, Blockchain, Bitcoin and Cryptocurrency.

Week 0: Probability Theory, Linear Algebra, Convex Optimization - (Recap)

Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance

Week 2: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares

Week 3: Linear Classification, Logistic Regression, Linear Discriminant Analysis

Week 4: Perceptron, Support Vector Machines

Week 5: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation

Week 6: Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures

Week 7: Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting

Week 8: Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks

Week 9: Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation

Week 10: Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering

Week 11: Gaussian Mixture Models, Expectation Maximization

Week 12: Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)

Books and References

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
2. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)

NOC21-EE32 **Sensors and Actuators** **3 0 0 3**

Week 1:
Basics of Energy Transformation: Transducers, Sensors and Actuators

Week 2:
Understanding of thin film physics: Application in MOSFET and its variants

Week 3:
Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD)

Week 4:
Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition)

Week 5:
Basics understanding of Photolithography for pattering layer. Detailed overview of Etching methods.

Week 6:
Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors

Week 7:
Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications

Week 8:
Explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications

Week 9:
Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques.

Week 10:
Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics

Week 11:
Understanding of Sensor Interfacing with Microprocessor to build electronic system

Week 12:
Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems.

NOC21-CS45 DATA ANALYTCS WITH PYTHON 3 0 0 3

Week 1 : Introduction to data analytics and Python fundamentals

Introduction to data analytics-Python Fundamentals-I Python Fundamentals-II-Central Tendency and Dispersion-I -Central Tendency and Dispersion-I Important Data files.

Week 2 : Introduction to probability

Introduction to Probability-I - Introduction to Probability-II Probability Distributions-I Probability Distributions-II Probability Distributions-III.

Week 3 : Sampling and sampling distributions

Python Demo for Distributions-Sampling and Sampling Distribution-Distribution of Sample Means, population, and variance-Confidence interval estimation: Single population - I-Confidence interval estimation: Single population - II.

Week 4 : Hypothesis testing

Hypothesis Testing- I-Hypothesis Testing- II-Hypothesis Testing- III-Errors in Hypothesis Testing-Hypothesis Testing: Two sample test- I-Important Data Sets.

Week 5 : Two sample testing and introduction to ANOVA

Hypothesis Testing: Two sample test- II-Hypothesis Testing: Two sample test- III-ANOVA - I-ANOVA - I I -Post Hoc Analysis(Tukey's test)-Important Data files.

Week 6 : Two way ANOVA and linear regression

Randomize block design (RBD)-Two Way ANOVA-Linear Regression - I-Linear Regression - II-Linear Regression - III-Important Data files.

Week 7 : Linear regression and multiple regression

Estimation, Prediction of Regression Model Residual Analysis-Estimation, Prediction of Regression Model Residual Analysis - II-MULTIPLE REGRESSION MODEL - I-MULTIPLE REGRESSION MODEL-II-Categorical variable regression-Important data Files.

Week 8 : Concepts of MLE and Logistic regression

Maximum Likelihood Estimation- I-Maximum Likelihood Estimation-II-LOGISTIC REGRESSION- I-LOGISTIC REGRESSION- II-Linear Regression Model Vs Logistic Regression Model-Important data files.

Week 9: ROC and Regression Analysis Model Building

Confusion Matrix and ROC –I and II-Performance of Logistic Model-III-Performance of Logistic Model-III-Regression Analysis Model Building-I – Regression Analysis Model Building-II.

Week 10: c^2 Test and introduction to cluster analysis

Chi-Square Test of independence –I –II-Square Goodness of Fit Test-Cluster analysis.

Week 11: Clustering analysis.

Cluster Analysis-III-Part IV-Part V-K-Means clustering-Hierarchical method of clustering.

Week 12: Classification and Regression Trees (CART)

Hierarchical method of clustering-Classification and Regression Tress(CART-1) – Measures of attitude selection-CART.

Semester –VI	U15 GE 601B R: SOFT SKILLS AND APTITUDE – IV (For all Department except Civil)	L	T	P	C	Marks
		0	0	2	1	100

Course Outcomes

At the end of the course the student will be able to:

1. Demonstrate capabilities in job-oriented company selection processes using the hands-on approach
2. Solve problems of any given level of complexity in all areas of quantitative aptitude and logical reasoning and score 70-75% marks in company-specific internal tests
3. Demonstrate advanced-level verbal aptitude skills in English and score 70-75% marks in company-specific internal tests

1. Soft Skills	**Demonstrating Soft -Skills capabilities with reference to the following topics:** a. Mock group discussions b. Mock interviews c. Mock stress interviews
2. Quantitative Aptitude and Logical Reasoning	**Solving problems with reference to the following topics:** a. Crypto arithmetic problems b. Permutation & Combination c. Probability d. Clocks & Calendars e. Functions & polynomials f. Logarithm g. Geometry h. Puzzles i. Data interpretation j. Data Sufficiency k. Company specific aptitude questions (AMCAT & Co cubes)
a. 3. Verbal Aptitude	**Demonstrating English language skills with reference to the following topics:** a. Writing captions for given pictures b. Reading comprehension c. Critical reasoning d. Theme detection e. Jumbled sentences f. Writing a story on given pictures g. Company specific aptitude questions

Department of Placement Training
Sona College of Technology,
Salem-636 005.

ECE

SENSORS AND SMART STRUCTURES TECHNOLOGIES

PREAMBLE:

Advanced sensors, smart materials, and smart structures technology represent an emerging multidisciplinary field that has unlimited potential of broad engineering applications.

Radical developments in material science, telecommunication and sensor technology are about to transform the way of engineering design is conceived and carried out. In the next ten years smart materials and structures, with embedded sensors and systems capable of self-diagnosis, will be part of our life, from simple goods to civil buildings. In recent years, numerous civil infrastructures have been built in metropolitan areas all over the world. The performance of these infrastructures during construction, operation, maintenance, and upgrading is a major concern for the society. The traditional sensors, such as strain gages, thermal couples, pressure transducers, and displacement sensors, are becoming intelligent with integration with a microprocessor, a communication module, and an energy harvesting system. Recent years there are increasing number of smart sensors that are enabled by various nanotechnologies. An equal progress has been made on the actuator front. Solid state actuators, such as shape memory alloys , shape memory polymers, magnetostrictive materials , magnetic shape memory materials, and piezoceramics, have migrated from military/space applications to industrial and consumer applications. Meanwhile, a new class of smart fluids materials, such as magneto-rheological (MR) fluids and electrical–rheological (ER) fluids, have emerged and enable a new class of semi-active control devices, such MR dampers and ER dampers, of which the damping properties can be actively controlled.These smart sensors and smart devices are often integrated with various structures to form so-called smart structures, which possess the ability to sense or/and to respond to environmental or structural changes in a pre-defined way. With the developments in microprocessor technology, wireless communications, and sensor networks, smart sensors, and smart structures are finding more and more applications in structural health monitoring and structural control in aerospace engineering, civil engineering, mechanical engineering, and other disciplines

This course provides an overview of smart technologies from a cross-disciplinary perspective with special focus on, smart materials, strain measuring techniques, fiber optic sensors, autonomous motion sensors,fire and humidity sensor, control devices and actuators, data acquisition ,signal processing and decision making.

U15EC1006R	SENSORS AND SMART STRUCTURES TECHNOLOGIES	L T P C 3 0 0 3

COURSE OUTCOMES

At the end of each unit, the students will be able to -

1. Insight into the basic concept regarding smart materials and their use in structures.
2. Analyze the use of measuring techniques in smart materials and structures.
3. Identify the suitable sensors for smart materials.
4. Apply the techniques of actuators in smart structures.
5. Understand the data acquisition techniques, signal processing and control for smart structures.

UNIT I	INTRODUCTION TO SMART MATERIALS AND STRUCTURES Introduction to Smart Materials and Structures – Instrumented Structures Functions and Response – Sensing Systems – Smart Bridge – Self Diagnosis – Signal Processing Consideration – Actuation Systems and Effectors.	9
UNIT II	MEASURING TECHNIQUES Strain Measuring Techniques using Electrical Strain Gauges, Types – Resistance – Capacitance – Inductance – Wheatstone Bridges – Pressure Transducers – Load Cells – Temperature Compensation – Strain Rosettes.	9
UNIT III	SENSORS Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain Measurement – Inductively Read Transducers – The LVDT – Fiber Optic Techniques.Chemical and Bio-Chemical Sensing in Structural Assessment – Absorptive Chemical Sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed Measurement –Fire Sensor –Emergency Fire Alarm –Humidity Sensor – Accelerometers – Motion Sensors and Pressure Sensors.	9
UNIT IV	ACTUATORS Actuator Techniques – Actuator and Actuator Materials – Piezoelectric and Electrostrictive Material – Magnetostrictive Material – Shape Memory Alloys – Electro Rheological Fluids– Electro Magnetic Actuation – Role of Actuators and Actuator Materials.	9
UNIT V	SIGNAL PROCESSING AND CONTROL SYSTEMS Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear.	9
		Total: 45

TEXT BOOKS

1. A.K. Sawhney, *"A Course in Electical and Electronic and Measurements and Instrumentation",* Dhanpat rai and co pvt limited, 2015.
2. Brain Culshaw , "*Smart Structure and Materials*", Artech House, Borton. London, 1996.

REFERENCE BOOKS

1. L. S. Srinath , "*Experimental Stress Analysis*", Tata McGraw,1998.
2. J. W. Dally & W. F. Riley, "*Experimental Stress Analysis*", Tata McGraw, 1998.
3. Srinivasan, A.V and Michael McFarland. D, *"Smart Structures -Analysis and Design"*, Cambridge University Press, 2001.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title		Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory								
1	U15EC701R	Microwave Engineering		3	0	0	3	45
2	U15EC702R	Optical Fiber Communication		3	0	0	3	45
3	U15EC703R	Computer Networks		3	0	0	3	45
4	U15EC901R	**Elective –**	Satellite Communication	3	0	0	3*	45
5	U15EC915R		Computer Architecture					
	U15EC917R		Bio-Medical Instrumentation	3	0	0	3*	45
	U15EC924R		Professional Ethics and Human Values					
	U15EC927R		Deep Learning					

***Any 2 electives to be opted by a student among 5 professional electives.**

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electronics and Communication Engineering, Seventh Semester BE ECE Students and Staff, COE

6	U15CE1003R	**Open Elective –**	Energy Efficiency and Green Building	3	0	0	3	45
	U15CS1004R		Mobile Application Development					
	U15EE1006R		Renewable Energy Systems					
	U15IT1003R		Problem Solving Techniques Using Java Programming					
	U15MC1002R		3D Printing Technology					
	U15ME1002R		Renewable Energy Sources					
	U15ME1004R		Industrial Safety					
	U15ME1005R		Maintenance Engineering					
	U15ME1010R		3D Printing					
Practical								
7	U15EC704R	Microwave and Optical Laboratory		0	0	2	1	30
8	U15EC705R	Mini Project		0	0	4	2	60
9	U15EC706R	Comprehensive Review		0	0	2	1	30
						Total Credits	**22**	

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

Copy to:-

HOD/Electronics and Communication Engineering, Seventh Semester BE ECE Students and Staff, COE

U15EC701R **MICROWAVE ENGINEERING** **3 0 0 3**

Course Outcomes

At the end of the course, the student will be able to

1) Explain the two RF circuits and networks used in Microwave communication systems.
2) Analyze the multi- port RF networks and RF transistor amplifiers
3) Analyze the passive & active Microwave devices and circuits
4) Analyze the microwave generation and to design the Micro strip lines
5) Measure and analyze Microwave signal parameters

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3	3	2	2	3	2	1	2	2	3	3	2
CO2	3	2	3	3	3	3	3	2	2	2	2	3	3	2
CO3	2	3	3	3	3	2	3	2	1	2	3	3	3	2
CO4	2	2	3	3	3	2	3	2	2	2	3	3	3	2
CO5	2	2	3	3	3	2	3	2	1	2	3	3	3	2

Unit I TWO PORT RF NETWORKS-CIRCUIT REPRESENTATION **9**

Review of Low Frequency Parameters – Impedance – Admittance – Hybrid and ABCD parameters – Different Types of Interconnection of Two Port Networks – High Frequency Parameters – Formulation of S Parameters – Properties of S Parameters – Reciprocal and Lossless Network – Transmission Matrix – RF Behaviour of Resistors - Capacitors and Inductors.

Unit II MICROWAVE SEMICONDUCTOR DEVICES AND CIRCUITS **9**

Open - Short and Matched Terminations – Coupling Probes and Loops – Power Divider – Directional Coupler – Attenuators – Phase Shifter – Circulator – Isolator – Impedance Matching Devices– Tuning Screw – Stub and Quarter-Wave Transformers – Crystal Diodes and Schottky Diode – Detector and Mixers – PIN Diode Switch – Gunn Diode Oscillator – IMPATT Diode Oscillator and Amplifier – Varactor Diode and Parametric Amplification.

Unit III RF AMPLIFIERS AND MATCHING NETWORKS 9

Characteristics of Amplifiers – Amplifier Power Relations – Stability Considerations – Stabilization Methods – Noise Figure – Constant VSWR – Broadband - High power and Multistage Amplifiers – Impedance Matching using Discrete Components – Two Component Matching Networks – Frequency Response and Quality Factor – T and Pi Matching Networks – Microstrip Line Matching Networks.

Unit IV MICROWAVE GENERATION AND MICROWAVE TRANSMISSION LINES 9

Two Cavity Klystron Amplifier – Power and Efficiency Considerations – Reflex Klystron Oscillators – Modes and Efficiency Considerations – Magnetrons – TWT - Introduction – Micro Strip Lines – Derivation of Characteristic Impedance of Micro Strip Lines using Quasi Static Analysis – Losses in Micro Strip Lines – Quality Factor Q of Micro Strip Lines – Substrate Materials – Parallel Strip Lines – Characteristic Impedance – Attenuation Losses – Coplanar Strip Lines – Shielded Strip Lines – Problems.

Unit V MICROWAVE MEASUREMENTS 9

Measuring Instruments – VSWR Meter – Power Meter – Spectrum Analyzer – Network Analyzer – Principles – Measurement of Impedance – Frequency – Power – VSWR - Q – factor - Dielectric Constant - Magic Tee - S-Parameter - Return Loss and Directional Coupler.

TOTAL : 45 HOURS

Text Book

1) Reinhold Ludwig and Gene Bogdanov, *"RF Circuit Design: Theory and Applications"*, Pearson Education Inc., 2011.
2) Annapurna Das and Sisir K Das, *"Microwave Engineering"*, Tata Mc Graw Hill Inc., 2nd edition, 2014.

References

1) Samuel Y- Liao, *"Microwave Devices and Circuits"*, Pearson/Prentice Hall of India, 3rd Edition 2011.
2) David M. Pozar, *"Microwave Engineering",* Wiley India (P) Ltd, New Delhi, 2008.
3) Thomas H Lee, *"Planar Microwave Engineering: A Practical Guide to Theory, Measurements and Circuits"*, Cambridge University Press, 2004.

U15EC702R **OPTICAL FIBER COMMUNICATION** **3 0 0 3**

Course Outcomes

At the end of the course, the student will be able to

1) Analyze the basic elements and laws of optical fiber transmission systems
2) Analyze the causes for signal degradation in optical fibers
3) Illustrate the working of optical sources and coupling techniques
4) Evaluate the noise performance in fiber optic receiver
5) Analyze the digital transmission systems

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	3	2	2	1	1	2	3	3	3	2
CO2	2	2	3	3	3	2	2	1	1	2	3	3	3	2
CO3	2	2	3	3	3	2	2	1	1	2	3	3	3	2
CO4	2	2	3	3	3	2	2	1	1	2	3	3	3	2
CO5	2	2	3	3	3	2	2	1	1	2	3	3	3	2

Unit I INTRODUCTION TO OPTICAL **9**

Evolution of Fiber Optic Systems – Elements of an Optical Fiber Transmission Link – Ray Theory –Total Internal Reflection – Acceptance Angle – Numerical Aperture – EM Mode Theory of Optical Propagation – Phase and Group Velocity –Fiber Configurations-Single Mode Fibers-Multimode Fibers – Cut Off Wavelength – Mode Field Diameter – Effective Refractive Index.

Unit II SIGNAL DEGRADATION IN OPTICAL FIBERS **9**

Attenuation – Material Absorption Losses in Silica Glass Fiber – Linear and Nonlinear Scattering Losses – Fiber Bend Losses – Dispersion – Material Dispersion – Waveguide Dispersion – Intermodal Dispersion – Overall Fiber Dispersion – Polarization – Fiber Birefringence – Polarization Mode Dispersion – Polarization Maintaining Fibers – Non Linear Effects

Unit III OPTICAL SOURCES AND COUPLING **9**

LED's – LED Structure – Surface Emitters – Edge Emitters – LASER – Diodes – Semiconductor Laser Diodes – Fabry-Perot Lasers – Distributed Feedback (DFB) Lasers – Modulation of LASER Diodes – Temperature Effects – Power Launching and Coupling – Source to Fiber Power Launching – Lensing Schemes for Coupling Improvement.

Unit IV OPTICAL RECEIVERS **9**

PIN Photo Detector – Avalanche Photodiodes – Photo Detector Noise – Detector Response Time – Avalanche Multiplication of Noise – Temperature Effects on Photo Detectors – Phototransistors – Fundamental Receiver Operation– Error Sources – Receiver Configuration – Probability of Error – Quantum Limit

Unit V DIGITAL TRANSMISSION SYSTEMS **9**

Point to Point Link Systems Considerations – Link Power Budget – Rise Time Budget – Erbium Doped Fiber Amplifier (EDFA's) - Wavelength Division Multiplexing (WDM) - DWDM -SONET/SDH - Wavelength Routing Networks - Optical switches.

TOTAL : 45 HOURS

Text Book

1) Gerd Keiser, *"Optical Fiber Communications",* Tata Mc Graw Hill, 5th edition, 2014.
2) John M. Senior,*"Optical Fiber Communications",* Pearson, 3rd edition, 2009

References

1) Joseph C.Palais, *"Fiber Optic communications"*, Pearson, 5th edition, 2005
2) G.P. Agarwal, "*Fiber Optic Communication systems",* John wiley&Sons NewYork, 4th edition, 2011

U15EC703R **COMPUTER NETWORKS** **3 0 0 3**

Course Outcomes

At the end of each unit, the students will be able to

1) Explain the basic concept in modern data communication and computer networking
2) Analyze the functions and services of data link layer
3) Categorize the functions and services of network layer
4) Examine the basic functions of transport layer and congestion in networks
5) Analyze the concepts of various network applications and data security

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	3	3	2	3		3	2	3	3	3
CO2	2	2	3	3	3	2	1	2		3	2	3	3	3
CO3	2	2	3	3	3	3	2	3		3	2	3	3	3
CO4	2	2	3	3	3	3	1	2		3	2	3	3	3
CO5	2	3	3	3	3	3	2	3		3	2	3	3	3

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 – TCP/IP Model.

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 - IEEE 802.5 – IEEE 802.11–FDDI - SONET – Bridges.

Unit III NETWORK LAYER **9**

Internet Works - Packet Switching and Datagram Approach – IPv4 - IPv6– Subnetting – 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**

Principles of Network Application – Domain Name Space (DNS) – SMTP – FTP – HTTP - E-Mail - The WEB – Principles of Cryptography – Message Integrity – End Point Authentication – Security Email – Network Layer Security- Modes - Security Protocol – IKE - VPN -Transport Layer Security - SSL Architecture-Application Layer Security - E-mail Security - PGP-S/MIME.

TOTAL : 45 HOURS

Text Book

1) Behrouz A. Foruzan, "*Data communication and Networking*", Tata McGraw-Hill, fifth edition, 2017.

2) James F. Kurouse & W.Rouse, "*Computer Networking: A Topdown Approach Featuring*", Pearson Education, sixth edition, 2017.

References

1) Andrew S. Tannenbaum, "*Computer Networks*", PHI, Fifth edition,2010.

2) William Stallings, "*Data and Computer Communication*", Tenth Edition, Pearson Education, 2017.

3) Larry L.Peterson & Peter S. Davie, "*Computer Networks*", Harcourt Asia Pvt. Ltd., fifth Edition,2011.

U15EC901R SATELLITE COMMUNICATION 3 0 0 3

Course Outcomes

After successful completion of this course, the students should be able to

1) Analyze the satellite orbits
2) Analyze the space segment and budget equation
3) Analyze the earth segment and various test equipments
4) Analyze the various multiple access techniques.
5) Know the latest trends in satellite and its applications

Pre-requisite

Analog & Digital Communication

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2		2			2	2	2	3	3
CO2	3	2	3	3	2		2			2	2	2	3	3
CO3	3	2	3	3	2		2			2	2	2	3	3
CO4	3	2	3	3	2		2			2	2	2	3	3
CO5	3	2	3	3	2		2			2	2	2	3	3

Unit I SATELLITE ORBITS 9

Kepler's Three Laws of Planetary Motion – Definition of Terms for Earth – Orbiting Satellites – Orbital Elements – Orbital Parameters – Orbital Perturbations – Station Keeping – Frequency Allocation – Non Geo-Stationary Orbits – Geostationary Orbits – Sun Transit Outages – Limits of Visibility – Look Angle Determination – Sub Satellite Point – Elevation Angle Calculation – Azimuth Angle Calculation – Launching of Geo Stationary Satellites – Launch Vehicles and Propulsion

Unit II SPACE SEGMENT AND SATELLITE LINK DESIGN 9

Power Supply – Attitude Control – Spinning Satellite Stabilization – Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders –

Wideband Receiver – Input Demultiplexer – Power Amplifier – Antenna Subsystem – Link Design – Satellite Up Link – Down Link – Link Power Budget– C/N0 – G/T– Noise Temperature – System Noise Propagation Factors – Rain and Ice Effects – Polarization.

Unit III EARTH SEGMENT **9**

Transmitters – Receivers – Antennas – Terrestrial Interface– TVRO – MATV – CATV – Test Equipments – Measurements on G/T – C/No – EIRP – Antenna Gain.

Unit IV SATELLITE ACCESS **9**

Modulation and Multiplexing – Voice- Data – Video – Analog – Digital Transmission System – Multiple Access –FDMA Systems – TDMA Systems – Beam Switching and Satellite Switched TDMA – CDMA.

Unit V SATELLITE APPLICATIONS **9**

Mangalyaan – Chandraayan Mobile satellite services – GSM – GPS – INMARSAT – LEO – MEO – Satellite Navigational System – Direct Broadcast satellites (DBS) – Direct to home Broadcast (DTH) – Digital audio broadcast (DAB) – World space services, Business TV(BTV) – GRAMSAT – DVB.

TOTAL: 45 HOURS

Text Book

1) Dennis Roddy, *"Satellite Communication",* 4th Edition, McGraw Hill International, 2006.

References

1) S.Jayapoorani *"Satellite Communication*", Ist Edition, Scitech Publishers 2017.
2) Timothy pratt , Bostian, C W, & Allnult, J, *"Satellite Communication*", latest edition , John Wiley publications,2003.
3) Bruce R. Elbert, *"The Satellite Communication Applications"*, Hand Book, Artech House Bostan London, 1997.
4) Robert Emanuel Fthenakis*, "Manual of Satellite Communications",* McGraw Hill Book Co., 1984.
5) Brian Ackroyd, *"World Satellite Communication and earth station Design*", BSP professional Books, 1990.

U15EC915R **COMPUTER ARCHITECTURE** **3 0 0 3**

Course Outcomes

At the end of the course, the student will be able to

1) Illustrate the operational concepts of computers and classify instruction set architectures
2) Identify the mechanism of control signals generation in Hardwired control and micro programmed control unit
3) Illustrate processing of pipelined operation; list various types of hazards and methods to overcome hazards
4) Discriminate main memory, cache memory and Virtual memory concepts
5) Design I/O system requirements for any commercial processor

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	3	3							3	3	2
CO2	2	2	3	3	3							3	3	2
CO3	2	2	3	3	3							3	3	2
CO4	3	3	3	3	3							3	3	2
CO5	3	3	3	3	3							3	3	2

Unit I BASIC STRUCTURE OF COMPUTERS **9**

Functional Units – Basic Operational Concepts – Bus Structures – Performance and Metrics – Instructions and Instruction Sequencing – Hardware – Software Interface – Instruction Set Architecture – Addressing Modes – RISC – CISC

Unit II BASIC PROCESSING UNIT **9**

Fundamental Concepts – ALU Design – Fixed Point and Floating Point Operations – Execution of a Complete Instruction – Multiple Bus Organization – Hardwired Control – Micro Programmed Control.

Unit III PIPELINING **9**

Basic Concepts – Data Hazards – Instruction Hazards – Influence on Instruction Sets – Data Path and Control Considerations – Performance Considerations – Exception Handling.

Unit IV MEMORY SYSTEM **9**

Basic Concepts – Semiconductor RAM – ROM – Speed – Size and Cost – Cache Memories – Improving Cache Performance – Virtual Memory – Memory Management Requirements – Associative Memories – Secondary Storage Devices.

Unit V I/O ORGANIZATION **9**

Accessing I/O devices – Programmed Input/output -Interrupts – Direct Memory Access – Buses – Interface Circuits – Standard I/O Interfaces (PCI, SCSI, USB, SATA, and ISA) – I/O processors.

TOTAL : 45 HOURS

Text Book

1) Carl Hamacher, Zvonko Vranesic and Safwat Zaky, *"Computer Organization",* Fifth Edition, Tata McGraw Hill, 2012

References

1) David A. Patterson and John L. Hennessy, *"Computer Organization and Design: The Hardware/Software interface"*, Third Edition, Elsevier, 2005
2) William Stallings, *"Computer Organization and Architecture – Designing for Performance"*, Sixth Edition, Pearson Education, 2003
3) Dr.M.Usha, T.S. Srikanth, *"Computer System Architecture and Organization",* Wiley Publications, 2013

U15EC917R BIO-MEDICAL INSTRUMENTATION 3 0 0 3

Course Outcomes

At the end of the course, the student will be able to

1) Summarize various aspects of bio-potential recording systems from the body
2) Interpret the various temperature measurement methods and translate flow of blood as metrics
3) Describe the special features of various types of measuring equipment based on heart
4) Outline the objectives and working principles of the various diagnosis and radiological equipment's

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	1	2	1	1	1	1	1	1	2	1
CO2	2	1	1	1	1	2	1	1	1	1	1	1	2	1
CO3	2	1	1	1	1	2	1	1	1	1	1	1	2	1
CO4	2	1	1	1	1	2	1	1	1	1	1	1	2	1
CO5	2	1	1	1	1	2	1	1	1	1	1	1	2	1

Unit I RECORDING INSTRUMENTS 9

Electro-Physiology and Bio-potential Recording 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 MEASUREMENT AND ANALYSIS TECHNIQUE 9

Measurement of Blood Flow – Radiographic – Indicator Dye Dilution – Thermal Convection – Magnetic Blood Flow Rate – Ultrasonic Blood Flow meter – Sphygmomanometer – Blood Gas Analyzer – Oximeter – Auto-Analyzers – Electrophoresis – Colorimeter – Spectrophotometer – Flame Photometer.

Unit III THERAPEUTIC EQUIPMENTS AND PATIENT SAFETY 9

Stimulators – Defibrillators – Pacemakers – Diathermy – Respirators – Blood Pumps Ventilator – Haemo-dialysis Machine – Role of Laser in Health Care – Patient Safety –

Macro – Micro Shock – Preventive Measures – Earth-Free Patient Monitoring.

Unit IV MEDICAL IMAGING **9**

X-Ray Imaging and CT scan – Application and X-Ray Therapy – CAT Scan – MRI – PET –Physics of Ultrasound – Ultrasound Imaging – A-Scan and B-Scan Displays – Multi Array Scanning – M-Mode Scanning – Advantages and Disadvantages of Ultrasound Scanning Thermal Imaging Systems.

Unit V COMPUTER APPLICATIONS IN MEDICAL FIELD **9**

Computer Applications in Medicine – Patient Monitoring System – Endoscopy Unit – Radio-pill – Telemedicine and Medical Informatics

TOTAL : 45 HOURS

Text Book

1) Leislie Cromwell, "Biomedical instrumentation and measurement", Prentice Hall of India, New Delhi, 2015

References

1) Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA McGraw-Hill, New Delhi, 2015

2) Ananda Natarajan.R, "Biomedical instrumentation and measurement", Prentice Hall of India, New Delhi, 2015.

U15EC924R PROFESSIONAL ETHICS AND HUMAN VALUES 3 0 0 3

Course Outcomes

At the end of the course, the student will be able to

1) Identify the core values that shape the ethical behavior of an engineer
2) Utilize opportunities to explore one's own values in ethical issues
3) Apply codes of ethics and standards in the engineering field
4) Explore various safety issues and ethical responsibilities of an engineer
5) Recognize and resolve global issues

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1			3				3	2	3	3	2	2		
CO2		2	3			3	3	1	3	3	2	2		
CO3			2	2	3	3	3	3	3	3	2	2	3	3
CO4		3	3	2	3	3	3	3	3	3	2	2	3	3
CO5		3	2	2	3	3	3	3	3	3	2	2	3	3

Unit I HUMAN VALUES 9

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

Unit II ENGINEERING ETHICS 9

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral Dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Profession and Professionalism – Professional Ideals and Virtues – Theories of Right action- Uses of Ethical Theories.

Unit III ENGINEERING AS SOCIAL EXPERIMENTATION **9**

Engineering as Experimentation – Contrasts with standard experiments- Engineers as Responsible Experimenters – Importance and limitations of Codes of Ethics - Industrial Standards - A Balanced Outlook on Law – Case Study: Space shuttle challenger disaster.

Unit IV SAFETY, RESPONSIBILITIES AND RIGHTS **9**

Safety and Risk – Types of risk - Assessment of Safety and Risk – Risk Benefit analysis- Reducing Risk – Case Studies -Chernobyl and Bhopal plant disaster.

Collegiality and Loyalty – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Importance and consequences of whistle blowing - Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

Unit V GLOBAL ISSUES **9**

Multinational Corporations – Environmental Ethics – Computer Ethics and Internet- Engineers and Technological progress – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Participation in professional societies- Sample Code of Conduct (pertaining to specific professional societies)

TOTAL : 45 HOURS

Text Book

1) Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, Indian Edition, Tenth reprint, 2017

2) Professional Ethics and Human values- Sonaversity, Edition 2018

References

1) Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, 2012.

2) Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2016

3) R.Subramanian , “Professional Ethics “,Oxford University Press ,Reprint ,2015

4) Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001

5) David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, 2003

U15EC927R **DEEP LEARNING** **3 0 0 3**

Course Outcomes

At the end of the course, the student will be able to

1) Explain the basic concepts in Neural Networks and applications
2) Understand and use feature extraction techniques in Neural Networks
3) Learn the fundamentals of deep learning, and the main research activities in this field
4) Implement CNN and RNN algorithms and solve real world problems
5) Analyse detection and recognition tasks using convolution neural networks

CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	3	2							3	3	2
CO2	2	2	3	3	3							3	3	2
CO3	2	3	2	3	2							3	3	2
CO4	2	2	3	3	3							3	3	2
CO5	2	2	3	2	3							3	3	2

Unit I MODERN PRACTICAL DEEP NETWORKS **9**

Fundamentals Of Neural Networks – Model of Biological and Artificial Neuron – Neural Network Architectures – Activation Functions- McCulloh Pitts neuron Model- Perceptron Learning Algorithms - XOR Problem-K Means Clustering – Decision Trees.

Unit II LINEAR MODELS **9**

Multilayer Perceptron- Gradient Descent- Forward and Backward Backpropagation-RBF- Fully Connected layers- PCA- GLCM - LBP – Particle Swarm Optimization- Cuckoo Search optimization- Grey wolf optimization -Support Vector Machine

Unit III IMPROVING DEEP LEARNING **9**

Introduction to deep learning - Shallow Neural Networks – Radial Basis Function Neural Network -Planar data classification with a hidden layer -Layers in Neural Network- Convolution and its types-Pooling layers and its types- Building your Deep Neural Network: step by step- Deep Neural Network - Hyperparameter tuning, Batch Normalization.

Unit IV DEEP CONVOLUTIONAL MODELS: CASE STUDIES **9**

1D, 2D, 3D Convolutional Neural Network, Basic structure of Convolutional Network – Overfitting-Activation ReLU - Case studies: LeNet, Alex net, VGGNet, GoogLeNet – RNN- Design of New architectures.

Unit V DATA TO KNOWLEDGE **9**

Data Preparation- Numerical Measure- Confusion Matrix- Visualization-Applications of CNN–YOLO – SSD- Faster RCNN Object Detection, MNIST Image Classification - Face Recognition - Natural Language Processing, Speech Recognition via Spectrogram- 3D-Pose Estimations using Deep learning algorithms.

TOTAL : 45 HOURS

Text Book

1) Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr. D Karthika Renuka, Deep Learning Using Python, Wiley, 2019,

References

1) Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006
2) Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009
3) Satis Kumar, Neural networks: A Classroom Approach, Tata McGraw-Hill Education, 2000

U15EC704R MICROWAVE AND OPTICAL LABORATORY 0 0 2 1

Course Outcomes

After successful completion of this course, the students should be able to

1) Measure microwave signals and parameters
2) Analyze the performance behaviour of microwave components
3) Analyze the performance of optical components

Pre-requisite

Transmission lines and waveguides

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3					2		3	3	3	3
CO2	3	3	2	3					2		3	3	3	3
CO3	3	3	2	3					2		3	3	3	3

List of Experiments

1) Study of Microwave Components
2) Reflex Klystron Mode Characteristics
3) Characteristics of Gunn Oscillator
4) Measurement of Impedance
5) Measurement of Frequency, Wavelength, VSWR
6) S parameter measurement of Isolator & circulator
7) Measurement of Directivity and Coupling coefficient of directional coupler
8) Design of microwave integrated circuits based on directional coupler
9) Study of Resonant characteristics of Microwave integrated circuits
10) DC characteristics of LED and LD
11) DC characteristics of PIN PD
12) DC characteristics of APD

TOTAL : 30 HOURS

U15EC706R **COMPREHENSIVE REVIEW** **0 0 2 1**

Course Outcomes

After successful completion of this course, the students should be able to

1) Analyse the semiconductor devices and design digital circuits.
2) Apply the importance of Transforms in signals analysis and analyse the features of electromagnetics and wave guide
3) Analyse the analog & digital communication systems fundamental of applications

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	2	2	2	1	2	2	1	3	3
CO2	3	3	2	3	1	1	2	2	1	2	2	1	3	2
CO3	2	3	3	3	3	1	2	2	1	2	1	1	3	3

Unit I ELECTRONIC DEVICES AND ANALOG CIRCUITS **9**

Energy Band in Silicon Intrinsic and Extrinsic – Diffusion Current – Drift Current – Mobility – Resistivity. Diodes – P-N Junction – Zener Diode – Tunnel Diode – BJT – JFET – MOS – Transistor – LED – PIN Diode. Diodes – Clipper – Clamper – Rectifier – Biasing – Stability of Transistor – Types of Amplifiers – Op-Amp – CMRR – Slew Rate – 555 Timers – Basic Circuit Theory Concept.

Unit II DIGITAL ELECTRONICSAND MICROPROCESSOR **9**

Logic Gates – Boolean Algebra – Boolean Laws – K-map Realization – Combinational and Sequential Circuits – Code Conversion. 8085 Architecture and their Interfaces –Instruction Sets – Assembly Language Program

Unit III SIGNALS AND SYSTEMS **9**

Types of Signals – Continuous and Discrete Time Signals – Classification of signals – Continuous and Discrete Time Fourier Transforms – DFT and FFT – Z Transforms – Sampling Theorem – Linear Time in Varient Systems – Convolutions - Linear and Circular Convolutions.

Unit IV ELECTROMAGNETICS AND TRANSMISSION LINES AND WAVEGUIDES **9**

Divergence – Curl – Gauss law – Stokes Theorem – Ampere Circuital Law – Maxwell's

Equations – Differential Form and Integral Form – Pointing vector– Characteristics Impedance – Boundary Conditions – Cut off Frequencies.

Unit V COMMUNICATION SYSTEMS (ANALOG & DIGITAL) 9

Principles of Modulations – SNR for Analog Modulation Methods – Digital Pulse Modulation Schemes – Generation and Detection – Digital Keying Techniques – Multiple Access Techniques (CDMA, TDMA, FDMA).

TOTAL : 30 HOURS

U15EC1008R **MOBILE TECHNOLOGY AND ITS APPLICATIONS** **3 0 0 3**

Course Outcomes

At the end of each unit, the students will be able to

1) Analyze the 1G and 2G Technologies.
2) Explain the 2.5G evolutions
3) Analyze the principles of 3G and UMTS
4) Analyze the evolutions of 4G
5) Summarize the various wireless security applications and solve the mobile phone faults

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3		1		1	1	3
CO2	3	3	3	3	3	3		1		1	1	3
CO3	3	3	3	3	3	3		1		1	1	3
CO3	3	3	3	3	3	3		1		1	1	3
CO4	3	3	3	3	3	3		1		1	1	3

Unit I 1G and 2G **09**

First Generation (1G): 1G Systems – General 1G System Architecture – Generic MTSO Configuration – Generic Cell Site Configuration – Call Setup Scenarios – Handoff – Frequency Reuse – Spectrum Allocation – Channel Band Plan Second generation (2G): Enhancements over 1G Systems – Integration with Existing 1G Systems – GSM – IS-136 System Description – IS-95 System Description – iDEN – CDPD Channels

Unit II 2.5G Generation **09**

Enhancements over 2G – Technology Platforms – General Packet Radio Service (GPRS) – Enhanced Data Rates for Global Evolution (EDGE) – High-Speed Circuit Switched Data (HSCSD) – CDMA2000 (1XRTT) – WAP Migration Path from 2G to 2.5G to 3G.

Unit III 3G Generation **09**

Introduction – Universal Mobile Telecommunications Service (UMTS) – UMTS Services – The UMTS Air Interface – Overview of the 3GPP Network Architecture – Overview CDMA2000 – Commonality Between WCDMA/CDMA2000/CDM
Universal Mobile Telecommunications Service (UMTS): Introduction – UMTS Basics – The WCDMA Air Interface, The UTRAN Architecture – Handover – UMTS Core Network Evolution.

Unit IV 4G and Beyond **09**

Introduction to LTE -A–Requirements and Challenges – Network architectures – EPC – E-UTRAN architecture – Mobility management – Resource management – Services – Channel – logical and transport channel mapping – downlink/uplink data transfer – MAC control element – PDU packet formats – scheduling services – random access procedure – Objectives of 5G- Architecture – Features and benefits

Unit V Wireless Security and Mobile Phone Service **09**

Introduction – Finger Print – Classification of major security attacks against RFID systems – GSM Security – Barcode scanner technology features and applications – QR code – BAR code – OTP – AirDrop.
Mobile phone Service: Parts in the mobile phones -Mobile phones assembling and disassembling –motherboard - Mobile Operating Systems - Fault finding - Advanced troubleshooting techniques.

TOTAL : 45 HOURS

TEXT BOOKS

1) Clint Smith,P.E, Dannel Collins, "3G Wireless Networks" 2nd edition, Tata McGraw-Hill, 2008.

REFERENCES

1) Vijay K.Garg, "Wireless Network Evolution- 2G & 3G" Pearson, 2013.

2) T.S Rapp port, "Wireless Communications" Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint, 2013.

3) JochenH.Schiller, "Mobile Communications", 2/e, Pearson, 2014.

4) SassanAhmadi, "LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII 2015R (CBCS)
Branch: Electronics and Communication Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	U15EC801R	Project Work	0	0	24	12	360
					Total Credits	**12**	

Approved By

Chairperson, Electronics and Communication Engineering BoS	**Member Secretary, Academic Council**	**Chairperson, Academic Council & Principal**
Dr.R.S.Sabeenian	Dr.R.Shivakumar	Dr.S.R.R.Senthil Kumar

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