E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade | Accredited by NBA (CSE, EEE, MECH)

NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

First Year – First Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1901MA104	Engineering Mathematics –I (Linear Algebra, Calculus and Partial differentiation)	3	1	0	4	40	60	100
1901CH102	Chemistry for Electronic Engineers	3	0	0	3	40	60	100
1901GEX03	Programming for Problem Solving	3	0	0	3	40	60	100
1901ENX01	English for Engineers	2	0	0	2	100	-	100
Laboratory Course								
1901GEX52	Computer Programming Lab	0	0	2	1	50	50	100
1901GEX51	Engineering Intelligence I	0	0	2	1	50	50	100
1901CHX51	Engineering Chemistry Lab	0	0	2	1	50	50	100
1901HS151	Communication Skills	0	0	2	1	100	0	100
Total		**11**	**1**	**8**	**16**	**470**	**330**	**800**

L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester

1901MA104	MATHEMATICS –I (LINEAR ALGEBRA, CALCULUS AND PARTIAL DIFFERENTIATION)	L	T	P	C
		3	1	0	4

(Common for ECE, MECH & BME Programme)

MODULE I MATRICES **9 Hours**

Inverse and rank of a matrix - rank-nullity theorem - System of linear equations – Symmetric-skew-symmetric and orthogonal matrices – Determinants - Eigen values and Eigen vectors-Diagonalization of matrices-Cayley-Hamilton Theorem - Orthogonal transformation.

MODULE II DIFFERENTIAL CALCULUS **9 Hours**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature- Evaluates and involutes.

MODULE III INTEGRAL CALCULUS **9 Hours**

Double integration – Cartesian and polar coordinates – Change the order of Integration – Applications: Area of a curved surface using double integral – Triple integration in Cartesian co-ordinates – Volume as triple integral.

MODULE IV SEQUENCES AND SERIES **9 Hours**

Convergence of sequence and series-Tests for convergence - Power series - Taylor's series,
Series for exponential - trigonometric and logarithm functions.

MODULE V PARTIAL DIFFERENTIATION **9 Hours**

Partial derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers.

TOTAL: 45 HOURS

REFERENCES:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

1901CH102	CHEMISTRY FOR ELECTRONIC ENGINEERS (Common for ECE & EEE Programme)	L	T	P	C
		3	0	0	3

MODULE I **9 Hours**

Electrochemistry- Cell Terminology-Electrochemical cells- Electrolytic cells- Cell reactions- Daniel cell- Difference between electrolytic cells and electrochemical cells. Reversible cells and irreversible cells -types- EMF and its applications - Nernst equation (derivation and problems). Single electrode potential - Hydrogen electrode - Calomel electrode - Glass electrode - pH measurement using glass electrode.

MODULE II **9 Hours**

Semiconductors- Conductors, insulators, semiconductors, – Band theory semiconductors – Junction devices – Super conductivity – Ionic conductivity – defects in stoichiometric and Non stoichiometric crystals. Optical properties of solids – Lasers and phosphors – Photovoltaic effect- Solar energy storage and conversion materials.

MODULE III **9 Hours**

Materials for communications - crystalline semiconductors; metalized film conductors; dielectric films; solders; ceramics and polymers. Electronic materials, Semiconductor crystals - Silicon, III–V compounds, Photoresist films, Packaging materials, Photonic materials, Crystalline materials - Epitaxial layers, Optical switching, Optical transmission-NLO and OLED Materials.

MODULE IV **9 Hours**

Biosensors- biosensors -types of biosensors- magnetic biosensors, thermal biosensors- piezoelectric biosensors- optical biosensors - applications of biosensor. introduction: classification of polymers – natural and synthetic; thermoplastic and thermosetting. conducting polymers, electron conducting polymers- polyaniline (pan), polypyrroles (ppy), polythiophenes (pt) and polyphenylene vinylenes (ppv) - light emitting diodes , photo-induced doping.

MODULE V **9 Hours**

Nanotechnology - Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube (CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications.

TOTAL: 45 HOURS

REFERENCES:

1. Dara S.S, Umare S.S, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company, Ltd., New delhi 2010
3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, “Polymer Science”, New Age .
4. Ozin G. A. and Arsenault A. C., “Nanochemistry: A Chemical Approach to Nanomaterials”, RSC Publishing, 2005
5. Biosensors: An Introductory Textbook by C. S. Pundir and Jagriti Narang,2017
6. J.O.M.Bockris & A.K.N.Reddy, “Modern Electrochemistry –Vol. I & II” , Plenum Press, New York, 2000
7. Peter Atkins and Julio de Paula, “Physical Chemistry”, VII Edition, Oxford University Press, New York, 2002.
8. A.J. Bard and L.R. Faulkner, “Electrochemical Methods – Fundamentals and applications” 3 rd edition John Wiley & Sons Inc, 2001.

	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	C
1901GEX03	(Common for all B.E./B.Tech Programme)	3	0	3	4

MODULE I INTODUCTION TO PROGRAMMING **9 Hours**

Components of Computers and its Classifications- Problem Solving Techniques – Algorithm- Flowchart–Pseudo code – Program-Compilation -Execution

MODULE II BASICS OF C PROGRAMMING **9 Hours**

Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/output statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives.

MODULE III ARRAYS AND STRINGS **9 Hours**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – Example Program: Matrix Operations - String operations

MODULE IV FUNCTIONS AND POINTERS **9 Hours**

Introduction to functions: Function prototype, function definition, function call, Built-in functions – Recursion – Example Program – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference

MODULE V STRUCTURES & FILE PROCESSING **9 Hours**

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Dynamic memory allocation -Files – Types - File processing: Sequential access, Random access - Command line arguments

TOTAL: 45 HOURS

REFERENCES:

1. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, ―Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

1901ENX01	ENGLISH FOR ENGINEERS	L	T	P	C
	(Common for all B.E./B.Tech. Programme)	**3**	**0**	**0**	**3**

MODULE I FOCUS ON LANGUAGE (Vocabulary and Grammar) 9 Hours

Vocabulary -The Concept of Word Formation - prefixes- suffixes- Synonyms – Antonyms - Grammar -Articles- Preposition- Adjective-Adverb-connectives -Tenses (present, past & future) - Sentence pattern- types of sentences -Active voice –passive voice and Impersonal passive voice - Wh- Questions.

MODULE II LISTENING SKILLS 9 Hours

Listening- listening intently-arousing and sustaining interest-listening to short or longer texts- formal and informal conversations- telephonic etiquettes- narratives from different sources. -listening and Note taking-correlative verbal and nonverbal communication-listening to TOEFL & IELTS programs-listening to Project presentation- listening to technical seminar and conferences.

MODULE III SPEAKING SKILLS 9 Hours

Speaking - stress and intonation –persuasive speaking -Describing person, place and thing - sharing personal information — greetings –taking leave -Individual and Group Presentation-impromptu Presentation-public speaking-Group Discussion- project planning-facing viva voce and delivering project.

MODULE IV READING SKILLS 9 Hours

Reading– comprehending general and technical articles -cloze reading - inductive reading- short narrative and descriptions from newspapers – Skimming and scanning-reading and interpretation-critical reading interpreting and transferring graphical information- sequencing of sentences-analytical reading on various Projects.

MODULE V WRITING SKILLS 9 Hours

Writing- Precise writing –Summarizing- interpreting visual texts (pie chart, bar chart, picture - advertisements etc., - Proposal writing (launching new units or department in a institution or industry & to get loan from bank) -report writing (accident, progress, project, survey, Industrial visit)- job application-e-mail drafting- letter writing (permission, accepting and decaling)-instructions –
recommendations –checklist

TOTAL: 45 HOURS

REFERENCES:

1. Raman, Meenakshi and Sangeetha Sharma, “Technical Communication: Principles and Practice”, Oxford University Press, New Delhi, 2011.
2. Rizvi and Ashraf M., “Effective Technical Communication”, Tata McGraw-Hill, New Delhi, 2005.
3. G. Radhakrishna Pillai, “English for Success”, Central Institute of English and Foreign Languages”, Emerald Publishers ,Hyderabad, 2003
4. Jones, D, “The Pronunciation of English”, CUP, . Cambridge,2002.

1901GEX52	COMPUTER PROGRAMMING LAB (Common for all B.E./B.Tech. Programme)	L 0	T 0	P 2	C 1

List of Experiments:

1. Working with word and style sheets
2. Write a C program to implement basic concepts
3. Write a C program to implement Decision Making and Branching statements
4. Write a C program to implement looping statements
5. Write a C program to implement Arrays
6. Write a C program to implement Strings
7. Write a C program to implement pointers
8. Write a C program to implement Structures
9. Write a C program to work with files in C

Total: 45 Hours

References:

1. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, ―Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

1901GNX51	ENGINEERING INTELLIGENCE I	L	T	P	C
	(Common for all B.E./B.Tech. Programme)	0	0	2	1

MODULE I BEHAVIORAL CHANGES – TRANSITION OF SCHOOL TO COLLEGE **6 Hours**

Vocabulary -The Concept of Word Formation - prefixes- suffixes- Synonyms – Antonyms - Grammar - Articles-Preposition- Adjective-Adverb-connectives -Tenses (present, past & future) - Sentence pattern-types of sentences -Active voice –passive voice and Impersonal passive voice - Wh- Questions.

MODULE II EXPOSURE TO INDIVIDUAL COMPETANCE **6 Hours**

Listening- listening intently-arousing and sustaining interest-listening to short or longer texts- formal and informal conversations- telephonic etiquettes- narratives from different sources. -listening and Note taking- correlative verbal and nonverbal communication-listening to TOEFL & IELTS programs-listening to Project presentation- listening to technical seminar and conferences**.**

MODULE III CAREER PLANNING **6 Hours**

Speaking - stress and intonation –persuasive speaking -Describing person, place and thing - sharing personal information — greetings –taking leave -Individual and Group Presentation-impromptu Presentation-public speaking-Group Discussion- project planning-facing viva voce and delivering project.

MODULE IV INTRODUCTION TO COMMUNICATION SKILLS **6 Hours**

Reading– comprehending general and technical articles -cloze reading - inductive reading- short narrative and descriptions from newspapers – Skimming and scanning-reading and interpretation-critical reading interpreting and transferring graphical information- sequencing of sentences-analytical reading on various Projects.

MODULE V COMMUNICATION EXERCISE-1 **6 Hours**

Writing- Precise writing –Summarizing- interpreting visual texts (pie chart, bar chart, picture - advertisements etc., - Proposal writing (launching new units or department in a institution or industry & to get loan from bank) -report writing (accident, progress, project, survey, Industrial visit)- job application-e-mail drafting- letter writing (permission, accepting and decaling)-instructions – **recommendations –checklist**

TOTAL: 30 HOURS

REFERENCES:

1. Dr.P.Prasad(2012) “The Functional Aspects of COMMUNICATION SKILLS”;fifth Edition;S.K Kataria &Sons Publication
2. Kalyana; (2015) “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd.
3. Aruna Koneru (2008) “Professional Communication”; Second edition; Tata McGraw-Hill Publishing Ltd.

1901CHX51	ENGINEERING CHEMISTRY LAB (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

List of Experiments:

1. Determination of total, temporary & permanent hardness of water by EDTA method
2. Determination of strength of given hydrochloric acid using pH meter
3. Estimation of iron content of the given solution using potentiometer
4. Estimation of sodium present in water using flame photometer
5. Corrosion experiment – weight loss method
6. Determination of molecular weight of a polymer by viscometer method
7. Conductometric titration of strong acid Vs strong Base
8. Estimation of dissolved oxygen in a water sample/sewage by Winkler's method.
9. Comparison of alkalinities of the given water samples
10. Determination of concentration of unknown colored solution using spectrophotometer
11. Determination of percentage of copper in alloy
12. Determination of ferrous iron in cement by spectrophotometry method
13. Adsorption of acetic acid on charcoal
14. Determination the flash point and fire point of a given oil using pen skyMartine closed cup apparatus
15. Determination the calorific value of solid fuels
16. Determination the structural of the compound using chemo software.

Total: 45 Hours

References:

1. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel‟s Textbook of practical organic chemistry", LBS Singapore (1994).
2. Jeffery G.H., Bassett J., Mendham J.and Denny vogel‟s R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
3. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

1901HS151	COMMUNICATION SKILLSLAB (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

List of Experiments:

1. **Activities on Fundamentals of Inter-personal Communication**

Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals.

2. **Activities on Reading Comprehension**

General Vs Local comprehension, reading for facts, guessing meanings from context, Scanning, skimming, and inferring meaning, critical reading & effective googling.

3. **Activities on Writing Skills**

Structure and presentation of different types of writing - letter writing/ Resume writing/e-correspondence/ Proposal writing/Technical report writing/ Portfolio writing - planning for writing - improving one's writing.

4. **Activities on Presentation Skills**

Oral presentations (individual and group) through JAM sessions / seminars / PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.- creative and critical thinking.

5. **Activities on Soft Skills**

Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation-Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews-Timemanagement-stress management –paralinguistic features- Multiple intelligences – emotionalintelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.

Total: 45 Hours

References:

1. Raman, Meenakshi and Sangeetha Sharma, “Technical Communication: Principles and Practice”, Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , “Advanced Communication Skills Laboratory Manual” , Pearson Education 2011.
3. Paul V. Anderson ,“Technical Communication”,. Cengage Learning pvt. Ltd. New Delhi, 2007.
4. “English Vocabulary in Use series”, Cambridge University Press 2008.
5. “Management Shapers Series” ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., “Effective Technical Communication”, Tata McGrawHill, New Delhi, 2005.
7. Jones, D, “The Pronunciation of English”, CUP, . Cambridge,2002.

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NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

First Year **Second Semester**

Course Code	Course Name	L	T	P	C	Maximum Marks		
						C	E	Tot
Theory Course								
1901MA204	Engineering Mathematics II (Calculus, Ordinary Differential Equations and Complex	3	2	0	4	40	60	100
1901PH202	Semiconductor Physics and Optoelectronics	3	0	0	3	40	60	100
1901GEX01	Basic Electrical and Electronics Engineering	3	0	0	3	40	60	100
1901GEX0	Engineering Graphics	2	2	0	3	5	50	10
1901GE20	Engineering Exploration	2	0	0	2	4	6	10
Laboratory Course								
1901GE254	Computer Hardware and IT Essentials Lab	0	0	2	1	50	50	100
1901GE25	Engineering Intelligence - II	0	0	2	1	10	0	10
1901GEX5	CAD Lab	0	0	2	1	5	5	10
1901GEX53	Basic Electrical and Electronics Engineering Lab	0	0	2	1	50	50	100
1901PHX5	Engineering Physics Lab	0	0	2	1	5	50	10

L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester

1901MA204	ENGINEERING MATHEMATICS II (Calculus, Ordinary Differential Equations and Complex Variable)	L	T	P	C
		3	2	0	4

MODULE I LAPLACE TRANSFORM 12 Hours

Laplace Transform Conditions for existence – Transform of Elementary Functions – Basic Properties Transform of Unit step function and Impulse function – Transform of Periodic function – Inverse Laplace Transform Convolution Theorem (excluding Proof) – Initial and Final value Theorems – Solution of Linear ODE of Second order with constant coefficient using Laplace Transform techniques.

MODULE II VECTOR CALCULUS 12 Hours

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration: Green‟s theorem in a plane, Gauss divergence theorem and Stokes‟ theorem (excluding proofs) – Applications of the above theorems to find surface area of a closed region and volume of cube and parallel piped.

MODULE III ORDINARY DIFFERENTIAL EQUATIONS 12Hours

Second order linear differential equations with variable coefficients, method of variation of parameters.

MODULE IV COMPLEX VARIABLE – DIFFERENTIATION 12Hours

Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; Conformal mappings, Mobius transformations.

MODULE V COMPLEX VARIABLE– INTEGRATION 12 Hours

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

TOTAL: 60 HOURS

REFERENCES:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

1901PH202	SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS	L	T	P	C
		3	0	0	3

MODULE I ELECTRONIC MATERIALS 9 Hours

Free electron theory, Density of states and energy band diagrams, Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors and insulators, Occupation probability, Fermi level.

MODULE II SEMICONDUCTORS 9 Hours

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier- concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal- semiconductor junction (Ohmic and Schottky).

MODULE III SEMICONDUCTOR LASERS 9 Hours

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain. Semiconductor laser (GaAs): materials, device characteristics, figures of merit and Vertical-Cavity Surface-Emitting Lasers (VECSEL), Tunable semiconductor lasers.

MODULE IV SEMICONDUCTOR PHOTODETECTORS 9 Hours

Types of semiconductor photodetectors -p-n junction, PIN, and Avalanche and their structure, working principle, and characteristics, Noise limits on performance; Solar cells.

MODULE V NANO- OPTOELECTRONIC DEVICES 9 Hours

Digital systems: Boolean algebra - Reduction of Boolean expressions - De-Morgan"s theorem - Logic gates - Implementation of Boolean expressions.

TOTAL: 45 HOURS

REFERENCES:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: “Semiconductor Optoelectronics by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

1901GEX01	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO DC AND AC CIRCUITS **7 Hours**

Introduction to DC and AC circuits: Ohms law - Kirchhoff's laws - Mesh analysis - Nodal analysis - Generation of AC waveforms - Analysis of R-L, R-C, R-L-C circuits - Introduction to three phase systems - Types of connections.

MODULEII ELECTRICAL MACHINES **6 Hours**

Electrical Machines: DC Generator, DC Motor, Transformer, Induction Motor: Working principle, construction and applications.

MODULEIII MEASURING INSTRUMENTS **6 Hours**

Measuring instruments: Classification of instruments; Voltmeter, Ammeter, Wattmeter, Energy meter, Multimeter, CRO: Principles and operation.

MODULEIV SEMICONDUCTOR DEVICES **7 Hours**

Semiconductor devices: V-I characteristics of PN junction diode and Zener diode; Rectifiers - Half wave and full wave rectifiers; BJT - configurations; Amplifiers & Oscillators: classification, operation and applications; SCR: Construction and V-I characteristics; Basic power converters (Block diagram approach only).

MODULEV DIGITAL SYSTEMS **6 Hours**

Digital systems: Boolean algebra - Reduction of Boolean expressions - De-Morgan‟s theorem - Logic gates - Implementation of Boolean expressions.

MODULEVI COMMUNICATION SYSTEMS **6 Hours**

Communication Systems: Model of communication system - Analog and digital, Wired and wireless channel - Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system.

MODULEVII ELECTRICAL SAFETY AND WIRING **7 Hours**

Electrical safety and wiring: Safety measures in electrical system - Safety devices - types of wiring - Wiring accessories- staircase, fluorescent lamps and corridor wiring - Basic principles of earthing - Types of earthing - layout of generation, transmission and distribution of power (Single line diagram).

TOTAL: 45 HOURS

REFERENCES:

1. Smarajit Ghosh, “Fundamentals of Electrical and Electronics Engineering”, 2nd Edition, PHI Learning, 2010.
2. R. Muthusubramaniam, S. Salaivahanan and K.A. Mureleedharan, Basic Electrical Electronics and Computer Engineering ,Tata McGraw Hill, 2004.
3. D.P. Kothari and I.J. Nagrath, Theory and Problems of Basic Electrical Engineering , PHI learning, New Delhi, 2004
4. J.B. Gupta, “Fundamentals of Electrical Engineering and Electronics , S.K. Kataria and Sons, Reprint 2012 Edition.
5. R.L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory , Pearson, 11th Edition, 2013.
6. George Kennedy and Bernard Davis, “Kennedy‟s Electronic communication Systems”, McGraw Hill Education, 5th Edition, 2011.
7. Donald P. Leach, Albert Paul Malvino and Goutam Saha, “Digital Principles and Applications”, McGraw-Hill Education, 8th Edition, 2014.

1901GEX02	ENGINEERING GRAPHICS	L	T	P	C
		2	2	0	3

MODULE I CONCEPTS AND CONVENTIONS (Not for Examination) 5 Hours

Importance of graphics in engineering applications Use of drafting instruments – BIS conventions and specifications Size, layout and folding of drawing sheets Lettering and dimensioning.

MODULEII PLANE CURVES AND FREE HAND SKETCHING 9 Hours

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of Objects.

MODULEIII PROJECTION OF POINTS, LINES AND PLANE SURFACES 9 Hours

Orthographic projection- principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

MODULEIV PROJECTION OF SOLIDS 9 Hours

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

MODULE V PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 9 Hours

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

MODULE VI ISOMETRIC AND PERSPECTIVE PROJECTIONS 9 Hours

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 45+5 HOURS

REFERENCES:

1. Gopalakrishna K.R., Engineering Drawing (Vol. I&II combined), Subhas Stores, Bangalore,2016.
2. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson, 2nd Edition, 2015.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2017.
5. Natrajan K.V., “A text book of Engineering Graphics , Dhanalakshmi Publishers, Chennai, 2015.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing , Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. Bhatt N.D. and Panchal V.M., “Engineering Drawing , Charotar Publishing House, 50th Edition, 2016.

1901GE201	ENGINEERING EXPLORATION	L	T	P	C
		2	0	0	2

What is Engineering: Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements

.

Engineering Design: Problem definition, idea generation through brainstorming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement.

Defining problems and Brainstorming: Researching design, sketching problem solving.

Communicating solution: Dimensioning orthographic drawing, perspective drawing.

Modeling and Testing final output: Product evaluation, reverse engineering, final project report.

Civil Engineering: Structural forces structural analysis, bridge design components, structural design.

Mechanical Engineering: Types of motion, mechanical power system, mechanical power formula, mechanical design.

Electrical Engineering: Reading analog multimeter, measuring current, voltage and resistance, electricity from chemicals, solar cells, magnets, Ohms law and watts law, circuit identification and circuit calculation, resistor color code, continuity.

Computer Engineering: Logic gates, algorithms, computer architecture, binary code.

TOTAL: 30 HOURS

REFERENCES:

1. Ryan A.Brown, Joshua W.Brown and Michael Berkihiser: Engineering Fundamentals: Design, Principles, and Careers", Goodheart-Willcox Publisher, Second Edition, 2014.
2. Saeed Moaveni ,"Engineering Fundamentals: An Introduction to Engineering , Cengage learning, Fourth Edition, 2011.

1901GE254	COMPUTER HARDWARE AND IT ESSENTIALS	L	T	P	C
		0	0	2	1

List of Experiments:

1. Study of hardware components (such as storage devices, I/O devices, CPU, Motherboard, other peripherals).
2. Installation of operating systems (Windows and Linux).
3. Other software installation.
4. Study of network components.
5. Network establishment(configuring IP address, Domain name system)
6. Study of Internet.
7. Introduction to Web.
8. Usage of internet services- Email, File Sharing, Social Media etc.
9. Study of firewalls and Antivirus.
10. Troubleshooting various problems.

TOTAL: 30 HOURS

REFERENCES:

1. Craig Zacker& John Rourke, The complete reference:PC hardware , Tata McGrawHill, New Delhi, 2001.
2. Mike Meyers, “Introduction to PC Hardware and Troubleshooting , Tata McGrawHill, New Delhi, 2003.
3. B.Govindarajulu, IBM PC and Clones hardware trouble shooting and maintenance”,
4. Tata McGraw-Hill, New Delhi, 2002
5. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014.
6. James F. Kurose, ―Computer networking: A Top-Down Approach‖, Sixth Edition, Pearson, 2012.
7. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014
8. Craig Zacker& John Rourke, “The complete reference:PC hardware , Tata McGrawHill, New Delhi, 2001.

1901GE252	ENGINEERING INTELLIGENCE II	L	T	P	C
		0	0	2	1

MODULE I VOCABULARY BULIDING **6 Hours**

Parts of Grammar- SVA- Art of Writing- word building activities

MODULEII COMMUNICATION WORKSHOP **6 Hours**

Story Telling- Newspaper Reading-Extempore.

MODULEIII INTERPERSONAL SKILLS **6 Hours**

Personality Development - Creativity and innovation Critical Thinking and Problem Solving – Work Ethics-Technical Skill Vs Interpersonal Skills

MODULEIV LEADERSHIP& EMPLOYABILITY SKILLS **6 Hours**

Levels of Leadership-Making of leader-Types of leadership-Transactions Vs Transformational Leadership Exercises - Industry Expectations & Career Opportunities- Recruitment patterns.

MODULE V RESUME BUILDING **6 Hours**

Importance of Resume- Resume Preparation - introducing onself

TOTAL: 30 HOURS

REFERENCES:

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills , First Edition; Oxfor Publishers.
2. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007.
3. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.

1901GEX51	CAD (COMPUTER AIDED DRAFTING) LAB	L	T	P	C
		0	0	2	1

List of

Basics commands of a CAD software- two-dimensional drawing, editing, layering and dimensioning - coordinate Systems-Drawing practice - orthographic views of simple solids using CAD software.

1. Study of capabilities of software for Drafting and Modeling Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
7. Drawing isometric projection of simple objects.
8. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

TOTAL: 30 HOURS

References:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing House Pvt. Ltd., 2014.
2. P.S. Gill, A Textbook of Machine Drawing, Katson books, 2013.
3. R.K. Dhawan, A Textbook of Machine Drawing, S. Chand,2012.
4. K.C. John, Textbook of Machine Drawing, PHI Learning Pvt. Ltd.,2009.

1901GEX53	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

List of

1. Experiments related to verification of Ohm‟s law and Kirchhoff‟s laws
2. Experiments involving logic gates
3. Fan and light control using regulators
4. Design of 6V regulated power supply
5. Energy conservation demonstration experiment using energy meter
6. Waveform generation and calculation of RMS and average values
7. IC 555 and IC 741 based experiments
8. Experiments in earthing
9. Staircase wiring and residential building wiring
10. Speed control of DC shunt motor

Total: 30 Hours

References:

1. Edward Hughes, Electrical Technology, , Pearson Education
2. D.P. Kothari and Nagrath Basic Electronics”,MH Education 2013.
3. Paul Scherz and Simon Monk Practical Electronics for inventors Mc Graw Hill Publications 2013.

1901PHX51	ENGINEERING PHYSICS LAB	L	T	P	C
		0	0	2	1

List of Experiments:

1. Determination of wavelength of various colours of mercury spectrum using Laser grating
2. Determination of velocity of liquids using ultrasonic interferometer
3. Determine the dispersive power of a prism using spectrometer
4. Determine the unknown resistance of the given wire using Carey-Foster‟s Bridge
5. Determine the band gap of the given semiconductor
6. Determine the acceptance angle and particle size using Laser
7. Torsional pendulum – Rigidity modulus of a steel wire
8. Thickness of a thin wire – Air Wedge
9. Measurement of Young‟s modulus – Uniform and Non-uniform bending
10. Thermal conductivity –Lee‟s Disc method

Total: 45 Hours

References:

1. „Practical Physics‟, R.K. Shukla, Anchal Srivastava, New age international (2011)
2. „B.Sc. Practical Physics‟, C.L Arora, S. Chand &Co. (2012)

E.G.S. PILLAY ENGINEERING COLLEGE(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai |

Accredited by NAAC with „A"Grade |Accredited by NBA (CIVIL, CSE, ECE, EEE, IT, MECH)

NAGAPATTINAM – 611 002

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

FullTimeCurriculum And Syllabus

Second Year **Third Semester**

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1901MA301	Engineering Mathematics III (Linear Algebra and Vector Calculus)	3	1	0	4	40	60	100
1902EC301	Electronic Devices	3	0	0	3	40	6	1
1902EC302	Circuits and Networks	2	1	0	3	40	6	1
1902EC303	Digital Electronics	2	1	0	3	40	6	1
1901EC304	Biology for Engineers	3	0	0	3	40	6	1
1902CS306	Object Oriented Programming and Data	3	0	0	3	40	60	100
Laboratory Course								
1902EC351	Devices and Circuits Laboratory	0	0	2	1	5	5	1
1902EC352	Digital Electronics Laboratory	0	0	2	1	5	5	1
1902CS354	Object Oriented Programming and Data	0	0	2	1	50	50	100
1904GE351	Life Skills: Verbal Ability	0	0	2	1	10	0	1
Tot		**18**	**3**	**6**	**2**	**59**	**51**	**1100**
Audit Course								
1901MCX0	Constitution of India	2	0	0	0	0	-	0

L–Lecture|T–Tutorial|P Practical|C–Credit|CA –ContinuousAssessment| ES–EndSemester

1901MA301	ENGINEERING MATHEMATICS III (LINEAR ALGEBRA AND VECTOR CALCULUS)	L	T	P	C
		3	1	0	4

MODULE I VECTOR SPACES **12 Hours**

Vector spaces Subspaces – Linear combinations and system of Linear equations Linear independence and Linear dependence Bases and Dimensions

MODULE II LINEAR TRANSFORMATIONS **12 Hours**

Linear combination system of linear equation algebra of transformation Linear transformation of matrices Linear functional transpose of linear transformation

MODULE III FOURIER SERIES **12 Hours**

Dirichlet‟s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval‟s identity – Harmonic analysis.

MODULE IV FOURIER TRANSFORMS **12 Hours**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval‟s identity

MODULEV Z TRANSFORMS AND DIFFERENCE EQUATIONS **12 Hours**

Z - transforms Elementary properties Inverse Z transform (using partial fraction and residues) Convolution theorem – Formation of difference equations Solution of difference equations using Z transform.

TOTAL: 60 HOURS

REFERENCES:

1. Friedberg, A.H., Insel, A.J. and Spence, L., ―Linear Algebra‖, Prentice - Hall of India, New Delhi, 2004.
2. Veerarajan. T., “Transforms and Partial Differential Equations”, Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012
3. Kumaresan, S., ―Linear Algebra – A geometric approach‖, Prentice – Hall of India, New Delhi, Reprint, 2010.
4. Grewal. B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publishers, Delhi, 2012.
5. Bali.N.P and Manish Goyal, “A Textbook of Engineering Mathematics”, 7th Edition, Laxmi Publications Pvt Ltd , 2007
6. Ramana.B.V., “Higher Engineering Mathematics , Tata Mc-GrawHill Publishing Company Limited, New Delhi, 2008.
7. Narayanan.S.,ManicavachagomPillay.T.K and Ramanaiah.G “Advanced Mathematics for Engineering Students Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
8. www.nptelvideos.in/2012/11/mathematics-iii.html

1902EC301	ELECTRON DEVICES	L	T	P	C
		3	0	0	3

MODULE I SEMICONDUCTOR DIODE **9 Hours**

PN junction diode, Current equations, Diffusion and drift current densities, forward and reverse bias characteristics, Switching Characteristics.

MODULE II BIPOLAR JUNCTION TRANSISTOR **9 Hours**

NPN - PNP – Junctions - Early effect - Current equations – Input and Output characteristics of CE, CB, CC - Hybrid - π model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter transistor.

MODULE III FIELD EFFECT TRANSISTORS **9 Hours**

JFETs – Drain and Transfer characteristics - Current equations - Pinch off voltage and its significance – MOSFET - Characteristics - Threshold voltage - Channel length modulation, D-MOSFET, E-MOSFET- Current equation - Equivalent circuit model and its parameters, FINFET, DUAL GATE MOSFET.

MODULE IV SPECIAL SEMICONDUCTOR DEVICES , **9 Hours**

Metal-Semiconductor Junction- MESFET, Schottky barrier diode - Zener diode - Varactor diode Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

POWER DEVICES AND DISPLAY DEVICES

UJT, SCR, Diac, Triac, Power BJT, LED, Photo diode, Photo transistor, Opto Coupler, Solar cell, LCD,CCD.

MODULE V RECTIFIERS & POWER SUPPLIES **9 Hours**

Full-wave: Centre tapped and bridge rectifiers with resistive load -Analysis for V_{dc} and ripple voltage with C, C-L, L-C and C-L-C filters. Clippers and clampers.Zener diode regulator –Transistor voltage regulators: Series and shunt regulators - Switched mode power supply

Total: **45 Hours**

TEXT BOOKS:

1. Salivahanan .S and Sureshkumar .N, ―Electronic Devices & Circuits‖, 3rd Edition, Tata McGraw- Hill, New Delhi, 2011, ISBN : 9781259006418

References:

1.Jacob Millman, Christos C. Halkias―Electronic Devices and Circuits‖, 3rdEdition, McGraw Hill Education (India) Private Limited, 2010, ISBN :9780070700215

2.Allen Mottershead, ―Electronic Devices and Circuits-An Introduction‖, 1stEdition, PHI, New Delhi, 1990, ISBN : 9788120301245.

3.Electronic Devices and Circuits Theory, Boylsted, Prentice Hall Publications.

4. https://www.youtube.com/watch?v=oqOG6XErAl8

5. https://www.youtube.com/watch?v=Kp-jS6NHsB8&list=PLF178600D851B098F

1902EC302	CIRCUITS AND NETWORKS	L	T	P	C
		2	1	0	3

MODULE I BASIC ELECTRIC CIRCUITS **9+3=12 Hours**

Basic of electric circuits, Ohms law- Thevenintheorem-Norton theorem-Maximum power transfer theorem- KCL and KVL, Nodal analysis and Mesh analysis with dependant and independent Current & Voltage Sources, Analysis of ladder and lattice networks - Tuned circuits

MODULE II RLC CIRCUITS **9+3=12 Hours**

Voltage current relationship of Capacitor- Inductor- Resistor, First order RL,RC circuits- Laplace transformation-S domain-Source free and step response of RL-RC-Tank Circuit, Second order RLC- Source free and step response of RLC serial & parallel

MODULE III AC POWER ANALYSIS **9+3=12Hours**

Sinusoidal waves- Phasor-Impedance and Admittance in AC-Phasor based circuit analysis-Power and Energy calculation, Self-inductance Mutual Inductance- Ideal transformers, Frequency response and resonance

MODULE IV TWO PORT NETWORK **9+3=12 Hours**

Network functions - Poles and Zeros of network functions - Complex frequency - Two port parameters Z,Y,H and ABCD - Scaling network functions - Interrelationships between the parameters-T and π equivalent circuits- Bridged networks-Coupled circuits as two port network

MODULE V NETWORKS AND GRAPHS **9+3=12Hours**

Loop Impedance and Node Admittance Matrices, Duality in Electrical Networks, Network graph-Tie set-Cut set-Duality

Total: **45+15 =60 Hours**

References:

1. David A Bell Electric Circuits, (7thEdition, 2011) . Oxford press.
2. Franklin F.Kuo, Network Analysis and Synthesis (5th Edition ,2012)" Wiley International;2010
3. A.V.Bakshi, U.A.Bakshi "Circuit Theory (First edition, 2009), Technical Publications
4. A Nagoorkani "Circuit theory" (Third Edition 2016) Mcgraw hill education
5. S. Salivahanan, N.Suresh Kumar, Electronic devices and ciruits (Second edition, 2011), Mcgraw hill Education
6. M.E.VanValkenberg, Introduction to Modern Network Synthesis", Wiley Eastern.

1902EC303	DIGITAL ELECTRONICS	L	T	P	C
		2	1	0	3

MODULE I BOOLEAN ALGEBRAANDLOGICGATES (6+2) 8 Hours

Boolean Algebra: Booleanexpression – MinimizationofBoolean expressions–Minterm–Maxterm-Sum of Products (SOP) ProductofSums (POS) Karnaugh map Minimization(2,3,4,5 Variables) Quine- McCluskeymethod ofminimization.

MODULE II COMBINATIONAL LOGICS (9+3) 12 Hours

Introduction – Designprocedure Adders &subtractor (Halfadder, Full Adder,Half subtractor, Full subtractor FastAdders, SerialAdder/Subtractor,BCDadder)–BinaryMultiplier/ Divider-Multiplexer/Demultiplexer–decoder/ encoder–paritygenerators/checker codeconverters -MagnitudeComparator

MODULE III SEQUENTIAL LOGICS 2+4) 16

Latches,Flipflop SR,JK,D,T,Edgetriggering,LevelTriggering-Design of Synchronouscounters,SynchronousUp/Downcounters,Programmablecounters, Modulo ncounter-Registers,Universalshift registers-AsynchronousRippleorserial counter,AsynchronousUp/Downcounter –StateMachines–ProblemsinAsynchronousCircuits

MODULE IV PROGRAMMABLE LOGIC DEVICES (9+3) 12Hours

Classificationofmemories(RAM,ROM,PROM,EPROM,EEPROM)-ProgrammableLogicDevices (PLA,PAL,FPGA)-Implementationof combinational logiccircuitsusing ROM,PLA, PAL

MODULE V 8085 MICROPROCESSOR (9+3) 12 Hours

Evolution Of Microprocessors - 8-Bit Processor - 8085 Architecture, Register Organization, Instruction Sets, Timing Diagram, Addressing Modes, Interrupts, Interrupt Service Routines- Assembly Language Programming Using 8085.

Total: (45+15) 60 Hours

References:

1. Ronald J. Tocci, Neal S. Widmer & Gregory L. Moss, "Digital Systems: Principles and Applications", 10th Edition, Pearson Prentice Hall, 2007
2. M.MorrisMano, DigitalDesign",4th Edition,PrenticeHallofIndiaPvt.Ltd.,2008/Pearson Education (Singapore)Pvt.Ltd., NewDelhi,2003
3. Ramesh Gaonkar "Microprocessor Architecture, Programming, and Applications with the 8085"- 5th edition Penram International Publishing-2000.
4. John F.Wakerly, DigitalDesign",FourthEdition,Pearson/PHI,2008
5. John.MYarbrough, "Digital Logic Applications andDesign ,ThomsonLearning, 2006

E-References

1. https://www.coursera.org/learn/digital-systems (Digital Systems: From Logic Gates to Processors from barcelona autonomous university)
2. Electronics-Digital Circuit Design-Udemy
3. https://nptel.ac.in/courses/117106086/ (Digital Circuits and Systems by IITM)

1901EC304 **BIOLOGY FOR ENGINEERS** **L T P C**
3 0 0 3

MODULE I Life (Introduction to cells) **8 Hours**

Biomolecules: Carbohydrates, Proteins, Nucleic Acids, Lipids, Enzymes. Cell structure and composition; The central dogma in molecular biology; Darwinian evolution; Molecular perspective and classification; Phylogenetic trees; Study of inter-and intra-species relationships; Microorganisms and Infectious Diseases

MODULE II Life Processes (Functioning of Human Systems) **7 Hours**

Muscular System; Nervous System; Special Senses; Sensory organs (eye, ear, smell, taste, touch); Cardiovascular System; Respiratory System; Renal System; Immune System; Endocrine System; Cancer and Life style diseases; Stem cells

MODULE III Biochips **10 Hours**

Biochips -Introduction to Biochips, Its features, types and components. Advantages and Disadvantages, Applications of Biochips.Human-organs-on-chips; Applications; Challenges; Future scopes

MODULE IV Bioelectronics **10 Hours**

Overview of bioelectronics – Electron Transfer through proteins – Electrochemical DNA Sensors – Interfacing Biological molecules with Group IV Semiconductors for Bioelectronics sensing DNA Templated Electronics Neuron semiconductor Interface - Medical applications of bioelectronics: ECG, EEG, etc.

MODULE V Bio-Sensors **10 Hours**

Introduction – Basic Principle of Biosensor Components of Biosensor: Bioreceptors : Enzyme bioreceptors, Antibody bioreceptors, Nucleic acid bioreceptors, Aptasensors, Microbial biosensors – Classification of biosensors based on transducers – Piezoelectric biosensors – Non-invasive biosensors – Electrochemical Biosensors – Biosensor electrode fabrication technique Biomedical Applications

Total: 45 Hours

Further Reading:

Bio medical Instrumentation

References:

1. Biology for Engineers, Rajiv Singal , CBS Publishers and Distributors Pvt Ltd; First Edition edition (4 June 2019).
2. Biology for Engineers, Wiley Editorial, Wiley (2018).
3. Biosensors: An Introductory Textbook, Jagriti Narang, C.S. Pundir, Jenny Stanford Publishing; 1 edition (11 April 2017)
4. Biochips: Technology and Applications, Wan-Li Xing , Jing Cheng, Springer; 2003 edition (11 July 2003)
5. Biosensors and Bioelectronics, Chandran Karunakaran Kalpana Bhargava Robson Benjamin, Elsevier publications book series

1902CS306	OBJECT ORIENTED PROGRAMMING AND DATA	L	T	P	C
		3	0	0	3

MODULE I OBJECT ORIENTED PROGRAMMING 9Hours

Evolution of Programming methodologies- Introduction to OOP -Basic Concepts - Structure of C++ Program- Compiling and Executing C++ Program - Data types - Operators - Expressions - Control statements &Iteration statements in C++ - Arrays-Structures-Pointers

MODULE II FUNCTIONS& CONSTRUCTORS 9Hours

Functions - Passing Data to Functions - Scope and Visibility of variables in Functions - Dynamic Binding - data members - member functions - this Pointer - Friend Functions - Friend Classes - Constructors and Destructors.

MODULE III LINEAR DATA STRUCTURES 9 Hours

Abstract Data Types (ADTs) List ADT array-based implementation linked list implementation singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions

MODULE IV NON-LINEAR DATA STRUCTURES 9 Hours

Trees Binary Tree-Binary search trees -Tree traversal -Expression manipulation -Symbol table construction - AVL trees: Rotation, Insertion, Deletion, Red black tree – Graph and its representations Graph Traversals Representation of Graphs Breadth-first search Depth-first search - Connected components.

MODULE V SORTING AND SEARCHING 9 Hours

Sorting Techniques-Selection, Bubble, Insertion, Merge, Heap, Quick, and Radix sort -Address calculation - Linear search -Binary search -Hash table methods.

Total: 45 Hours

References:

1. Deitel and Deitel, C++, How To Program , Seventh Edition, Pearson Education, 2013.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++ , Fourth Edition, Addison-Wesley, 2013.
3. Bhushan Trivedi, “Programming with ANSI C++, A Step-By-Step approach , Oxford University Press, 2010.
4. Goodrich, Michael T., Roberto Tamassia, David Mount, “Data Structures and Algorithms in C++ , 7th Edition, Wiley. 2016.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, Mc Graw Hill, 2009.
6. Bjarne Stroustrup, “The C++ Programming Language”, 3rd Edition, Pearson Education, 2007.
7. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, Fundamentals of Data Structures in C++ , Galgotia Publications, 2007.

1902EC35		DEVICES AND CIRCUITS LABORATORY	L	T	P	C
			0	0	2	1

List of Experiments:		
1.Characteristics of PN Junction Diode and Zener diode		
2.Characteristic of Rectifiers, clippers and clampers		
3.Characteristics of BJT (common emitter configuration) and determination of h parameters		
4.Characteristics of JFET and MOSFET		
5.Characteristics of SCR and UJT		
6.Characteristics of TRIAC		
7. Verification of Ohm„s Law and Kirchoff„s Laws.		
8. Verification of Thevenin„s and Norton„s Theorem.		
9.Verification of Superposition Theorem, Maximum Power Transfer Theorem		
10.Simulation of Transient Response of RL and RC circuits using PSPICE		
Mini Project • Design of Power supply.		
• Design of Regulators using zener diode.		
	Tota	**45 Hours**

1902EC352	DIGITAL ELECTRONICS LABORATORY	L	T	P	C
		0	0	2	1

List of Experiments:

1. Study and Verification of Boolean Theorems using basic gates
2. Design, Simulate andimplementationof4 bit codeconvertersusinglogicgates
3. Design, Simulate andimplementationof4 bit binary Adder/ Subtractorand BCD adder
4. Design, Simulate andimplementationof 4:1Multiplexerand De-multiplexerusinglogicgates
5. Design, Simulateand implementationof4 to 2 encoderand decoderusinglogicgates
6. Design, Simulateand implementationof 4 bit parity generator and checker
7. Design, Simulate and implementation of 2 bit Magnitude Comparator
8. Constructionand verificationof4 bit synchronousup/down counterandMod-9/Mod-14Ripple counters(Both simulation and implementation)
9. Simulation and ImplementationofSISO, SIPO, PISO andPIPO shift registersusing Flip- flops
10. Simulation of 4 bit multiplier and Random number generator using HDL

Total: 45 Hours

Additional Experiments:

1. Design and Implementation of seven segment display using basic logic gates
2. Simulation of 4 bit parallel divider and state machine problems

References:

1. Ronald J. Tocci, Neal S. Widmer & Gregory L. Moss, Digital Systems: Principles and Applications", 10th Edition, Pearson Prentice Hall, 2007
2. M.MorrisMano, DigitalDesign",4thEdition,PrenticeHallofIndiaPvt.Ltd.,2008/Pearson Education (Singapore)Pvt.Ltd., NewDelhi,2003
3. Joseph Cavanagh, "Verilog HDL: Digital Design and Modeling", Taylor & Francis, 2007
4. John F.Wakerly, DigitalDesign",FourthEdition,Pearson/PHI,2008
5. John.MYarbrough, "Digital Logic Applications andDesign ,ThomsonLearning, 2006

1902CS354	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

List of Experiments:

1. Basic Programs for C++ Concepts
2. Array implementation of List Abstract Data Type (ADT)
3. Linked list implementation of List ADT
4. Cursor implementation of List ADT
5. Stack ADT - Array and linked list implementations
6. Implementation of Stack ADT (by using files (i) and implementing file (iii))
7. Implement another Stack Application using array and linked list implementations of Stack ADT (by implementing files (iv) and using file (ii), and then by using files (iii) and (iv)
8. Queue ADT – Array and linked list implementations
9. Search Tree ADT - Binary Search Tree
10. Implement an interesting application as separate source files and using any of the searchable ADT files developed earlier. Replace the ADT file alone with other appropriate ADT files. Compare the performance.

Total: 45 Hours

Additional Experiments:

1. Hash table implementation
2. Graph traversals

References:

1. F.RichardGilberg, A.Behrouz. Forouzan, Data Structures, A Pseudocode Approach with C. Thomson, 2007.
2. M. A. Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, 2009.
3. Y.Langsam, M. J.Augenstein and A. M.Tenenbaum, Data Structures using C, Pearson Education,2004.
4. A. M.AhoHopcroft and J.D. Ullman, Data Structures and Algorithms, Pearson education, 2000.

1904GE351	LIFE SKILLS: VERBAL ABILITY	L	T	P	C
		2	0	0	1

MODULE I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.

MODULE II COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages Theme detection Deriving conclusion from passages

MODULE III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism – Redundancy Ambiguity – Concord - Common Errors – Spotting Errors – Sentence improvement Error Detection FAQ in Competitive exams.

MODULE IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice Spelling test.

MODULE V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing Essay writing Indexing Market surveying.

Total: 30 Hours

References:

1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017
2. R S Aggarwal and Vikas Aggarwal , Quick Learning Objective General English ,S.Chand Publishing House, 2017
3. Dr.K.Alex , Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007

1901MCX02	CONSTITUTION OF INDIA	L	T	P	C
		1	0	0	0

MODULE I INTRODUCTION **6 Hours**

Historical Background - Constituent Assembly of India - Philosophical foundations of the Indian Constitution - Preamble - Fundamental Rights - Directive Principles of State Policy - Fundamental Duties - Citizenship - Constitutional Remedies for citizens.

MODULE II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6 Hours**

Union Government - Structures of the Union Government and Functions - President- Vice President- Prime Minister - Cabinet - Parliament - Supreme Court of India - Judiciary view.

MODULE III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6 Hours**

State Government-Structure and Functions - Governor - Chief minister-Cabinet-State Legislature- Judicial System in States -High Courts and other sub ordinate Courts.

MODULE IV CONSTITUTION FUNCTIONS **6 Hours**

Indian Federal System -Center -State Relations- Constitutional Amendments - Constitutional Functionaries - Assessment of working of Parliamentary System in India.

MODULE V INDIAN SOCIETY **6 Hours**

Society: Nature, Meaning and definition; India Political Structure; Caste, Religion, Languages in India;Constitutional Remedies for citizens-Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections

Total: 30 Hours

References:

1. Durga Das Baslli 'Introduction to the Constitution of India " Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) 'Indian Political System', S.Chand and Company, New Delhi.
3. Maciver and Page, • Society: An Introduction Analysis " Mac Milan India Ltd., New Delhi.
4. K.L.Sharma, (1997) 'Social Stratification in India: Issues and Themes', Jawaharlal NehruUniversity, New Delhi.

Approved in IV Academic Council Meeting Held on25.05.2019

E.G.S. PILLAY ENGINEERING COLLEGE(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai |

Accredited by NAAC with „A"Grade |Accredited by NBA (CIVIL, CSE, ECE, EEE, IT, MECH)

NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Full Time Curriculum And Syllabus

Second Year **Fourth Semester**

Course Code	Course Name	L	T	P	C	Maximum Marks		
						C	E	Total
Theory Course								
1901MA402	Probability Theory and StochasticProcesses	3	0	0	3	40	60	100
1902EC401	Electronics Circuits	3	0	0	3	4	60	100
1902EC402	Signals and Systems	2	1	0	3	4	60	100
1902EC403	Electromagnetic Fields	3	0	0	3	4	60	100
1902EC404	Analog Integrated Circuits	3	0	0	3	4	60	100
1902EC405	Microprocessors and Microcontrollers	3	0	0	3	40	60	100
Laboratory Course								
1902EC451	Electronics and Integrated Circuits Laboratory	0	0	2	1	50	50	100
1902EC452	Microprocessors and Microcontrollers Laboratory	0	0	2	1	50	50	100
1904GE451	Life Skills: Reasoning	2	0	0	1	10	-	100
Tot		**19**	**1**	**4**	**2**	**54**	**46**	**1000**
Audit Course								
1901MCX0	Environmental Science	0	0	0	0	10	-	100

L–Lecture|T–Tutorial|P Practical|C–Credit|CA –ContinuousAssessment| ES–EndSemester

1901MA402	PROBABILITY THEORY AND STOCHASTIC PROCESSES	L	T	P	C
		3	1	0	4

PREREQUISITE :

1. Advanced and multivariate differential calculus and integral calculus.
2. Linear algebra and matrices

COURSE OBJECTIVES:

1. To analyze the concepts of probability, random variables and distribution functions.
2. To acquire skill in handling situation with more than one random variable with time function.
3. To analyze the concept of signals and system.

Module 1 PROBABILITY THEORY 9+3Hours

Sets and set operations; Probability, Conditional probability and Bayes theorem; Discrete and continuous random variables Moments Moment generating functions Real Time Problems.

Module 1I DISCRETE AND CONTINUOUS RANDOM VARIABLES 9+3 Hours

Discrete Distributions: Binomial, Poisson, Geometric - Continuous Distributions: Uniform, Exponential, Normal distributions- Application of Distribution in Engineering Problems

Module III TWO - DIMENSIONAL RANDOM VARIABLES 9+3 Hours

Joint distributions Marginal and conditional distributions Covariance Correlation and Linear regression

Module IV STOCHASTIC PROCESSES 9+3 Hours

Stationary process Markov process Markov chains transition probabilities – Limiting distributions Poisson process. Stochastic processes,Stochaststically larger-preposition,coupling-stochastic monotonicity properties of birth and death processes-exponential convergence in markov chains.

Module V RANDOM PROCESSES 9+3 Hours

Auto correlation-cross correlation-power spectral density-cross spectral density-Properties-Wiener-Khintchine relation- Linear time invariant system- system transfer function-Linear system with random inputs-White noise.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 To apply probability techniques to analyze the performance of Electronic systems.(K3)
CO2 To apply standard distributions in describing real life phenomena.(K3)
CO3 To solve problems involving two dimensional random variable.(K3)
CO4 Make use of theorems related to random signals(K3)
CO5 To understand propagation of random signals in linear time invariant systems.(K2)

REFERENCES:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.
7. www.indiastudychannel.com

	ELECTRONIC CIRCUITS	L	T	P	C
1902EC401		3	0	0	3

Course Objectives:

1. To learn the fundamental concepts behind transistor biasing and to differentiate small signal and large signal circuit models
2. To study the performance metrics of Tuned amplifiers, Power amplifiers and oscillators.
3. To discuss various applications of analog circuits

Unit I ANALYSIS OF MOSFET 9 Hours

Biasing,Large and Small signal analysis CS, CG and source follower, miller effect, frequency response of CS, CG and source follower, Current Sources, Current Mirrors

Unit II DIFFERENTIAL AMPLIFIERS AND FEEDBACK AMPLIFIERS 9 Hours

Differential Amplifiers, CMRR, Differential amplifiers with active load, Two stage amplifiers,Feedback amplifiers - Current Series, Voltage Shunt, Current shunt and Voltage Series

Unit III TUNED AMPLIFIERS AND POWER AMPLIFIERS 9 Hours

Small signal tuned amplifiers Analysis of capacitor coupled single tuned amplifier double tuned amplifier Stagger tuned amplifiers.

Power amplifiers- class A, class B, class AB, Biasing circuits, class C and class D

Unit IV OSCILLATORS 9 Hours

Sinusoidal oscillators, General form of oscillator circuit (Hartley & Colpitts), Barkhausen Criterion, Design and analysis of RC phase shift oscillator, Wien bridge oscillators, Resonant circuit oscillators, Crystal oscillator.

Unit V APPLICATIONS OF ANALOG ELECTRONICS 9 Hours

Selection of Components and Circuit Elements in an Application - Automatic Switch on of Lamp in the Dark/Presence of Light Humidity and Smoke Detection - Future Advances – Case study: Revival in the Music Industry.

Total: 45 Hours

Further Reading:

Role of analog circuits in biomedical applications

Analog electronics applications in nanotechnology fields

Course Outcomes:

After completion of the course, Student will be able to

1. Determine various parameters of transistor amplifier circuits using signal analysis
2. Examine about differential amplifiers.
3. Design power amplifiers and tuned amplifiers
4. Design different types of oscillators.
5. Discuss the various applications of analog circuits

References:

1. A. Sedra and K. Smith, Microelectronic Circuits, 7th edition. Oxford Univ. Press, 2016

2. Hernando Lautaro Fernandez-Canque by Taylor & Francis Group, LLC, 2017

3.Jacob Millman, C. Halkias and Satyabrata Jit Electronic Devices and Circuits, 4TH Edition, Tata McGraw-Hill, 2015.

4. Salivahanan, N. Suresh Kumar and A. Vallava Raj, Electronic Devices and circuits , TMH, 2nd Edition 2008

1902EC402 **SIGNALS AND SYSTEMS** **L T P**
3 1 0

Course Objectives:

1. To study and analyze the continuous and discrete-time signals and systems,their properties and representations.
2. To have Knowledge of time-domain representation and analysis concepts asthey relate to difference equations, impulse response and convolution, etc.
3. To familiarize the concepts of frequency-domain representation and analysisusing Fourier Analysis tools, Z-transform.
4. To understand the concepts of the sampling process and to identify and solveengineering problems
5. To analyze the systems by examining their input and output signals

Unit I CLASSIFICATION OF SIGNALS AND SYSTEMS 9+3 Hours

Classification of Signals- Continuous time signals - Discrete time signals - Periodic and Aperiodic signals - Even and odd signals - Energy and power signals -Deterministic and random signals -Complex exponential and Sinusoidal signals. Classification of Systems: Continuous time systems- Discrete time systems - Linear system - Time Invariant system causal system - BIBO system - Systems with and without memory.

Unit II ANALYSIS OF CONTINUOUS TIME SIGNALS 9+3 Hours

Fourier series analysis-Trigonometric Fourier series, Cosine Fourier series, Exponential Fourier series, Fourier Spectrum of continuous time signals, Fourier transform, Laplace transform.

Unit III LTI CONTINUOUS TIME SYSTEM 9+3 Hours

Analysis of differential equation-Transfer function-Impulse response- Frequency response-Convolution integral- Fourier Methods-Laplace transforms analysis- Block diagram representation Cascade, Parallel and Direct Form -State variable equation and Matrix.

Unit IV ANALYSIS OF DISCRETE TIME SIGNALS 9+3 Hours

Discrete Time Fourier Transform (DTFT)-Properties of DTFT -Discrete Fourier Transform (DFT)- Z-Transform -Properties of Z - Transform and Inverse Z-Transform.

Unit V LTI DISCRETE TIME SYSTEMS 9+3 Hours

Analysis of differential equation-Transfer function-Impulse response - Convolution sum- Analysis and characterization of DT system using Z transformDifference Equations-Block diagram.

Total: 45+15 Hours

Further Reading:

Programs using mathematical computing tool for CT and DT system analysis using LT and ZT

Course Outcomes:

After completion of the course, Student will be able to

1. Analyze the properties of signals & systems
2. Apply Laplace transform, Fourier transform in signal analysis
3. Analyze continuous time LTI systems using Fourier and Laplace Transforms
4. Apply Z transform and DTFT in signal analysis for Discrete time signals
5. Analyze discrete time LTI systems using Z transform.

References:

1. Allan V.Oppenheim, Allan S.Wilskywith S. Hamid Nawab, Signals and Systems", Pearson, Second Edition 2015.
2. Rodger E. Ziemer, William H. Tranter and D. Ronald Fannin Signals and Systems Continuous and Discrete , Fourth Edition
3. Simon Haykin and Barry Van Veen, "Signals and Systems , John Willey &Sons, Inc., Second edition, 2004.
4. B. P. Lathi, Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
5. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.
6. Hwei. P.Hsu, Schaum"s Outlines: Signals and Systems, Pearson Education, 2002.
7. Anand Kumar A, "Signals and Systems" , PHI learning Pvt. Ltd., Secondedition, 2012.
8. Michael Roberts, "Fundamentals of Signals & Systems", 2nd edition, Tata McGraw-Hill, 2010,

1902EC403	ENGINEERING ELECTROMAGNETICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To impart knowledgeonthebasicsofstaticelectricandmagneticfieldandtheassociated laws.
2. To giveinsight into the propagation of EM waves and also to introduce the methods in computational electromagnetic.
3. To analyze the time varying fields.

UNIT I STATIC ELECTRIC FIELDS **9 Hours**

Co-ordinatesystem–Rectangular–Cylindricalandsphericalco-ordinatesystem Meaning ofstokestheorem anddivergencetheorem –Coulomb‟slawinvectorform –Definition of electricfieldintensity– Electricfielddueto chargesdistributeduniformlyonaninfiniteand finiteline– Electricfieldon theaxis of a uniformlychargedcirculardisc– Electric flux Density – Gauss law Proof of gauss law Applications.

UNIT II STATIC MAGNETIC FIELDS **9 Hours**

The Biot- Savartlawin vector form Magnetic field intensity due to a finite and infinite wire carrying a current I Magnetic field intensity on the axis of a circular and rectangular loop carrying a currentI Ampere‟s circuital law and simple applications–Magnetic flux density TheLorentz force quation for a moving charge and applications –Force on a wire carrying a currentI placed in a magnetic field.

UNIT III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS **9 Hours**

Poisson‟sandLaplace‟sequation– Electricpolarization –Nature ofdielectricmaterials– Definitionof capacitance– Electrostatic energy and energy density – Boundary conditions for electric fields – Electriccurrent Currentdensity–Continuityequationfor current Definitionofinductance Inductanceofloopsandsolenoids Definitionof mutualinductance– Energydensityinmagneticfields.

UNIT IV TIME VARYING ELECTRIC AND MAGNETIC FIELDS **9 Hours**

Faraday‟slaw–Maxwell‟sequationsinintegralform and point form–Displacementcurrent–Ampere‟scircuitallawin integralform –Modifiedform ofampere‟s circuitallawasMaxwell‟sfirstequationin integralform – Pointing vectorand the flow of power – Power flow in a co-axial cable – Instantaneous average and complex pointing vector.

UNIT V ELECTROMAGNETIC WAVES **9 Hours**

Derivationofwaveequation Waveequationinphasorform Planewavesinfreespaceandinahomogenous material Waveequationforaconductingmedium Planewavesinlossydielectrics Propagationingoodconductors Skineffect Linear ellipticalandcircularpolarization –Reflectionofplanewavefrom aconductor–Normalincidence- Dependence on polarization Brewster angle.

Total: 45 Hours

Further Reading:

Vector analysis - Vector Calculus -Principle of Superposition theorem-Natureof magnetic materials – Magnetization and permeability Magnetic boundary conditions.

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the fundamentals of electromagnetic.
2. Analyzefieldpotentialsdue tostaticchangesandstaticmagneticfields.
3. Explainhowmaterialsaffectelectricandmagneticfields.
4. Analyze the relationbetween thefieldsunder timevaryingsituations.
5. Discuss the principlesof propagationofuniformplanewaves.

References:

1. Hayt,WH.andBuck,J.A., EngineeringElectromagnetics ,7thEdition,TMH,2007.

2. Jordan, E.C, andBalmain, K. G., “Electromagnetic Waves and Radiating Systems”, 4th Edition, Pearson Education/PHI, 2006.

3.MathewN.O.Sadiku, ElementsofEngineeringElectromagnetics”,4thEdition, Oxford University Press, 2007.

4.Narayana Rao, N., Elements of Engineering Electromagnetics”, 6th Edition, Pearson Education, 2006.

5.Ramo, Whinneryand Van Duzer., Fields and Waves in Communication Electronics , 3rd Edition, John Wiley and Sons, 2003.

1902EC404 **ANALOG INTEGRATED CIRCUITS** **L T P C**
3 0 0 3

Course Objectives:

1 To learn the fundamental concepts behind Operational Amplifiers and to differentiate small signal and large signal circuit models.
2 To learn the concepts of Active filters, Analog to Digital and Digital to Analog converters for microelectronics.
3 To study the performance metrics of Phase Locked Loop and CMOS differential amplifiers.

Unit I BASICS OF OPERATIONAL AMPLIFIERS 9 Hours

OperationalAmplifiers,DCandACcharacteristics,Typicalop-ampparameters:Finite gain, Finitebandwidth,Offsetvoltagesandcurrents,Common-mode rejectionratio,Powersupply rejectionratio,Slew rate,ApplicationsofOp-amp: Precisionrectifiers, Summingamplifier, Integratorand Differentiator,Logand Antilogamplifiers. Instrumentationamplifiers, Voltage to Currentconverters.

Unit II ACTIVE FILTERS 9 Hours

Secondorder filter transfer function (lowpass,highpass, band passandband reject), Butterworth,Chebyshevand Besselfilters, Switched capacitor filter, Notchfilter,All passfilters and self-tunedfilters.

Unit ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Op- asacomparator,Schmitttrigger,Astableand Monostablemultivibrators, wave generator,Multivibratorsusing 555timer,Dataconverters:A/Dand D/A converters.

Unit IV PHASE LOCKED LOOP 9 Hours

PLL- Basicblockdiagramandoperation, Four quadrant multipliers,Phasedetector,VCO, ApplicationsofPLL: Frequencysynthesizers,AMdetection,FM detectionandFSK demodulation.

Unit V CMOSDIFFERENTIALAMPLIFIERS 9 Hours

DCanalysisandsmallsignalanalysisofdifferentialamplifier withResistiveload,currentmirrorloadand currentsourceload,Inputcommon-moderange andCommon-modefeedbackcircuits.OTAsvs Op-amps. Slew rate,CMRR,PSRR.Two stage amplifiers,Compensationin amplifiers (Dominantpolecompensation).

Total: 45 Hours

Further Reading:

Collector Emitter Feedback Bias.

Course Outcomes:

After completion of the course, Student will be able to

1 Implement basic applications of Op-amp using IC 741.
2 Interpret the concept of Active filter for Analog integrated circuits.
3 Construct an Multi vibratorsusing IC 555 and Data Converters for Analog integrated circuits.
4 IllustratethefunctionofapplicationspecificICssuchasVoltageregulators,PLL and itsapplicationin communication.
5 Describe the working of CMOS Differential amplifier in Analog integrated circuits.

References:

1 S.Franco,DesignwithOperational AmplifiersandAnalog IntegratedCircuits, Third edition TMH,2003.
2 Sedra and Smith,MicroelectronicsCircuits, First edition, Oxford Univ.Press, 2004.
3 Coughlin,Driscoll,OP-AMPS andLinear IntegratedCircuits, First edition, Prentice Hall,2001.
4 John D Ryder, ―Electronic fundamentals and Applications: Integrated and Discrete systems, 5th Edition, PHI, 2003
5 Donald .A. Neamen, Electronic Circuit Analysis and Design Second edition, Tata McGraw Hill, 2009

1902EC405 MICRO PROCESSOR AND MICRO CONTROLLER

L	T	P	C
3	0	0	3

Course Objectives:

To teach the architecture and functions of 8085 and 8086 Microprocessors.
To impart the concepts of 8051 microcontroller.
To convey aspects of I/O and Memory Interfacing circuits.

UNIT I INTRODUCTION TO MICROPROCESSORS 9 Hours

Evolution Of Microprocessors - 8-Bit Processor - 8085 Architecture, Register Organization, Instruction Sets, Timing Diagram, Addressing Modes, Interrupts, Interrupt Service Routines- Assembly Language Programming Using 8085.

UNIT II 8086 MICROPROCESSORS 9 Hours

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

UNIT III MICROCONTROLLERS 9 Hours

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

UNIT IV I/O INTERFACING 9 Hours

Memory Interfacing and I/O interfacing - Parallel communication interface Serial communication interface D/A and A/D Interface - Timer Keyboard /display controller Interrupt controller – DMA controller

UNIT V APPLICATIONS 9 Hours Home automation, Wireless Sensor monitoring, Smart Lighting, Smart Appliances, Smart Cities, Environment Monitoring,Case studies: Chasing LEDs, LED Dice, Real Time Clock, Digital Voltmeter with LCD, Calculator with Keypad and LCD, Serial Communication Based Calculator.

Total: 45 Hours

Further Reading:

1. Raspberry pi
2. Machine learning using raspberry pi

Course Outcomes:

After completion of the course, Student will be able to
Construct hardware, software and programming concepts of Microprocessor
Summarize architecture, instructions and addressing modes of 8086 Microprocessor
Describe addressing modes, Architecture, pins of 8051 Microcontroller
Illustrate interfacing of Serial, parallel, Keyboard, Display with Microcontroller
Use the programming concepts to write assembly language programs

References:

Milan Verle, "PIC Microcontrollers- Programming in C", mikroElektronika Publications, 2009.
Lucio Di Jasio "Programming 16-Bit PIC Microcontrollers in C: Learning to Fly the PIC 24" 2nd Edition Newnes 2011
Ramesh Gaonkar "Microprocessor Architecture, Programming, and Applications with the 8085"- 5th edition Penram International Publishing-2000.
SepehrNaimi, Sarmad Naimi, Muhammad Ali Mazidi "The AVR Microcontroller and Embedded Systems Using Assembly and C: Using Arduino Uno and Atmel Studio" 2nd edition MicroDigitalEd 2017
Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", 2nd edition Newnes Publication, 2013
PIC 16F877 datasheet-Microchip
E-References:
https://www.coursera.org/learn/raspberry-pi-interface (University of California)
https://www.coursera.org/learn/raspberry-pi-platform (University of California)

		L	T	P	C
1902EC451	ELECTRONICS AND INTEGRATED CIRCUITS LABORATORY	0	0	2	1

Course Objectives:

6 To understand the basics of Analog integrated circuits and available Ics.
7 To gain hands on experience in designing Analog integrated circuits.
8 To learn PSPICE software used in circuit design.
9 To apply operational amplifiers in linear and non-linear applications.

LIST OF EXPERIMENTS:
DESIGN, SIMULATION AND IMPLEMENTATION OF

1. Inverting, Non inverting and Differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass,band-pass, and Band stop filters.
5. Astable& Monostable multivibrators and Schmitt Trigger
6. Phase shift and Wien bridge Oscillator
7. Astable and monostable multivibrators using NE555 Timer.
8. PLL characteristics and its use as Frequency Multiplier.
9. RPS power supply using LM317 and LM723.

M**INI PROJECT:**
Mini project using Op-Amp and Specialized IC"s.
List of Hardware/Software Required
1.CRO (Min 30MHz) – 15 Nos.
2. Signal Generator /Function Generators (2 MHz) – 15 Nos.
3. Dual Regulated Power Supplies (0 – 30V) – 15 Nos.
4. Digital Multimeter – 15 Nos IC tester - 2 Nos.
5. Standalone desktops PC 15 Nos.
6. SPICE Circuit Simulation Software: (any public domain or commercial software) Components and Accessories: - 50 Nos.
7. Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs.
Note: Op-Amps uA741, LM 301, LM311, LM 324, LM317, LM723, 7805, 7812, 2N3524, 2N3525, 2N3391, AD 633, LM 555, LM 565 may be used.

TOTAL 45 HOURS

Course Outcomes:
After completion of the course, Student will be able to
1 Design oscillators and amplifiers using operational amplifiers.
2 Design filters using Op-amp and perform experiment on frequency response.
3 Analyse the working of PLL and use PLL as frequency multiplier.
4 Design Regulated power supply using ICs.
5 Analyse the performance of oscillators and multi vibrators using PSPICE

		L	T	P	C
1902EC452	**MICROPROCESSORS AND MICROCONTROLLERS LABORATORY** (Common to B.E / B.Tech – ECE,CSE & IT)	**0**	**0**	**4**	**2**

Course Objectives: **The student should be made to:**

1. Write ALP for arithmetic and logical operations in 8085, 8086 and 8051
2. Differentiate Serial and Parallel Interface
3. Interface different I/Os with Microprocessors& Microcontrollers
4. Be familiar with MASM

List of Experiments:

8085 Programs using kits

1. Basic arithmetic operations
2. Basic Logical operations
3. Ascending and descending
4. Maximum and minimum number

8086 Programs using kits

5. Move a data block without overlap
6. Floating point operations, string manipulations
7. Code conversion.
8. sorting and searching

8051 Experiments using kits

9. Basic arithmetic and Logical operations
10. Square and Cube program, Find 2″s complement of a number

Peripherals and Interfacing Experiments

11. Traffic light control
12. Stepper motor control
13. Key board Display
14. Serial interface and Parallel interface and Printer status.
15. A/D and D/A interface and Waveform Generation

Total: 45 Hours

Additional Experiments: https://www.intel.in

Basic experiments using Arduino processor

Course Outcomes:

After completion of the course, Student will be able to

1. Write ALP Programmes for fixed and Floating Point and Arithmetic
2. Interface different I/Os with processor
3. Generate waveforms using Microprocessors&Execute Programs in 8051
4. Explain the difference between simulator and Emulator

1904GE451	LIFE SKILLS - REASONING	L	T	P	C
		0	0	2	0

Course Objectives:

1. To help students comprehend and use vocabulary words in their day to day communication.
2. To apply appropriate reading strategies for interpreting technical and non-technical documents used in job-related settings
3. To ensure students will be able to use targeted grammatical structures meaningfully and appropriately in oral and written production
4. To enable the students to arrange the sentences in meaningful unit and to determine whether constructions rely on active or passive voice
5. To Apply the principles of effective business writing to hone communication skills
6. To apply the principles of business etiquettes and Market surveying.

UNIT I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms Single word Substitution Newspaper, Audio and video listening activity.

UNIT II COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning Social Science passages Business and Economics passages latest political and current event based passages Theme detection Deriving conclusion from passages

UNIT III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism Redundancy Ambiguity Concord - Common Errors Spotting Errors Sentence improvement Error Detection FAQ in Competitive exams.

UNIT IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences Cloze Test - Idioms and Phrases Active and passive voice Spelling test.

UNIT V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette Report Writing - Proposal writing Essay writing– Indexing –Market surveying.

Total: 30 Hours

Course Outcomes:

After completion of the course, Student will be able to

Construct new words in their day to day communication.

Predict the information swiftly while reading passages.

Elaborate their oral and written communication.

Rephrase the sentences and able to identify the voice of the sentence.

Summarize their knowledge of the best practices to craft effective business documents

Make use of the etiquettes in business.

References:

1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017
2. R S Aggarwal and Vikas Aggarwal , Quick Learning Objective General English ,S.Chand Publishing House, 2017
3. Dr.K.Alex, Soft Skills,S.Chand Publishing House, Third Revise Edition, 2014
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007

E.G.S.PILLAY ENGINEERING COLLEGE

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B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Full Time Curriculum and Syllabus

Third Year Fifth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks			Category
						CA	ES	Total	
Theory Course									
1902EC5	Analog Communication	3	0	0	3	4	60	100	PCC
1902EC5	Digital Signal Processing	2	2	0	3	4	60	100	PCC
1902EC5	Transmission Lines and Wave	2	2	0	3	4	60	100	PCC
1902EC504	Control Systems	2	2	0	3	4	60	100	PCC
1902EC50	Computer Networks	2	0	0	2	4	60	100	PCC
	Professional Elective I	3	0	0	3	4	60	100	PEC
Laboratory Course									
1902EC55	Digital Signal Processing	0	0	2	1	5	50	100	PCC
1902EC55	Computer Networks Laboratory	0	0	2	1	5	50	100	PCC
1904GE55	Life Skills: Aptitude I	2	0	0	1	100	-	100	EEC
Audit Course									
1901MCX03	Essence of Indian Traditional Knowledge	2	0	0	0	100	-	100	MC
Tot		**1**	**6**	**4**	**2**	**540**	**4**	**1000**	

1902EC501	ANALOG COMMUNICATION	L	T	P	C
		3	0	0	3

MODULE I AMPLITUDE MODULATION 9 Hours

Introduction to communication systems Modulation Need for modulation Classifications of modulation techniques – Amplitude Modulation – Generation and Detection of AM – Transmitters and Receivers of AM Super heterodyne receiver – Double Side Band Suppressed Carrier (DSBSC) systems - generation and detection – Single Side Band (SSB) systems – SSB-SC generation and detection, Vestigial Side Band (VSB) Comparison of various AM systems.

MODULE II ANGLE MODULATION 9 Hours

Frequency modulation: Narrowband and wideband FM – Generation of FM signal: Direct FM, indirect FM – Demodulation of FM signals using detectors – FM transmitters – FM receivers – Phase Modulation – Phase Locked Loop Comparison of AM,FM and PM.

MODULE III NOISE IN COMMUNICATION SYSTEM 9 Hours

Noise sources and types – External Noise – Internal Noise – Noise calculation – Noise figure – Noise temperature – Noise equivalent bandwidth – Narrowband noise – PSD of in-phase and quadrature noise Noise in AM receivers – Noise in FM receivers – Pre-emphasis and de-emphasis in FM system – Capture effect and threshold effect – Comparison of noise performance of AM and FM systems.

MODULE IV PULSE MODULATION AND SAMPLING 9 Hours

PAM – PWM – PPM – Comparison of Pulse modulation – Time Division Multiplexing – Frequency Division Multiplexing Pulse Time Modulation systems: Generation and detection Sampling Process: Sampling of Band limited signals Ideal and practical sampling Anti aliasing and reconstruction filters.

MODULE V INTRODUCTION TO INFORMATION THEORY 9 Hours

Measure of information – Entropy and properties – Source coding theorem – Channel coding theorem Discrete memory less channels – Binary Symmetric Channel – Mutual information – Channel capacity – Shannon Hartley law Shannon Fano algorithm Huffman Coding LZ coding.

Total: 45 Hours

Further Reading:

1. Working principle of MODEM, AM /FM broadcasting.
2. Design of AM and FM radio, Television Receivers.

References:

1. Simon Haykin, Communication Systems John Wiley &Sons , 4th Edition-2016.
2. J.G. Proakis, “Digital Communications McGraw Hill, 5th edition -2007
3. B.P. Lathi, Communication Systems BS Publication-2004.
4. V.Chandrasekar, “Analog communication , Oxford University press-2010
5. P.Rama Krishna rao, Analog Communication, Tata McGraw-Hill-2011
6. Nptel link: https://nptel.ac.in/courses/117/105/117105143/

1902EC502	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	2	0	4

MODULE I DISCRETE FOURIER TRANSFORM 9 Hours

Introduction to DFT and IDFT – Properties of DFT –Filtering methods based on DFT – FFT Algorithms Decimation in time Algorithms,Decimation in frequency Algorithms.

MODULE II IIR FILTER DESIGN 9 Hours

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design byImpulse Invariance, Bilinear transformation, Approximation of derivatives (LPF, HPF, BPF, BRF)filter design using frequency translation.

MODULE III FIR FILTER DESIGN 9 Hours

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques(Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques.

MODULE IV FINITE WORDLENGTH EFFECTS 9 Hours

Finiteword length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.Fixed point and floating point number representations – Quantization- Truncation and Roundingerrors - Quantization noise – quantization error – Overflowerror – Roundoff noise power - limit cycle oscillations due to product round off and overflow errors.

MODULE V DIGITAL SIGNAL PROCESSORS 9 Hours

Introduction – TMS320c5X Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DSP Processors TMS320C64XX, TMS320 C54X.

Total: 45+15 Hours

Further Reading: http://www.ti.com/processors/dsp/overview.html

1. Spectrum estimation.
2. Linear estimation and prediction

References:

1. J.G. Proakis and D.G. Manolakis, „Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, „Digital Signal Processing – A Computer Based Approach", McGraw Hill Edu, 2013.

3. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

4. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning,2014.

5. P. Ramesh Babu, „Digital Signal Processing",Scitech Publications Pvt Ltd, Fourth Edition - 2011

1902EC503	TRANSMISSION LINES AND WAVEGUIDES	L	T	P	C
		3	0	0	3

MODULE I TRANSMISSION LINE THEORY 10 Hours

Generalsolutionoftransmissionline Thetwostandardformsforvoltageandcurrentof alineterminatedbyanimpedance Physicalsignificanceoftheequation andtheinfinite line Reflectioncoefficient–Wavelength andvelocityofpropagation Waveform distortion–Distortion lesstransmissionline Thetelephonecable Inductanceloading of telephone cables Input impedance of lossless lines – Reflection on a line not terminatedbyZ_O Transferimpedance–Reflection factorandreflectionloss.

MODULE II THE LINE AT RADIO FREQUENCIES 8 Hours

Standingwavesandstandingwaveratio onaline Oneeighthwaveline Quarterwave lineandimpedancematching Thehalf-waveline Smith chart – Application of the smith chart – Conversion from impedance to reflection co-efficient and vice-versa Impedance to admittance conversion and vice-versa – Input impedanceof a lossless lineterminatedby an impedance Single stub matching and double stub matching.

MODULE III FILTERS AND GUIDED WAVES 9 Hours

Constant K Filters - Low pass, High pass band, pass band elimination filters - m -derived sections Waves between parallel planes of perfect conductors Transverse electric and transverse magnetic waves Characteristics of TE and TM waves Transverse electromagnetic waves Velocitiesofpropagation– Componentuniform planewavesbetweenparallel planes Attenuation of TE and TM waves in parallel plane guides – Wave impedances. **MODULE IV RECTANGULAR WAVEGUIDES**

9 Hours Transversemagneticwavesinrectangularwave guides Transverseelectricwavesin rectangular waveguides Characteristics of TE and TM waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangularwaveguide– AttenuationofTEandTMmodesin rectangularwaveguide Wave impedance Characteristic impedance Excitation of modes.

MODULE V CIRCULAR WAVE GUIDESAND RESONATORS 9 Hours

Besselfunctions–Solutionoffieldequationsin cylindricalco-ordinates TMandTE waves in circular guides –Wave impedancesand characteristic impedance Dominant modeincircularwaveguide Excitationof modes Microwavecavities Rectangular cavityresonators Circularcavityresonator Semicircularcavityresonator–Qfactorof a
cavity resonator for TE_{101}mode.

Total: 45Hours

Further Reading: Transmission line equations at radio frequencies - Characteristic impedance of symmetrical networks- Thecirclediagram forthe dissipation less line composite filters.

References:

1. Ryder J. D., “Networks, Lines and Fields”, PHI, 2003.
2. Jordan E.C. and BalmainK. G., “Electro Magnetic Waves and Radiating System , PHI, 2003.
3. Ramo, Whineeryand Van Duzer, Fields and Waves in Communication Electronics ,John Wiley, 2003.
4. David M. Pozar, Microwave Engineering , 2nd Edition, John Wiley, 1997.
5. DavidK.Cheng, FieldandWavesinElectromagnetism ,PearsonEducation, 1989.

1902EC504	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

MODULE I CONTROL SYSTEMS REPRESENTATION 10 Hours

Introduction to Control systems- Open loop and Closed loop control systems-Transfer function-Modelling of control systems – Mechanical translational and Rotational systems - Electrical systems -Block diagram reduction techniques Signal flow graph reduction using Masons gain formula.

MODULE II TIME RESPONSE ANALYSIS 8 Hours

Standard test signals- type and order of a system - Time response of First order control systems for step input-Time response of Second order control systems for step input-Time domain specifications--Steady state error- Controllers-PI, PD, PID controllers.

MODULE III FREQUENCY RESPONSE ANALYSIS 9 Hours

Frequency domain specifications-Frequency response analysis using Polar plot-Bode Plot and Nyquist Plot

MODULE IV STABILITY ANALYSIS OF CONTROL SYSTEMS 9 Hours

Introduction to stability-Stability and the roots of characteristic equation-Routh Hurwitz stability criterion-conditionally stable systems-Construction of Root locus.

MODULE V COMPENSATORS AND STATE SPACE ANALYSIS 9 Hours

Compensators:

Compensators-Lead, Lag and Lag-Lead Compensation Design of compensator using Bode plot.

State Space Representation:

Introduction to state space analysis-State model of linear systems-Solution of state equation - State transition matrix-Concept of Controllability and Observability.

Total: 45Hours

Further Reading: www.nptel.ac.in/courses/108101037

References:

1. Nagrath I.J. and Gopal M., ―Control Systems Engineering‖, 5th Edition, New Age International Publishers, New Delhi, 2011.
2. Norman S. Nise, ―Control Systems Engineering‖, 6th Edition, Wiley Publishers, 2011
3. Nagrath I.J. and Gopal.M,‖Control Systems Engineering ‖, 5th Edition, New Age International Publishers, New Delhi, 2008
4. Kuo,B.C, ―Automatic Control Systems‖, 8th Edition, John Wiley and Sons, New York, 2003

1902EC505	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION AND CONCEPTS OF NETWORKS 9 Hours

Networks Categories of Networks Network hardware Network software Network Architecture TCP/IP reference models Network LAN technologies - Transmission media.

MODULE II DATA LINK LAYER AND PHYSICAL LAYER 9 Hours

Data link layer: Functionality of data link layer- Data link control and protocols Error Detection and Error Correction - MAC – Ethernet- Wireless LAN- Broadband wireless Bluetooth – Data link layer switching **Physical layer:** Basis for data communication- Wireless transmission- Transmission media- Multiplexing- Channel capacity- switching

MODULE III NETWORK LAYER 9 Hours

Network layer Functionality of network layer- Network addressing- Network routing- Routing algorithms- Internetworking- Quality of service- Network layer protocols- Switching concepts Circuit switching Packet switching- Network layer design issues.

MODULE IV TRANSPORT LAYER 9 Hours

Functionality of transport layer- Transport layer service Elements of transport protocols- Transmission control protocol– Congestion control and avoidance User datagram protocol- Delay tolerant networking- Transport for Real Time Applications (RTP).

MODULE V APPLICATIONS AND SECURITY 12 Hours

Applications protocols Client and server model- Network services- DES- RSA- Web security- Recent trends, development and issues

Total: 45 + 15 Hours

Further Reading:

1. Computer Networks- A- Tanenbanum- 5th edition
2. Computer Networking- A top down approach- Kurose/ Ross- 6th edition

References:

1. Achyut S Godbole,AtulHahate, Data Communications and Networks", Second edition 2011
2. Andrew S.Tannenbaum David J. Wetherall, "Computer Networks" Fifth Edition , Pearson Education 2011
3. Douglas E. Comer, ―Internetworking with TCP/IP (Volume I) Principles, Protocols and Architecture‖, Sixth Edition, Pearson Education, 2013.
4. Forouzan, Data Communication and Networking , Fifth Edition , TMH 2012.
5. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition,2012.
6. Larry L. Peterson & Bruce S. Davie, Computer Networks A systems Approach", Fifth Edition, Morgan Kaufmann, 2012
7. William Stallings, ―Data and Computer Communications‖, Tenth Edition, Pearson Education, 2013

1904GE551	LIFE SKILLS: APTITUDE - I	L	T	P	C
		0	0	2	1

MODULE I INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS OF ADDITION, MULTIPLICATION, DIVISION **6 Hours**

Classification of numbers – Types of Numbers - Divisibility rules - Finding the Modules digit - Finding remainders in divisions involving higher powers - LCM and HCF Models - Fractions and Digits Square, Square roots Cube, Cube roots Shortcuts of addition, multiplication, Division.

MODULE II RATIO AND PROPORTION, AVERAGES **6 Hours**

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion, Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean method.

MODULE III PERCENTAGES, PROFIT AND LOSS **6 Hours**

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions - Problems on percentages - Problems on Profit and Loss percentage- Relation between Cost Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

MODULE IV CODING AND DECODING, DIRECTION SENSE **6 Hours**

Coding using same set of letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving problems by drawing the paths - Finding the net distance travelled - Finding the direction - Problems on clocks - Problems on shadows - Problems on direction sense using symbols and notations.

MODULE V NUMBER AND LETTER SERIES NUMBER AND LETTER ANALOGIES, ODD MAN OUT **6 Hours**

Difference series - Product series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Place values of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

Total: 30 Hours

Further Reading: http://www.ti.com/processors/dsp/overview.html

1. Spectrum estimation.
2. Linear estimation and prediction

References:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT", 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations", revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, A New Approach to REASONING Verbal & Non-Verbal , 2nd edition, Arihnat publication, 2014.

Professional Elective – I

1903EC004	DISPLAY SYSTEMS	L	T	P	C
		3	0	0	3

MODULE I INTRODUCTION TO DISPLAY SYSTEMS 9 Hours

Introduction to displays. Requirements of displays. Display technologies, CRT, Flat panel and advanced display technologies. Technical issues in displays.

MODULE II HEAD MOUNTED DISPLAY 9 Hours

Head mounted displays. Displays less than and greater than 0.5 m diagonal. Low power and light emitting displays.

MODULE III WORKING OPERATION OF DISPLAY 9 Hours

Operation of TFTs and MIMS. LCDs, Brightness. Types of LCD displays.

MODULE IV Types of Display 9 Hours

Emissive displays, ACTFEL, Plasma display and Field emission displays, operating principle and performance.

MODULE V APPLICATIONS OF DISPLAY 9 Hours

Types of Displays: 3D, HDTV, LED, Touch screen.

Total: 45 Hours

Further Reading:

1. 5G Communication
2. FSOC

References:

1. L.W. Mackonald& A.C. Lowe, Display Systems, Design and Applications, Wiley, 2003.
2. E.H. Stupp &M. S. Brennesholtz, Projection Displays, Wiley,1999
3. Peter A. Keller, Electronic Display Measurement: Concepts, Techniques, and Instrumentation, Wiley-Inter science, 1997.
4. Recent literature in Display Systems.

LABORATORY COURSES

1902EC551	**DIGITAL SIGNAL PROCESSING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

LIST OF EXPERIMENTS:

1. Generation of Signals
2. Properties of Discrete time Systems-Linearity, Stability, Causality &Time Variance.
3. Sampling of an audio signal with different sampling rate and reconstruct the sampled signal
4. Computation of DFT of a signal using basic equation and FFT & power spectrum estimation using DFT
5. Design and Simulation of IIR filters
6. Design and Simulation of FIR filters
7. Multirate signal processing-Down sampling , Up sampling , Decimation and Interpolation.
8. Arithmetic operations in DSPs.
9. Generation of waveforms using DSPs
10. Computation of convolution and correlation between signals using DSPs.
11. Implementation of IIR Filters using DSPs
12. Implementation of FIR Filters using DSPs

Total: 45 Hours

ADDITIONAL EXPERIMENTS:

1. Color image segmentation algorithm development
2. Image filtering in spatial and frequency domain
3. Morphological operations in analyzing image structures

References:

1. John G. Proakis& Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Emmanuel C..Ifeachor, &Barrie.W.Jervis, “Digital Signal Processing , Second Edition, Pearson Education / Prentice Hall, 2002.
3. Sanjit K. Mitra, Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.
4. A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete-Time Signal Processing , 8th Indian Reprint, Pearson, 2004
5. Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.

1902EC552	COMPUTER NETWORKS LAB	L	T	P	C
		0	0	4	2

List of Experiments:

1. Study of Network Topologies
2. Implementation and Study of Stop & Wait Protocol
3. Implementation and Study of Go Back N Protocol
4. Implementation and Study of Selective Repeat Protocol
5. Configure a Network Using Distance Vector Routing Protocol
6. Configure a Network Using Link State Vector Routing Protocol
7. Implementation and Study of CSMA/CA Protocol
8. Implementation of Data Encryption And Decryption
9. Configure a Network Topology Using Packet Tracer Software
10. To Create Scenario and Study The Performance of Network With CSMA/CD Protocols through Simulation

Total: 45 Hours

Additional Experiments:

1. To Create Scenario And Study The Performance of Token Bus And Token Ring Protocols Through Simulation
2. Study of Socket Processing

References:

1. Computer Networks: A Systems Approach, 4th Ed. (2007), by Larry Peterson and Bruce Davie. Covers background networking material with which students should have familiarity.
2. Computer Networking: A Top-Down Approach Featuring the Internet, 5th Ed. (2010), by James F. Kurose and Keith W. Ross. Covers similar material to Peterson and Davie.

Audit Course

1901MCX03	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (Common to All Branches)	L	T	P	C
		2	0	0	0

MODULE I INTRODUCTION TO CULTURE **6 Hours**

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

MODULE II INDIAN LANGUAGES, CULTURE AND LITERATURE **6 Hours**

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature.

MODULE III RELIGION AND PHILOSOPHY **6 Hours**

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only).

MODULE IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) **6 Hours**

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modernIndia.

MODULE V EDUCATION SYSTEM IN INDIA **6 Hours**

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

TOTAL 30 Hours

REFERENCES:

1. Kapil Kapoor, Text and Interpretation: The India Tradition ,ISBN: 81246033375,2005

2. Science in Samskrit , Samskrita Bharti Publisher, ISBN 13: 978-8187276333,2007

3. NCERT, “Position paper on Arts, Music, Dance and Theatre , ISBN 81-7450 494-X,200

4. S. Narain, Examinations in ancient India , Arya Book Depot,1993

5. Satya Prakash, Founders of Sciences in Ancient India , Vijay Kumar Publisher,1989

6. M. Hiriyanna, Essentials of Indian Philosophy , Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

E.G.S.PILLAYENGINEERINGCOLLEGE

(Autonomous)

Approved by AICTE, New Delhi| Affiliated to Anna University, Chennai Accredited by NAAC with „A" Grade| Accredited by NBA (CSE, EEE, MECH, ECE, CIVIL, IT)

NAGAPATTINAM–611002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Full Time Curriculum and Syllabus

Third Year **Sixth Semester**

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1902EC601	Antenna and Waveguide Propagation	2	2	0	3	40	60	100
1902EC602	VLSI Design	3	0	0	3	40	60	100
1902EC603	Digital Communication	3	0	0	3	40	60	100
1901MGX04	HSS Elective I	3	0	0	3	40	60	100
1903EC030	Open Elective I	3	0	0	3	40	60	100
1903EC00	Professional Elective II	3	0	0	3	40	60	100
Laboratory Course								
1902EC651	VLSI Design Laboratory	0	0	2	1	50	50	100
1902EC652	Analog & Digital Communication Laboratory	0	0	2	1	50	50	100
1904EC653	Industrial Visit Presentation	0	0	0	1	50	50	100
1904GE651	Life Skills: Aptitude II & GD	2	0	0	1	100	-	100
	Tot	**17**	**2**	**4**	**22**	**540**	**460**	**1000**

L–Lecture| T–Tutorial| P Practical| C–Credit| CA –Continuous Assessment| ES–End Semester

Course	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
HSS Elective -								
1901MGX01	Total Quality Management	3	0	0	3	4	6	100
1901MGX0	Project Management and Finance	3	0	0	3	4	6	100
1901MGX0	Operations Research	3	0	0	3	4	6	100
1901MGX0	Principles of Management	3	0	0	3	4	6	100
Open Elective I (Even Semester)								
1903EC0	Medical Electronics	3	0	0	3	4	60	100
1903EC0	High Speed Networks	3	0	0	3	4	60	100
1903EC030	Generations of Communication Technology.	3	0	0	3	40	60	100
1903EC0	Optical Networks	3	0	0	3	4	6	100
1903EC0	Satellite Communication	3	0	0	3	4	6	100
Professional Elective -								
1903EC00	Radar and Navigation Aids	3	0	0	3	4	6	100
1903EC00	Automotive Electronics	3	0	0	3	4	6	100
1903EC00	Internet of Things	3	0	0	3	4	6	100
1903EC00	Biomedical Engineering	3	0	0	3	4	6	100
1903EC01	Information Coding Techniques	3	0	0	3	4	6	100

1902EC601	ANTENNAS AND WAVE PROPOGATION	L	T	P	C
		3	0	0	3

MODULE I FUNDAMENTALS OF RADIATION **9 Hours**

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

MODULE II ANTENNA ARRAYS **9 Hours**

N element linear array, Pattern multiplication, Broad side and End fire array Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial Arrays, Tchebychev polynomial.

MODULE III APERTURE AND SLOT ANTENNAS **9 Hours**

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas, Micro strip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis.

MODULE IV SPECIAL ANTENNAS **9 Hours**

Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas-Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR.

MODULE V PROPAGATION OF RADIO WAVES **9 Hours**

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth, concept Sky wave propagation Virtual height, critical frequency, Maximum usable frequency Skip distance, Fading , Multi hop propagation.

Total: 45 Hours

Further Reading:

1. Signal processing in Microwaves.

References:

1 John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, The McGraw Hill Companies, 3rd Edition, 2010.
2 K. D. Prasad, Antenna & Wave Propagation , SatyaPrakashan, New Delhi, Fourth Edition 2006.
3 John D Kraus, “Antenna& Wave Propagation , McGraw Hill, Communications and Networking, Morgan Kaufmann Publishers, an Imprint of Elsevier, 4th Edition, 2008.
4 C.A. Balanis, “Antenna Theory - Analysis and Design", John Wiley, Fourth Edition. 2016.
5 Vijay K Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, An Imprint of Elsevier, First Edition, 2008.

1902EC602

VLSI DESIGN

L	T	P	C
3	0	0	3

MODULE I FABRICATION OF CMOS IC AND PHYSICAL DESIGN **9 Hours**

An overview of Silicon Semiconductor technology- NMOS fabrication - CMOS fabrication: n-well, P-well- Twin Tub and SOI Process- Layout design rules- Lambda Design Rules Stick Diagrams-VLSI Layout Design - Layout of Basic Structures - CMOS Logic Gates- Implementation of given logic function using CMOS logic

MODULE II MOS CIRCUIT DESIGN PROCESS **9 Hours**

Pass Transistor and Transmission Gate Static CMOS design, Pseudo NMOS –dynamic CMOS logic Clocked CMOS logic, Pre charged domino logic- Keeper Circuits - Dual Rail- Cascade Voltage Switch Logic-Circuit Pit Falls

MODULE III CMOS MEMORIES AND CLOCKING **9 Hours**

Sequencing Static Circuits Conventional CMOS Latches and Flip-Flops, Class Semi dynamic Flip-Flop (SDFF) –TSPC Latches and FF – Memory architecture- Flash Memory ,CMOS Static RAM- Dynamic RAM and CAM -,CMOS Clocking Styles

MODULE IV VLSI SUBSYSTEM DESIGN **9 Hours**

CMOS Mux - Equality Detector - Shift and Rotation Operation – Priority encoder- Ripple Carry Adder-Carry Look Ahead Adder -Carry Skip Adder - Carry select and Carry save-Adder - Braun/ Baugh Wooley -Modified Booth Encoded Multiplier.

MODULE V IMPLEMENTATION STRATEGIES **9 Hours**

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

Total: 45 Hours

Further Readings:

1. Comparison of Logic Styles - Differential and Sense Amplifier Circuits Prescaler - Bit Slice ALU CMOS Clock Generation and Distributions - BICMOS- FINFET Technology

References:

1. John P. Uyemura, "Introduction to VLSI circuits and systems", John Wiley & Sons, 2015
2. Neil.H.E Weste David Harris CMOS VLSI Design: A Circuits and Systems Perspective, 4th edition, Pearson Addison Wesley, 2015.
3. Kamran Eshraghian, Douglas A. Pucknell, Essentials of VLSI Circuits and Systems Prentice Hall of India, 2015.
4. E. Fabricious, Introduction to VLSI Design, 1st edition, McGraw Hill, 2014
5. Keng,Lablebick, "CMOS Digital Integrated Circuits", Tata McGraw Hill, 2014

1902EC603	DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

MODULE I DIGITAL PULSE MODULATION **9 Hours**

Review of Sampling, Aliasing and Reconstruction – Quantization: Uniform and Non-uniform quantization Quantization noise Commanding of speech signal Waveform coding: Pulse Code Modulation Differential pulse code modulation – Adaptive differential pulse code modulation - Delta modulation – Adaptive Delta modulation Linear Predictive Coding.

MODULE II BASEBAND TRANSMISSION **9 Hours**

Digital line encoding techniques: Need for line shaping of signals, Properties of Line codes, Unipolar / Polar RZ & NRZ, Bipolar NRZ, Manchester Matched filter Inter Symbol Interference and Nyquist criteria for ISI cancellation Pulse shaping with raised cosine filter Correlative level coding – M ary PAM transmission Optimum linear receivers

– Equalization techniques – Eye pattern.

MODULE III ERROR CONTROL CODING TECHNIQUES **9 Hours**

Discrete memory less channel – Linear block codes – Hamming codes – Cyclic codes – BCH codes, RS codes, Go lay codes, CRC codes Convolution codes – State diagram Code Trellis Viterbi algorithm for decoding –Problems.

MODULE IV PASSBAND DATA TRANSMISSION TECHNIQUES **9 Hours**

Generation, Detection, Representation of signal, Signal constellation diagram, Error probability and Power spectrum of ASK, FSK, BPSK, DPSK, QPSK, MSK, GMSK and QAM coherent schemes Comparison and BER Analysis.

MODULE V SYNCHRONIZATION AND SPREAD SPECTRUM TECHNIQUES **9 Hours**

Importance of Synchronization – Carrier, frame and symbol/Chip synchronization techniques, Spread Spectrum- PN Sequence code and properties Direct Sequence and Frequency Hopping Spread Spectrum Systems –Processing gain and Jamming Margin.

Total: 45 Hours

Further Reading:

1. Mobile radio propagation
2. TDMA FDMA – CDMA – OF DMA.

References:

1. Simon Haykin, Digital Communications", John Wiley, 2015.
2. J.G. Proakis, "Digital Communications , McGraw Hill, 5th edition,2007
3. Bernard Sklar, "Digital Communication ,2nd Edition, Pearson Education, 2006.
4. H Taub& D L Schilling, "Principles of Communication Systems", 3rd Edition, Tata McGraw Hill, 2008.
5. Nptellink : https://onlinecourses.nptel.ac.in/noc20_ee17/course
6. https://www.tutorialspoint.com/digital_communication/index.htm

1902EC651	VLSI DESIGN LABORATORY	L	T	P	C
		0	0	4	2

List of Experiments:

1. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design and Simulate a CMOS Inverting Amplifier.
7. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers
8. Design and simulate a CMOS Basic Gates and Flip-Flops
9. FPGA Implementation of ALU
10. FPGA Implementation of 4 bit adder

Additional Experiments:

1. Designing a CMOS Latch
2. Using VHDL design a frequency divider

References:

1. E. Fabricious, Introduction to VLSI Design, 1st edition, McGraw Hill, 2014
2. Neil.H.EWeste David Harris CMOS VLSI Design: A Circuits and Systems Perspective, 4th edition, Pearson Addison Wesley, 2015
3. Kamran Eshraghian, Douglas A. Pucknell, Essentials of VLSI Circuits and Systems Prentice Hall of India, 2015.
4. John P.Uyemura, "Introduction to VLSI circuits and systems", John Wiley & Sons, 2015

1902EC652	ANALOG AND DIGITAL COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

List of Experiments:

Design, Simulate and implement the following,

1. Amplitude Modulation.
2. Frequency Modulation.
3. Pre-emphasis and de-emphasis in FM.
4. PAM, PWM and PPM.
5. Time Division Multiplexing and Frequency Division Multiplexing.
6. Analog Signal Sampling and Reconstruction.
7. Pulse Code Modulation.
8. Delta Modulation
9. Line Coding formats
10. Error Control Coding
11. ASK, FSK, BPSK, QPSK

Additional Experiments:

1. Super heterodyne Receiver
2. Simulation of Equalization Techniques

References:

1. J.G. Proakis, "Digital Communications", McGraw Hill, 5th edition, 2007
2. Simon Haykin, Communication Systems, John Wiley, 2001.
3. Jack Quinn, „Digital Data Communication , Prentice Hall; 1st edition,-199)
4. P.Michael Fitz, Fundamentals of Communication System, Tata McGraw-Hill -2008.
5. P.Rama Krishna rao, Analog Communication, Tata McGraw-Hill -2011

HSS ELECTIVE I

1901MGX01	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

MODULE I INTRODUCTION **9 Hours**

Definition of Quality - Dimensions of Quality - Quality Planning - Quality costs - Analysis Techniques for Quality Costs - Basic concepts of Total Quality Management - Historical Review - Quality Statements - Strategic Planning, Deming Philosophy - Crosby philosophy - Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, Kaizen - Obstacles to TQM Implementation

MODULE II TQM PRINCIPLES **9 Hours**

Principles of TQM, Leadership - Concepts - Role of Senior Management - Quality Council, Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits - Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure

MODULE III STATISTICAL PROCESS CONTROL (SPC) **9 Hours**

The seven tools of quality - Statistical Fundamentals - Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables X bar and R chart and attributes P, NP, C, and u charts, Industrial Examples, Process capability, Concept of six sigma - New seven Management tools

MODULE IV TQM TOOLS **9 Hours**

Benchmarking - Reasons to Benchmark - Benchmarking Process, Quality Function Deployment(QFD)- House of Quality, QFD Process, and Benefits - Taguchi Quality Loss Function - Total Productive Maintenance (TPM) - Concept, Improvement Needs, and FMEA - Stages of FMEA- Casestudies

MODULE V QUALITY SYSTEMS **9 Hours**

Concept, Requirements of ISO 9000 and Other Quality Systems - ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 9000:2005 and 9001:2015, ISO 14000.

Total: 45 Hours

Further Reading:

1. Case Study: TQM Quality and Environmental Concepts in real World Applications
2. Environment Management system

References:

1. Rathakrishnan, Gas Dynamics, 5th edition, PHI Learing Private Limited,2013.
2. N. Gupta and B. Valarmathi, Total Quality Management, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi,2009.
3. S. Kumar, Total Quality Management, Laxmi Publications Ltd. New Delhi,2006
4. P.N. Muherjee, Total Quality Management, Prentice Hall of India, New Delhi,2006.
5. DaleH.Besterfiled, Total Quality Management, Pearson Education Inc., New Delhi,2003.
6. James R. Evans and William M. Lidsay, The Management and Control of Quality, South- Western2002.

OPEN ELECTIVE II

1903EC030	GENERATIONS OF COMMUNICATION TECHNOLOGY	L	T	P	C
		3	0	0	3

MODULE I 1G EVOLUTIONS **9 Hours**

History of wireless cellular technology, radio communication, concept of cellular radio system, antenna used in 1G, security measures in 1G, advantages and disadvantages in first generation.

MODULE II 2G EVOLUTIONS **9 Hours**

Review of cellular standards, migration and advancement of GSM architecture and CDMA architecture, WLAN IEEE 802.11and HIPERLAN, Bluetooth.

MODULE III 3G EVOLUTIONS **9 Hours**

IMT-2000 - W-CDMA, CDMA 2000 – radio & network components, network structure, packet-data transport process flow, Channel Allocation, core network, interference-mitigation techniques, UMTS-services, air interface, network architecture of 3GPP, UTRAN – architecture, High Speed Packet Data-HSDPA,HSUPA.

MODULE IV 4G EVOLUTION **9 Hours**

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.

MODULE V 5G EVOLUTIONS **9 Hours**

Introduction, Need for 5G, Evolution of 5G, Comparison of different generations, QoS, 5G network architecture, Future enhancement.

Total: 45 Hours

Further Reading:

1. Free space optical communication
2. Satellite mobile networks

References:

1. Kaveh Pahlavan, “Principles of wireless networks”, Prentice-Hall of India, 2008
2. A.F.Molisch, Wireless Communications, Wiley, 2005.
3. T.S.Rappaport, Wireless Communications: Principles and Practice, Second Edition, PearsonEducation/ Prentice Hall of India, Third Indian Reprint 2003.
4. Vijay K.Garg, Wireless Network Evolution- 2G & 3G” Pearson, 2013.
5. K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies" Wiley,2012.
6. P.MuthuChidambaraNathan, Wireless Communications, PHI, 2008
7. A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.

1903EC025	SATELLITE COMMUNICATION (Open elective)	L	T	P	C
		3	0	0	3

MODULE I SATELLITE ORBITS **9 Hours**

Introduction - Spectrum allocations for satellite systems -Kepler„s Laws - orbital parameters - orbital perturbations– Type of orbits - Geo stationary orbits – look angle determination- limits of visibility – eclipse - sub satellite point sun transit outage

MODULE II SPACE AND EARTH SEGMENT **9 Hours**

Spacecraft technology- structure- power supply- attitude and station keeping ,orbit control - thermal control - communication subsystems - telemetry, tracking and command Transponders Antenna subsystem, Earth station technology -Receive only home TV systems - MATV CATV

MODULE III SATELLITE ACCESS **9 Hours**

Modulation and Multiplexing-Voice, Data, Video, Analog digital transmission system-Digital video broadcast - multiple accesses: (FDMA, TDMA, CDMA, SDMA-assignment methods) -spread spectrum communication

MODULE IV SATELLITE NAVIGATIONAL SYSTEM **9 Hours**

GPS principle of operation, position location determination, principle of GPS receiver and applications- launching procedures - launch vehicles and propulsion.

MODULE V SATELLITE APPLICATIONS **9 Hours**

Satellite mobile services – VSAT- Radarsat- Direct Broadcast satellites (DBS) - Direct to home Broadcast (DTH) -Digital audio broadcast (DAB) – World space services, Business TV (BTV) – GRAMSAT - Specialized services: E mail, Video conferencing, Internet- INTELSAT Series- INSAT – INMARSAT. Re

Total: 45 Hours

Further Reading:

1. GIS

References:

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

2.Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication SystemsEngineering , Prentice Hall/Pearson, 2007.

3.N.Agarwal, Design of Geosynchronous Space Craft , Prentice Hall, 1986.

4.Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House BostanLondon, 1997.

5.Tri T. Ha, "Digital Satellite Communication , II nd edition, 1990.

6. Elements electronic navigation system ,N.S.Nagaraja ,2nd edition Tata McGraw Hill 2000.

PROFESSIONAL ELECTIVE II

1903EC008	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

(Common to B.E / B.Tech – CSE, IT & ECE)

MODULE I Introduction to IoT **9 Hours**

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs ,Machine to Machine, Difference between IoT and M2M, Software Defined Network(SDN)

MODULE II Network and Communication Aspects **9 Hours**

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

MODULE III Challenges of IoT **9 Hours**

Design challenges, Development challenges, Security challenges, Other challenges

MODULE IV Applications of IoT **9 Hours**

Home automation, Industry applications, Surveillance applications, Other IoT applications

MODULE V Developing IoTs **9 Hours**

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Total: 45 Hours

Further Reading:

1. Cloud Computing
2. Dockers and Containers

References:

1. Vijay Madisetti, ArshdeepBahga, Internet of Things: A Hands-On Approach”

2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

1904EC653	INDUSTRIAL VISIT PRESENTATION	L	T	P	C
		0	0	2	1

GUIDELINE FOR EVALUATION

In order to provide the experiential learning to the students, shall take efforts to arrange at least two industrial visit / field visits in a year. A presentation based on Industrial visits shall be made in this semester and suitable credit may be awarded.

1904GE651 **LIFE SKILLS: APTITUDE - II**

L	T	P	C
0	0	2	1

MODULE I PARTNERSHIP, MIXTURES AND ALLEGATIONS, PROBLEM ON AGES, SIMPLE INTEREST, COMPOUND INTEREST **9 Hours**

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

MODULE II BLOOD RELATIONS, , CLOCKS, CALENDARS **9 Hours**

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date .

MODULE III TIME AND DISTANCE, TIME AND WORK **9 Hours**

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man-Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

MODULE IV DATA INTERPRETATION AND DATA SUFFICIENCY **9 Hours**

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy.

MODULE V ANALYTICAL AND CRITICAL REASONING **9 Hours**

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements - Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments .

Total: 45 Hours

References:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT", 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations", revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic , 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, A New Approach to REASONING Verbal & Non-Verbal , 2nd edition, Arihnat publication, 2014.

E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade |Accredited by NBA (CIVIL, CSE, ECE, EEE, IT, MECH)

NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Third Year – Seventh Semester

Course Code	Course Name	L	T	P	C	Maximum Marks			Category
						CA	ES	Total	
Theory Course									
1902EC701	Microwave Engineering	3	0	0	3	40	60	100	PCC
1902EC702	Optical Communication and Networks	3	0	0	3	40	60	100	PCC
1902EC703	Digital Image Processing	2	0	0	2	40	60	100	PCC
	HSS Elective II	3	0	0	3	40	60	100	HSSC
	Open Elective II	3	0	0	3	40	60	100	OEC
	Professional Elective - III	3	0	0	3	40	60	100	PEC
Laboratory Course									
1902EC751	Microwave and Optical Laboratory	0	0	2	1	50	50	100	PCC
1902EC752	Digital Image Processing Laboratory	0	0	2	1	50	50	100	PCC
1904EC653	Internship / In-plant Training	0	0	0	1	100	-	100	EEC
1904GE751	Life skills: Comprehensive Viva	2	0	0	2	100	-	100	EEC
1904GE753	Mini Project	0	0	2	1	100	-	100	EEC
Total		**19**	**0**	**6**	**23**	**640**	**460**	**1100**	

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
HSS Elective - II								
1901HS001	Innovation & Entrepreneurship fundamentals	3	0	0	3	40	60	100
1901HS002	Intellectual Property Rights for Engineers	3	0	0	3	40	60	100

1901HS003	Startup Entrepreneurship	3	0	0	3	40	60	100
1901HS004	Business Model Innovation	3	0	0	3	40	60	100
Open Elective – II (odd Semester) The courses listed below are offered by the Department of Electronics and Communication Engineering for students of other Departments.								
1903EC017	Embedded Systems	3	0	0	3	40	60	100
1903EC007	Automotive Electronics	3	0	0	3	40	60	100
1903EC026	Mobile Communication	3	0	0	3	40	60	100
1903EC004	Display systems	3	0	0	3	40	60	100
1903EC027	Analog and Digital Communication	3	0	0	3	40	60	100
Professional Elective - III								
1903EC011	Micro Electronics	3	0	0	3	40	60	100
1903EC012	Robotics	3	0	0	3	40	60	100
1903EC013	Network Security	3	0	0	3	40	60	100
1903EC014	Soft Computing	3	0	0	3	40	60	100
1903EC015	Advanced Digital Signal Processing	3	0	0	3	40	60	100

1902EC701		**MICROWAVE ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives:	
	1.To gain knowledge about RF Electronics.
	2. To study about the various microwave component, signal generators and amplifiers.
	3. To gain knowledge about integrated circuits and microwave measurements.

Unit I	**INTRODUCTION TO RF ELECTRONICS**	**9 Hours**
The Electromagnetic Spectrum, units and Physical Constants, Microwave bands, RF behavior of Passive components: Tuned resonant circuits, Vectors, Inductors and Capacitors. Voltage and Current in capacitor circuits, Tuned RF/IF Transformers.		
Unit II	**MICROWAVE COMPONENTS**	**9 Hours**
Introduction to Microwaves and their applications, Coaxial Line Components, Wave-guide Components, Directional Couplers, Hybrid Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors, Mixers.		
Unit III	**MICROWAVE SIGNAL GENERATORS AND AMPLIFIERS**	**9 Hours**
Vacuum Tube Triodes, Resonant Cavity Devices, Reflex Klystron, Two –Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes.		
Unit IV	**MICROWAVE INTEGRATED CIRCUITS**	**9 Hours**
Materials, Substrate, Conductor, Dielectric and Resistive Materials, MMIC Growth, Fabrication Techniques, MOSFET Fabrication, NMOS Growth and CMOS Development, Thin Film Formation.		
Unit V	**MICROWAVE MEASUREMENTS**	**9 Hours**
VSWR, Frequency, Guide Wavelength, Coupling and Directivity measurements		
	Total:	**45 Hours**

Further Reading:	
	1.Recent trend in Microwave application.

Course Outcomes:	
	After completion of the course, Student will be able to
	1.Explain about electromagnetic spectrum and passive components in Microwave field.
	2.Identify the component for microwave application.
	3.Discuss signal generator and amplifiers.
	4. Illustrate the concept of microwave integrated circuits.
	5.Experiment with microwave devices to measure microwave parameter.

References:

1. Reinhold Ludwing, Pavel Bretchko, “RF Circuit design: Theory and applications”, Pearson Education Asia Publication, New Delhi 2001.

2.Foundations For Microwave Engineering, R. R. Collin, McGraw Hill

3.Microwave Communications – Components and Circuits, E. Hund, McGrawHill.

4.Microwave Devices and Circuits, S. Y. Liao, PHI.

5.Microwave Engineering, R. Chatarjee, East – West Press Pvt. Ltd.

1902EC702		OPTICAL COMMUNICATION	L	T	P	C
			3	0	0	3

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, RI profile and cut-off wave length.
3. To learn about various Optical Sources and Detectors.
4. To Explore the trends of optical fiber measurement systems.
5. To Enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical CDMA

Unit I	**INTRODUCTION TO OPTICAL FIBERS**	**9 Hours**

Evolution of fiber optic system- Element of an Optical Fiber Transmission link Ray theory transmission- Total internal reflection-Acceptance angle –Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation –EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers –SM fibers- Graded Index fiber structure.

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

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion- Pulse Broadening in GI fibers-Mode Coupling -Optical fiber connectors**,** Fiber alignment and Joint Losses – Fiber Splices – Fiber connectors – Expanded Beam Connectors – Fiber Couplers

Unit III	**SOURCES AND DETECTORS**	**9 Hours**

Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, mono and hetero structures - internal - quantum efficiency, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies- injection laser diode structures.

Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise –Noise sources, Signal to Noise ratio , Detector response time.

Unit IV	**FIBER OPTIC RECEIVER AND MEASUREMENTS**	**9 Hours**

Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration– Probability of Error – Quantum limit. Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.

Unit V	**OPTICAL NETWORKS AND SYSTEM TRANSMISSION**	**9 Hours**

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –-Link Power budget -Rise time budget- Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA system – Solitons – Optical CDMA – Ultra High Capacity Networks**.**

	Total:	**45 Hours**

Further Reading:

1. Design Optimization of SM fibers-RI profile and cut-off wavelength.
2. Fiber amplifiers- Power Launching and coupling, Lencing schemes

Course Outcomes:

After completion of the course, Student will be able to

1. Discuss the various optical fiber modes, configurations.
2. Demonstrate various signal degradation factors associated with optical fiber.
3. Classify various optical sources and optical detectors and their use in the optical communication system.
4. Explain Various Fiber Optic measurements.
5. Calculate the digital transmission and its associated parameters on system performance.

References:

1. Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4th Edition., 2010.
2. John M. Senior , “Optical Fiber Communication”, Second Edition, Pearson Education, 2007.
3. Ramaswami, Sivarajan and Sasaki “Optical Networks”, Morgan Kaufmann, 2009
4. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008.
5. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

1902EC703		DIGITAL IMAGE PROCESSING	L	T	P	C
			3	0	0	3

Course Objectives:

1. To make the students to understand the digital image fundamentals.
2. To study the digital image using different transforms.
3. To acquire the basic knowledge in filters, image enhancement, image restoration and compression techniques.

Unit I	**DIGITAL IMAGE FUNDAMENTALS**	**9 Hours**

Elements of digital image processing systems, Elements of visual perception, Image sampling andquantization, Basic Relationships between pixels. Image Transforms:Discrete Fourier transform, Cosine,Hadamard, Haar, Walsh and Slant transform..

Unit II	**IMAGE ANALYSIS**	**9 Hours**

Histogram processing, Equalization and specification techniques,Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Image smoothing and sharpening using frequency domain filters.

Unit III	**IMAGE SEGMENTATION**	**9 Hours**

Point, line and edge detection-Detection of isolated points, Line detection, Edge models, Basic edgedetection, Edge linking and boundary detection. Thresholding-basic global thresholding, Otsu's method,Multiple, Variable and multivariable thresholding. Region-based segmentation-Region growing, Regionsplitting and merging.

Unit IV	**IMAGE RESTORATION AND RECOGNITION**	**9 Hours**

Image degradation/ restoration model, Noise models, Restoration-Spatial Filtering, Constrained Leastsquare filtering, Inverse filtering, Wiener Filtering, Object recognition-Patterns and patternclasses,Matching-Minimum Distance classifiers, Neural networks-Background, Training by Back Propagation.

Unit V	**IMAGE COMPRESSION**	**9 Hours**

Fundamentals, Basic compression methods-Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run – length coding, Lossless and Lossy predictive coding, Block transform coding, Waveletcoding.

Total:	**45 Hours**

Further Reading:

transform and their properties, Homomorphic filtering, Morphological image processing – Erosion and Dilation, Opening and closing, Segmentation using morphological watersheds, Applications of neural networks in image processing, Digital image watermarking.

Course Outcomes:

After completion of the course, Student will be able to

1. Analyze the image using image transforms.
2. Develop a methodology for smoothening and sharpening of the image
3. Segment the image using edge detection, thresholding and region based approach.
4. Develop a method to restore the image and object recognition
5. Compress the image using lossy and lossless compression techniques.

References:

1. C.Rafeal Gonzalez and E.Richard Woods, Digital Image Processing, Third Edition, Pearson Education 2008.
2. Anil K.Jain, Fundamentals of Digital Image Processing, PHI, 2010.
3. S Jayaraman, S Esakkirajan T Veerakumar, Digital Image Processing , Mc Graw- Hill, 2010
4. K.William Pratt, Digital Image Processing, John Wiley, 1997.
5. M.A.Sid Ahmed, Image Processing Theory, Algorithm and Architectures, McGraw - Hill, 1995.

LABORATORY COURSE

1902EC751		**Microwave and Optical Communication Lab**	**L**	**T**	**P**	**C**
			0	**0**	**4**	**2**

Course Objectives:	
	1. To have a detailed practical study on microwave signal and its components.
	2. To study the optical devices and to use in appropriate application.
List of Experiments:	
MICROWAVE EXPERIMENTS:	
1. Reflex Klystron – Mode characteristics	
2. Gunn Diode – Characteristics	
3. VSWR, Frequency and Wave Length Measurement	
4. Directional Coupler – Directivity and Coupling Coefficient – S – parameter measurement.	
5. Circulator – S - parameter measurement	
6. Attenuation and Power measurement	
7. S - matrix Characterization of E-Plane T, H-Plane T and Magic T.	
8. Radiation Pattern of Antennas.	
9. Antenna Gain Measurement	
OPTICAL EXPERIMENTS:	
1. DC characteristics of LED and PIN Photo Diode.	
2. Mode Characteristics of Fibers.	
3. Measurement of Connector and Bending Losses.	
4. Fiber Optic Analog and Digital Link	
5. Numerical Aperture Determination for Fibers	
6. Attenuation Measurement in Fibers.	
Additional Experiments:	
	1. Study of Manchester coding.
List of Hardware/Software Required	
	1. Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter, optical power meter. – 2 Nos
	2. Trainer kit for determining the mode characteristics, losses in optical fiber.- 2 Nos.
	3. Trainer kit for analyzing Analog and Digital link performance, 2 Mbps PRBS Data source, 10 MHz signal generator, 25 MHz Analog storage Oscilloscope. – 5 Nos.
	4.Kit for measuring Numerical aperture and Attenuation of fiber - 2 Nos.
	5.Glass and plastic fiber patch chords- 2 set.
	6. LEDs with ST / SC / E2000 receptacles – 650 / 850 nm - 2 set.
	7.PiN PDs with ST / SC / E2000 receptacles – 650 / 850 nm - 2 set.
	8. Microwave test Bench at X band to determine Directional coupler characteristics. - 2 Nos.
	9.Microwave test Bench at X band and Antenna turn table to measure Radiation pattern of Horn antenna, 2 Horn antennas. - 2 Nos.
	10.Microwave test Bench at X band to determine VSWR for Isolator and Circulator, VSWR meter, Isolator, Circulator, E Plane Tee, H plane Tee. - 2 Nos.

	11.Microwave test Bench at X band, Variable attenuator, Detector and 25 MHz Analog Oscilloscope. - 2 Nos.
Course Outcomes:	
	After completion of the course, Student will be able to
	1. Experiment with microwave devices to measure microwave parameter.
	2. Analyze the performance of Fiber optic cable for analog and digital signals.
References:	
1. Reinhold Ludwing, Pavel Bretchko, "RF Circuit design: Theory and applications", Pearson Education Asia Publication, New Delhi 2001.	
2.Foundations for Microwave Engineering, R. R. Collin, McGraw Hill	
3.Microwave Communications – Components and Circuits, E. Hund, McGrawHill.	
4.Microwave Devices and Circuits, S. Y. Liao, PHI.	
5.Microwave Engineering, R. Chatarjee, East – West Press Pvt. Ltd.	

1902EC752		**DIGITAL IMAGE PROCESSING LAB**	**L**	**T**	**P**	**C**
			0	**0**	**4**	**2**

Course Objectives:	
	3. To make the students to understand the digital image fundamentals.
	4. To demonstrate the digital image using different transforms.
	5. To apply the concepts and basic knowledge in filters, image enhancement, image restoration and compression techniques.
List of Experiments:	
1. The thresholding an image and the evaluation of its histogram using histogram equalization and illustrates the relationship among the intensities (gray levels) of an image and its histogram	
2. Show image rotation, scaling, and translation using Geometric transformations.	
3. Perform the Two-dimensional Fourier transform operation in an image.	
4. Perform the Linear filtering using convolution in an image	
5. Image Edge Detection Using Sobel Filtering and Canny Filtering	
6. Perform the following operations in an image. (a) erosion, (b) dilation,	
7. Perform the following operations in an image. (a) opening, (b) closing,	
Total:	**45 Hours**
Additional Experiments:	
	1. Color image segmentation algorithm development
	2. Image filtering in spatial and frequency domain
	3. Morphological operations in analyzing image structures
List of Hardware/Software Required	
	1. MATLAB with Simulink and Image Processing Tool Box or Equivalent Software in desktop systems -15 Nos
Course Outcomes:	
	After completion of the course, Student will be able to
	1. Understand the Fundamentals of Digital image processing and its applications.
	2. Perform the image enhancement technique for the improvement of pictorial information for human perception
	3. Apply the concepts of image segmentation and compression
	4. Demonstrate object detection and recognition technique learning
References:	
1. C.Rafeal Gonzalez and E.Richard Woods, Digital Image Processing, Third Edition, Pearson Education 2008.	
2. Anil K.Jain, Fundamentals of Digital Image Processing, PHI, 2010.	

3.	S Jayaraman, S Esakkirajan T Veerakumar, Digital Image Processing , Mc Graw- Hill, 2010
4.	K.William Pratt, Digital Image Processing, John Wiley, 1997.
5.	M.A.Sid Ahmed, Image Processing Theory, Algorithm and Architectures, McGraw - Hill, 1995.

1904GE751		Life skills: Comprehensive Viva	L	T	P	C
		(TECHNICAL SEMINAR)	**0**	**0**	**4**	**2**
		BE (ECE)				

Course Objectives:

1. To develop self-learning skills of utilizing various technical resources to make a technical presentation
2. To promote the technical presentation and communication skills.
3. To impart the knowledge on intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds.
4. To promote the ability for Interacting and sharing attitude.
5. To encourage the commitment-attitude to complete tasks

GUIDELINES

1. The students are expected to make two presentations on advanced topics (recent trends) related to IV year/ VII semester subjects
2. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also
3. It is mandatory that each student will interact individually a seminar/model on agreed topic and share their technical knowledge
4. Students are encouraged to use various teaching aids such as overhead Projectors. power point presentation and demonstrative models
5. During the final seminar sessions each student is expected to prepare and present a topic, for duration of not less than 15 minutes. At the end of the semester student would have to submit the Report on the presentation

TOTAL	**30 HOURS**

Course Outcomes:

After completion of the course, Student will be able to

3. Identify and utilize various technical resources available from multiple field
4. Improve the technical presentation and communication skills
5. Improve communicative competence
6. Interact and share their technical Knowledge
7. Understand and adhere to deadlines and commitment to complete the assignments

EVALUATION SCHEME

Continuous Assessment (100 Marks)

Distribution of Marks for Continuous Assessment	Marks
Presentation I	40
Report	10
Presentation II	40
Report	10
Total 100	100

References: https://spectrum.ieee.org/

1904GE753		MINI PROJECT	L	T	P	C
			0	0	2	1

Course Objectives:

The students should be made to:

1. To develop self-learning skills of utilizing various technical resources to make a technical presentation.
2. To test technical presentation and communication skills.

The students (with team size no more than 4 students in a team) are expected to make mini project on topics (Preferably in recent trends) related to Electronics and Communication Engineering. A faculty guide is to be allotted if requested and he / she will guide and monitor the progress of the student and maintain attendance also (If no guide is requested then course co coordinator will take care of attendance). Students are encouraged to use various teaching aids such as power point presentation and demonstrative models which should be presented to panel which consist no less than three faculties (excluding course co coordinator). The average of the mark given by all panel members is taken into consideration.

Evaluation Scheme: Continuous Assessment (100)

Distribution of marks for Continuous Assessment:

ZEROTH REVIEW :	10 marks
FIRST REVIEW:	20 marks
SECOND REVIEW:	20 marks
FINAL REVIEW/DEMO:	30 marks
REPORT:	20 marks
Total Marks:	**100**

Total: 30 Hours

Course Outcomes:

After completion of the course, Student will be able to

1. Utilize various technical resources available from multiple fields.
2. Improve the technical presentation and communication skills.
3. Connect different domains to make intelligent system.
4. Maximize their technical knowledge with discussing others.
5. Produce different assignments based on real time systems.

HSS Elective II

1901HS002		INTELLECTUAL PROPERTY RIGHTS FOR ENGINEERS	L	T	P	C
			3	0	0	3

Course Objectives:

1. To know about their rights for the protection of their invention done in their project work.
2. To learn about the patents processing system
3. To be familiar with copyrights and IPR related issues.

Unit I	**INTRODUCTION TO IPR**	**9 Hours**

Basic types of property - Tangible and Intangible property - Movable Property and Immovable Property - Intellectual Property – Invention and Creativity - Innovation – Intellectual Property (IP) – Importance – Protection of IPR.

Unit II	**CLASSIFICATIONS OF IPR**	**9 Hours**

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

Unit III	**INTERNATIONAL TREATIES ON IPR**	**9 Hours**

International convention relating to Intellectual Property – TRIPS Agreement - Madrid Agreement - Hague Agreement - Budapest Treaty; Berne convention-Patent cooperation treaty-Paris convention-Lisbon Agreement – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

Unit IV	**INDIAN IPR LEGISLATIONS**	**9 Hours**

Indian Position Vs WTO and Strategies – The Patent Act, 1970 – Inventions Non-Patentable – Compulsory licensing – Patents of Addition – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

Unit V	**IPR IN ELECTRONICS AND INFORMATION TECHNOLOGY**	**9 Hours**

IPR in Electronics & Information Technology -Case Studies on – Patents pertaining to Electronics & Information Technology – Software patents International scenario – Patent & Copyright Protection for software& Electronic inventions - IPR in Electronics and Information Technology.

Total:	**45 Hours**

Further Reading:

1. New developments in trade mark law
2. Foundations of patent law

Course Outcomes:

After completion of the course, Student will be able to

1. Understands the legal issues on Intellectual Property Rights
2. An ability to register a trade mark, copyrights, patents
3. Predict issues related to Intellectual property rights on trademarks, copyrights and patents
4. Summarize and evaluate trade secrets, unfair competition which is being adopted by various firms.
5. Distinguish between legal procedures for patents and copyrights.

References:

1. BARE ACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007.
2. V. Sople Vinod, Managing Intellectual Property by (Prentice Hall of India Pvt.Ltd), 2006.
3. Deborah E. Bouchoux, ―Intellectual Property Rights,‖ Cengage Learning India Private Ltd, 2005.
4. Stim,―Intellectual Property Copyrights, trademarks, and Patents,‖ Cengage Learning India Private Ltd, 2004.
5. Prabuddha Ganguli, ―Intellectual Property Rights,‖, TMH, 2001.
6. Lal, C.S, ―Intellectual property handbook: copyright, designs, patent and trademarks‖, Law Publishers Allahabad, 2000.

OPEN ELECTIVE-I

1903EC017		**EMBEDDED SYSTEMS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

1. Discuss the concepts of basic embedded systems
2. Describe the ARM architecture and Embedded communication protocols
3. To use the embedded controllers In real time applications

Unit I	**Introduction**	**9 Hours**
Introduction to Embedded System, Embedded System Architecture, Embedded hardware, Embedded software, Classifications of Embedded Systems and Characteristics, Challenges and Design issues in Embedded systems, Embedded System on-chip. .		
Unit II	**ARM Processor**	**9 Hours**
ARM processor naming, Types. CISC vs. RISC, Von-Neumann vs. Harvard architecture,ARM M3 features, Architecture, pipeline, Mode of operation, Instruction set, Exception handling		
Unit III	**Embedded Communication Protocols**	**9 Hours**
Communication protocols – USART, I2C, CAN, SPI. Wireless communication protocols: Bluetooth, ZigBee, Z wave.		
Unit IV	**I/O Device Interfacing**	**9 Hours**
C Programming, Interfacing Simple I/O Devices Like LED, Seven Segment, LCD, Switches, Motor (DC, Stepper, Servo), Relays and Sensors. Introduction to IOT		
Unit V	**Embedded controllers Application**	**9 Hours**
Home automation, Wireless sensor monitoring, Environmental monitoring, Gas leakage detection, Elevator design, Alarm clock using timers, Washing machine, Auto focusing Digital camera and Wearable devices		
	Total:	**45Hours**
Further Reading:		
	1. Arduino Machine learning using raspberry pi	
Course Outcomes:		
	After completion of the course, Student will be able to	
	1. Outline the properties of embedded system.	
	2. Point out the functionality ofARM processor	
	3. Make use of the communication protocols in application specific purposes	
	4. Interface I/O device peripherals with microcontroller	
	5. Solve the real life problems using embedded systems	
References:		
1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", Second Edition, Tata McGraw-Hill Publications, 2008.		
2. Julio Sanchez Maria P.Canton, “Microcontroller Programming: The microchip PIC”, CRC Press, Taylor & Francis Group, 2007.		
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C Second Edition Muhammad Ali Mazidi Janice GillispieMazidiRolin D. McKinlay		
4. Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", Newnes Publication, 2006		

1903EC007		**AUTOMOTIVE ELECTRONICS**	**L**	**T**	**P**	**C**
		(Open elective)	**3**	**0**	**0**	**3**
Course Objectives:						
	1. To describe on Automotive Sensors, Actuators and Instrumentations 2. To articulate functions of various systems in automobiles.					
Unit I	**VEHICLE SYSTEMS**					**9 Hours**
Power Train System (Air System, Fuel System (Carburettor& Diesel Fuel Injection), Ignition System, Exhaust System and other Auxiliary Systems (Cooling, Lubrications & Electrical Systems)),						
Unit II	**VEHICLE AUXILLARY SYSTEMS**					**9 Hours**
Transmission System (Front, Rear &4 wheels Drive, Manual, Automatic Transmission, Differential). Braking System (Drum, Disc, Hydraulic, Pneumatic), Steering System (Rack and Pinion, Power Steering).						
Unit III	**ELECTRONIC CONTROL**					**9 Hours**

Digital Engine Control, EGR Control, Electronic Ignition Control, Integrated Engine Control System, Anti-locking Braking System, Electronic Suspension System, Electronic Steering Control.		
Unit IV	**SENSORS AND INDICATORS**	**9 Hours**
Computer Based Instrumentation, Display Devices, Flat Panel Display, Fuel Quantity Measurement, Coolant Temperature Measurement, Oil Pressure Measurement, Speed Measurement,		
Unit V	**COMMUNICATION AND NAVIGATION**	**9 Hours**
High-Speed Digital Communication (CAN BUS), Telematics, GPS Navigation, GPS System Structure, Automotive Diagnostics.		
	Total:	**45 Hours**

Further Reading:	E-Vehicles, Hybrid trains.
Course Outcomes:	
	After completion of the course, Student will be able to
	1. Describe various vehicle systems in an automobile
	2. Illustrate different types of auxiliary system in an automobile
	3. Outline the various electronic control systems
	4. Demonstrate various sensor and measurement techniques
	5. Examine various communication and navigation techniques

References:

1. Joerg Schaeuffele, Thomas Zurawka, ―Automotive Software Engineering Principles, Processes, Methods and Tools‖, SAE International, 2005.
2. BOSCH Automotive Handbook, 6th Edition, 2014.
3. William B. Ribbens, "Understanding Automotive Electronics- An Engineering Prespective",7th Edition, Butterworth-Heinemann Publications, 2012.
4. Young A.P. & Griffiths, "Automotive Electrical Equipment" , ELBS & New Press,1999.
5. Tom Weather Jr. & Cland c. Ilunter, "Automotive computers and control system", Prentice Hall Inc., New Jersey.
6. Crouse W.H., "Automobile Electrical Equipment" , Mc Graw Hill Co. Inc., New York ,1995.
5. Bechhold, " Understanding Automotive Electronic", SAE,1998

1903EC026		**MOBILE COMMUNICATION**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

4. To impart the fundamentals concepts of wireless communication systems.
5. To introduce various technologies and protocols involved in wireless cellular communication.
6. To understand the concepts of signalling schemes for fading channels and analyze its channel capacity.

Unit I	**INTRODUCTION TO WIRELESS MOBILE COMMUNICATION**	**9 Hours**
History and evolution of mobile radio systems, Types of mobile wireless services/systems – Cellular, WLL, Paging, Satellite systems, Standard, Future trends in personal wireless systems		
Unit II	**CELLULAR MOBILE WIRELESS SYSTEMS**	**9 Hours**
Cellular Systems: Structure - Cell Cluster - Frequency reuse - Channel Interference - Cell splitting and sectoring - Channel Assignment schemes: Fixed, Dynamic and Hybrid - Network Architecture - Mobility Management - Location Management - Resource Management: Microcell Concept.		
Unit III	**WIDEBAND SYSTEMS**	**9 Hours**
GSM Network Architecture - GPRS: Network Architecture, Signaling, Mobility management, Location Management, Roaming. CDMA: IS95 systems, Forward link, Reverse Link, PN sequence related to CDMA - UMTS: Network Architecture and Interface		
Unit IV	**WORKING PRINCIPLE OF CELL PHONE**	**9 Hours**
Basics of cell phones, How cell phone work, Cell phone network, Cell phone call travel, Setting up a call process, making a call, receiving a call, Invention of mobile.		
Unit V	**MOBILE TECHNOLOGY**	**9 Hours**

GSM.3G, 4G (LTE), NFC systems, WLAN technology. WLL. Hyper LAN. Ad hoc networks. Bluetooth.						
					Total:	**45 Hours**
Further Reading:						
	1. 5G Communication					
	2. FSOC					
Course Outcomes:						
	After completion of the course, Student will be able to					
	6. Describe the concept of cellular and wireless mobile communication.					
	7. Design Base Station (BS) parameters and analyze the antenna configurations.					
	8. Explain the various concept of Wideband systems.					
	9. Summarize the working principles of cell phone					
	10. Assess the latest wireless technologies.					
References:						
1. Cory Beard and William Stallings, "Wireless Communication Networks and Systems" Pearson, 2015.						
2. A.F.Molisch, Wireless Communications, Wiley, 2005.						
3. T.S.Rappaport, Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.						
4. ITI Saha Misra, "Wireless Communication and Networks : 3G and beyond", McGraw Hil Education Pvt Ltd., Second edition, 2013.						
5. K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies" Wiley, 2012.						
6. P.MuthuChidambaraNathan, Wireless Communications, PHI, 2008						
7. A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.						

1903EC004		**DISPLAY SYSTEMS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Course Objectives:						
	1. To expose the students to the basics of the display systems and to illustrate the current design practices of the display systems.					
Unit I	**Introduction to Display systems**					**9 Hours**
Introduction to displays. Requirements of displays. Display technologies, CRT, Flat panel and advanced display technologies. Technical issues in displays.						
Unit II	**Head Mounted Display**					**9 Hours**
Head mounted displays. Displays less than and greater than 0.5 m diagonal. Low power and light emitting displays.						
Unit III	**Working Operation of Display**					**9 Hours**
Operation of TFTs and MIMS. LCDs, Brightness. Types of LCD displays.						
Unit IV	**Types of Display**					**9 Hours**
Emissive displays, ACTFEL, Plasma display and Field emission displays, operating principle and performance.						
Unit V	**Applications of Display**					**9 Hours**
Types of Displays: 3D, HDTV, LED, Touch screen.						
					Total:	**45 Hours**
Further Reading:						
	1. 5G Communication					
	2. FSOC					
Course Outcomes:						
	After completion of the course, Student will be able to					
	1. appreciate the technical requirement of different types of displays systems					
	2. analyze the various low power lighting systems					
	3. understand the operation of TFTs and LCD displays.					
	4. analyze the various kinds of emissive displays					
	5. critically evaluate the recent advancements in the displays device technology.					
References:						

1. L.W. Mackonald & A.C. Lowe, Display Systems, Design and Applications, Wiley, 2003.
2. E.H. Stupp &M. S. Brennesholtz, Projection Displays, Wiley,1999
3. Peter A. Keller, Electronic Display Measurement: Concepts, Techniques, and Instrumentation, Wiley-Inter science, 1997.
4. Recent literature in Display Systems.

1903EC027		**ANALOG AND DIGTIAL COMMUNICATION**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:	
	1. To introduce the concepts of variousmodulations and their spectral characteristics.
	2. To learn Pulse modulation techniques.
	3. To understand the various Band pass signaling schemes and spread spectrum techniques.

Unit I	**AMPLITUDE MODULATION**	**9 Hours**
Introduction to communication systems – Modulation – Need for modulation – Classifications of modulation techniques – Amplitude Modulation – Generation and Detection of AM – Transmitters and Receivers of AM –Super heterodyne receiver – Double Side Band Suppressed Carrier (DSBSC) systems - generation and detection – Single Side Band (SSB) systems – SSB-SC generation and detection, Vestigial Side Band (VSB) – Comparison of various AM systems.		
Unit II	**ANGLE MODULATION**	**9 Hours**
Frequency modulation: Narrowband and wideband FM – Generation of FM signal: Direct FM, indirect FM – Demodulation of FM signals using detectors – FM transmitters – FM receivers – Phase Modulation – Phase Locked Loop – Comparison of AM,FM and PM.		
Unit III	**PULSE MODULATION TECHNIQUES**	**9 Hours**
PAM – PWM – PPM – Comparison of Pulse modulation – Sampling of Band limited signals – Anti aliasing and reconstruction filters - Quantization – Companding - Pulse Code Modulation – Differential pulse code modulation - Delta modulation – Adaptive Delta modulation – Intersymbol Interference – Eye pattern		
Unit IV	**PASSBAND DATA TRANSMISSION TECHNIQUES**	**9 Hours**
Generation, Detection, Representation of signal, Signal constellation diagram, Error probability and Power spectrum of ASK, FSK, BPSK, DPSK, QPSK, MSK, GMSK and QAM coherent schemes – Comparison and BER Analysis.		
Unit V	**SYNCHRONIZATION AND SPREAD SPECTRUM TECHNIQUES**	**9 Hours**
Importance of Synchronization – Carrier, frame and symbol/Chip synchronization techniques, Spread Spectrum- PN Sequence code and properties – Direct Sequence and Frequency Hopping Spread Spectrum Systems –Processing gain and Jamming Margin – Multiple access techniques TDMA – FDMA – CDMA		
	Total:	**45 Hours**

Further Reading:	
	3. Design of AM and FM radio, Television Receivers.
	4. Mobile radio propagation.

Course Outcomes:	
	After completion of the course, Student will be able to
	1. Examine the spectrum and methods of generation and detection of AM systems and its types.
	2. Develop the mathematical model for time domain representation, spectrum and methods of generation and detection of angle modulation systems.
	3. Apply the concepts of sampling process and determine the characteristics of Pulse Modulation schemes.
	Analyze the performance of different digital modulation /demodulation techniques
	Apply the knowledge on the principle of spread spectrum and synchronization.

References:	

1. Simon Haykin, “Communication Systems” John Wiley & Sons , 4th Edition-2016.
2. J.G. Proakis, “Digital Communications” McGraw Hill, 5th edition -2007
3. B.P. Lathi, “Communication Systems” BS Publication-2004.
4. V.Chandrasekar, “Analog communication”, Oxford University press-2010
5. Bernard Sklar, “Digital Communication”,2nd Edition, Pearson Education, 2006.
6. Nptel link: https://nptel.ac.in/courses/117/105/117105143/
7. Nptel link : https://onlinecourses.nptel.ac.in/noc20_ee17/course

PROFESSIONAL ELECTIVES – III

1903EC011		**MICROELECTRONICS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

1. To be exposed of basics of semiconductor and applications.
2. To be familiar with advanced semiconductors and its applications.
3. To study the different types of amplifiers and its types.
4. To know about fabrication methodologies and circuit designing.

Unit I	**INTRODUCTION TO MICROELECTRONICS:**	**9 Hours**

Basic physics of semiconductor-diode models and circuits-physics of MOS transistor-MOS amplifiers – operational amplifiers- semiconductor theory- diodes –bipolar junction transistor(BJT)-BJT amplifiers-field effect transistor –FET amplifiers.

Unit II	**MOSFET AND IC AMPLIFIERS:**	**9 Hours**

Devices structure and physical operation-VI characteristics-biasing in MOS amplifier circuits-small signal operation and models-SPICE MOSFET-IC design philosophy-comparison of MOSFET and BJT-current sources –current mirrors-current steering circuits-high frequency response.

Unit III	**MULTI STAGE AMPLIFIER AND FEEDBACK:**	**9 Hours**

MOS differential pair –small signal operation of MOS differential pair-BJT differential pair-other non ideal characteristics and differential pair-differential amplifier with active words-multistage amplifiers-general feedback structure-four basic feedback topologies-series,shunt feedback-determining the loop gain- stability problems-effect of feedback in amplifiers poles-frequency compensation.

Unit IV	**MICROELECTRONICS FABRICATION:**	**9 Hours**

Clean room technology-silicon wafer production-thermal oxidation –lithography –advanced lithography – etching-diffusion process and ion implementation-thin film deposition –packaging –yields processing-CMOS & BIPOLAR process integration in practice-photo lithography-CVD epitaxy-plasma etching.

Unit V	**MICROELECTRONIC DEVICES AND CIRCUITS:**	**9 Hours**

Modelling-uniform semiconductor equilibrium-Uniform excitation of semiconductors- Nonuniform Situations:The Five basic equations-Non uniform Carrier Injection :Flow Problems –Non uniformly Doped Semiconductors-Junction Diodes-Bipolar Junction Transistors-The MOS capacitor-Field effect Transistors-Single Transistor Linear Amplifiers Stags-Differential Amplifiers Stages-High Frequency Analysis of Linear Amplifiers.

	Total:	**45 Hours**

Further Reading:

5. Commercial applications of Microelectronic circuits.
6. Finfet

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the theory, principle of semiconductors and its devices.
2. Learn the characteristics of advanced semiconductors and its applications
3. Discuss the working principle and characteristics of different types of amplifiers.
4. Explain the fabrication methodology of microelectronics components and devices
5. Explain the various characteristics of microelectronics devices and circuits

References:

1.Microelctronics by Claudio talarico,A.S.Sedra and K.C.Smith,microlctrcircuits,5/e,oxford university press.

2.Introduction to microelectronic fabrication by prof.glenn chapman.
3.Microelectronic devices and circuts 2006 electronic edition by clitonG.Fonsand.
4.Fundamentals of microelectronics, Behzadrazavi ,john wileyindia pvt,ltd,2008.
5.Microelectronics – analysis and design,sundaram Natarajan. Tata McGraw hill.2007

1903EC012		ROBOTICS	L	T	P	C
			3	0	0	3

Course Objectives:

4. To demonstrate the concepts behind robots
5. To interpret the electronics applications in robot for various purpose

Unit I	**INTRODUCTION**	**9 Hours**

Introduction – Definition and origin of robotics, Purpose of Robots, Artificial Intelligence, Robot Anatomy, Robot specifications, Robot characteristics – accuracy, precision, and repeatability, classification of robots, social issues of robotics.

Unit II	**ROBOTIC DRIVE SYSTEMS**	**9 Hours**

Robotic drive systems and actuators: Hydraulic, Pneumatic and Electric drives. Specification, principle of operation and areas of application of: Stepper motor, Servo motor and brushless DC motor, Microprocessor control of electric motors, speed control using PWM and direction control using H- Bridge

Unit III	**SENSORS**	**9 Hours**

Position and displacement sensors, Strain gauge based forcetorque sensors, Tachometers, Touch and Pressure, Piezoelectric material, Switches, Bend sensors, Pressure sensor, Smell, Humidity, Testing sensor.

Unit IV	**POWER AND NAVIGATION**	**9 Hours**

Photovoltaic Cells, Fuel Cells, Li ion Batteries
Vision,Voice communication, Route planning,Adaptive control ,Error monitoring and recovery,Autonomy and intelligence in robots, Automated Guided Vehicles

Unit V	**CASE STUDIES**	**9 Hours**

Pick and Place robot,Industrial applications of Robots in material handling and assemblySpeech-controlled mobile robot, Medical robots, Underwater bots, Aerobots , Drones And Robotic arm

Total:	**45 Hours**

Further Reading:

1. Humanoid robots
2. Kinematics, Inverse Kinematics, Jacobians

Course Outcomes:

After completion of the course, Student will be able to

4. Articulate the concepts behind robots
5. Outline the concepts of drive systems in robots
6. Summarize the sensors used in robots with its purpose
7. Examine various power sources for robot
8. Inspect various techniques related to navigation of robot.
9. Elaborate the applications of the robots

References:

8. Mikell and Groover, Industrial Robotics – Technology, Programming and Applications,McGraw Hill, 2/e, 2012
9. Saeed B. Niku Introduction to Robotics. Analysis and control, applications- Wiley student edition, 2010
10. Spong and Vidyasagar, Robot Dynamics and Control, John Wiley & Sons, 1990.
11. D J Todd "FUNDAMENTALS of ROBOT TECHNOLOGY" Springer Netherlands 1986
12. Ashitava Ghosal, Robotics, Fundamental concepts and analysis, OXFORD University Press, 2006

1903EC013		**NETWORK SECURITY**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:	
	6. To gain knowledge on the various attacks in a network
	7. To acquire knowledge on various encryption standards.
	8. To build the ability to develop security standard based on the requirement

Unit I	**INTRODUCTION**	**8 Hours**

Security Threats, Security Attacks, Security Services, Mechanisms- Model for Network Security- Classical Encryption Techniques- Substitutions-Transpositions Techniques- Stream Cipher, Block Cipher-Block Cipher Modes-ECB-CBC-CFB-OFB.

Unit II	**BLOCK CIPHERS AND THE DATA ENCRYPTION STANDARD**	**8 Hours**

Simple DES-Differential cryptanalysis- DES-Modes of operation-Triple DES-AES-RC4 –RSA.

Unit III	**HASH ALGORITHM, KEY MANAGEMENT**	**9 Hours**

Hash Function-Message Digest algorithm (MD 5)- Secure Hash Algorithm- Diffie-Hellman Key Exchange- Key Management Techniques- Key Distribution- Key Agreement - Elliptic Curve Cryptography - Digital Signatures- Authentication Protocols

Unit IV	**SECURITY PRACTICE & SYSTEM SECURITY**	**9 Hours**

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

Unit V	**E-MAIL, IP & WEB SECURITY**	**11 Hours**

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

	Total:	**45 Hours**

Further Reading:	
	7. Attacks- Primarily test- factoring, Discrete Logarithms
	8. Malicious software-viruses-Firewalls- Security Standards.

Course Outcomes:	
	After completion of the course, Student will be able to
	10. Identify vulnerability of computer networks to security threats.
	11. Acquire knowledge on existing security algorithms and cryptography standards.
	12. Understand various cryptography techniques and their implications on network security
	13. Analyze the type of security threat and the appropriate security standard to be adopted
	14. Formulate and implement new security standards

References:

13. William Stallings,"Cryptography and Network Security: Principles and Practice",Prentice Hall Professional Technical Reference, Fourth Edition. 2004
14. Alfred J. Menezes, Paul C.VanOorSchot, Scott A.Van Stone, "Handbook Of Applied Cryptography", CRC Press, 1996.
3. Atul Kahate "Cryptography and Network Security". Tata McGraw-Hill
Bruce Schneier,"Applied Cryptography: Protocols, Algorithms, and Source Code in C",Second Edition, Wiley, John & Sons, Incorporated, October 1995.
Richard E. Smith,"Internet Cryptography", Addison- Wesley, 1997

1903EC014		SOFT COMPUTING	L	T	P	C
			3	0	0	3

Course Objectives:

1. Tosummarize the concepts of genetic algorithm, neural networks
2. To employ fuzzy logic principles
3. To explain principles of python language

Unit I	NEURAL NETWORKS	9 Hours

Need of Softcomputing-Biological Neurons Networks – Artificial Neural Networks - Supervised - .unsupervised learning - Reinforcement Learning – Activation functions - Perceptron - Back Propagation networks – Radial Basis Function Networks - Adaptive Resonance architectures-TDNN -Convolution Neural Network-

Unit II	FUZZY LOGIC	9 Hours

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions -Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

Unit III	GENETIC ALGORITHM	9 Hours

Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimizations

Unit IV	INTRODUCTION TO PYTHON	9 Hours

Why Python? – Advantages of Python – Environment setting-Function Declaration - Import - Objects - Indenting as Requirement - Exceptions - Unbound Variables - Case Sensitive – Scripts- Native Data Types - Booleans - Numbers - Lists -Arrays-Tuples - Sets - Dictionaries - Comprehensions

Unit V	PROGRAMMING CONCEPTS IN PYTHON	9 Hours

Conditions-Loops (While, Do while, For)-Module -Scope-Exception Handling- Files I/O- List of Functions - Packages - Classes – Inheritance-Polymorphism- Encapsulation- Common Gateway Interface

Total:	45 Hours

Further Reading:

Machine learning

Course Outcomes:

After completion of the course, Student will be able to

6. Design of various neural networks based on application
7. Use fuzzy logic based on application
8. Examine various types of genetic algorithms
9. Describe the concepts of Python
10. Discuss various concepts OOPS in Python

References:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI / Pearson Education 2004.
2. Mark Pilgrim, ―Dive into Python 3‖, Apress, 2009.
3. S.Rajasekaran and G.A.VijayalakshmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
4. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013.
5. George J. Klir, Ute St. Clair, Bo Yuan, “Fuzzy Set Theory: Foundations and Applications” Prentice Hall, 1997.

E-References:

1. https://docs.python.org
2. Programming for Everybody (Getting Started with Python) Coursera By University of Michegan

1903EC015		ADVANCED DIGITAL SIGNAL PROCESSING	L	T	P	C
			2	2	0	3

Course Objectives:

1. To explore the concepts of multi rate signal processing and multi rate filters.
2. To study the adaptive filters and its applications.
3. To know about Linear and Prediction concepts.

	4. To learn fundamental concepts on signal processing in power spectrum estimation.	
Unit I	**Multirate Digital signal Processing**	**9 Hours**
Introduction-Sampling and Signal Reconstruction-Sampling rate conversion – Decimation by an integer factor – interpolation by an integer factor –Sampling rate conversion by a rational factor – poly-phase FIR structures – FIR structures with time varying coefficients - Sampling rate conversion by a rational factor- Multistage design of decimator and interpolator.		
Unit II	**Multirate FIR Filter Design**	**9 Hours**
Design of FIR filters for sampling rate conversion –Applications of Interpolation and decimation in signal processing –Filter bank implementation –Two channel filter banks-QMF filter banks –Perfect Reconstruction Filter banks – tree structured filter banks - DFT filter Banks – M-channel filter banks-octave filter banks		
Unit III	**Linear Estimation and Prediction**	**9 Hours**
Linear prediction- Forward and backward predictions, Solutions of the Normal equations- Levinson-Durbin algorithms. Least mean squared error criterion -Wiener filter for filtering and prediction, FIR Wiener filter and Wiener IIR filters, Discrete Kalman filter.		
Unit IV	**Design of Adaptive filters**	**9 Hours**
FIR Adaptive filters - Newton's steepest descent method – Adaptive filters based on steepest descent method - LMS Adaptive algorithm – other LMS based adaptive filters- RLS, Exponentially weighted RLS - Sliding window RLS – Simplified IIR Application: channel equalization, noise cancellation, prediction.		
Unit V	**Power Spectral Estimation**	**9 Hours**
Estimation of spectra from finite duration observations of a signal –The Periodogram-Use of DFT in Power spectral Estimation –Non-Parametric methods for Power spectrum Estimation – Bartlett. Welch and Blackman–Tukey methods –Comparison of performance of Non – Parametric power spectrum Estimation methods – Parametric Methods - Relationship between auto correlation and model parameters, Yule-Walker equations, solutions using Durbin's algorithm,AR, MA, ARMA model based spectral estimation.		
	Total:	**30 + 15 Hours**
Further Reading:		
	Applications of adaptive filters: Adaptive channel equalization Adaptive echo canceller - Adaptive noise cancellation-, 1/M-octave-band filter banks, Speech enhancement using spectrum estimation	
Course Outcomes:		
	After completion of the course, Student will be able to	
	1. Design and implement decimator and interpolator and to design multi rate filter bank and acquires knowledge of how a multi rate system work	
	2. Understand different spectral estimation techniques and linear prediction	
	3. Explain about LMS and RLS adaptive filters for signal enhancement, channel equation	
	4. Illustrate different Power spectrum methods and solutions	
References:		
1. H. Monson Hayes, **Statistical Digital Signal Processing and Modeling**, John Wiley and Sons, Inc., 2008.		
2. G.. John Proakis and G. Dimitris Manolakis, **Digital Signal Processing**, Pearson Education, 2006.		
3. P.P.Vaidyanathan, **Multirate Systems and Filter Banks**, Pearson Education, 2008.		
4. N.J.Filege, **Multirate Digital Signal Processing**, John Wiley and Sons, 2000.		
5. G. JohnProakis, **Algorithms for Statistical Signal Processing**, Pearson Education, 2002.		
6. G.Dimitris and G.Manolakis, **Statistical and Adaptive Signal Processing**, McGraw Hill, 2002.		
7. Sophoncles J. Orfanidis, **Optimum Signal Processing**, McGraw Hill, 2007.		

E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade |Accredited by NBA (CIVIL, CSE, ECE, EEE, IT, MECH)

NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Third Year – Eighth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks			Category
						CA	ES	Total	
Theory Course									
1901MGX01	Universal Human Values and Ethics	3	0	0	3	40	60	100	HSSC
	Professional Elective – IV	3	0	0	3	40	60	100	PEC
	Professional Elective – V	3	0	0	3	40	60	100	PEC
Laboratory Course									
1904EC851	Project Work	0	0	14	7	50	50	100	
Total		**9**	**0**	**14**	**16**	**170**	**230**	**400**	

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
PROFESSIONAL ELECTIVES – IV								
1903EC016	Machine Learning and Pattern recognition	3	0	0	3	40	60	100
1903EC017	Embedded System	3	0	0	3	40	60	100
1903EC018	Multimedia Communication	3	0	0	3	40	60	100
1903EC019	Wireless Communication	3	0	0	3	40	60	100
1903EC020	High Speed Switching Networks	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVES – V								
1903EC021	Nano Electronics	3	0	0	3	40	60	100

1903EC022	Opto Electronic Devices	3	0	0	3	40	60	100
1903EC023	Speech Processing	3	0	0	3	40	60	100
1903EC024	Microwave Integrated Circuits	3	0	0	3	40	60	100
1903EC025	Satellite Communication	3	0	0	3	40	60	100

1901MGX01		**Universal Human Values and Ethics**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
		(Common to B.E / B.Tech – CSE, IT & ECE)				

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Module I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**9 Hours**

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Module II	**Understanding Harmony in the Human Being - Harmony in Myself**	**9 Hours**

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensure Sanyam and Swasthya

Module III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**	**9 Hours**

13. Understanding harmony in the Family- the basic unit of human interaction
14. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;

Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship

15. Understanding the meaning of *Vishwas*; Difference between intention and competence
16. Understanding the meaning of *Samman*, Difference between respect and differentiation; the

other salient values in relationship

17. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitva* as comprehensive Human Goals

18. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha*)- from family to world family!

Module IV	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence**	**9 Hours**

19. Understanding the harmony in the Nature

20. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature

21. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space

22. Holistic perception of harmony at all levels of existence

Module V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**9 Hours**

23. Natural acceptance of human values

24. Definitiveness of Ethical Human Conduct

25. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

26. Competence in Professional Ethics:

a) Ability to utilize the professional competence for augmenting universal human order,

b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models

27. Case studies of typical holistic technologies, management models and production systems

28. Strategy for transition from the present state to Universal Human Order:

a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b) At the level of society: as mutually enriching institutions and organizations

	Total:	**45 Hours**

Further Reading:

Professional Ethics & Business Ethics

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the value of harmonious relationship based on trust and respect in their life and profession
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

References:

Text Book:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Reference Book:

1.Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA

2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5.A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
10.M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11.B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12.B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

LABORATORY COURSE

1904EC851		PROJECT WORK	L	T	P	C
			0	0	14	7

Course Objectives:	The students should be made to:
	1. To develop self-learning skills of utilizing various technical resources to design a product.
	2. To test technical presentation and communication skills.

The students (with team size no more than 4 students in a team) are expected to make a project on topics (Preferably in recent trends) related to Electronics and Communication Engineering. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Students are encouraged to use various teaching aids such as power point presentation and demonstrative models which should be presented to panel which consist no less than five faculties (excluding course co coordinator). The average of the mark given by all panel members is taken into consideration. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Evaluation Scheme: Continuous Assessment (100)

Distribution of marks for Continuous Assessment:

ZEROTH REVIEW :	10 marks
FIRST REVIEW:	20 marks
SECOND REVIEW:	20 marks
FINAL REVIEW/DEMO:	30 marks
REPORT:	20 marks

Total Marks:		**100**	
		Total:	**210 Hours**
Course Outcomes:			
	After completion of the course, Student will be able to		
	1. Inspect technology for designed product in Electronics and communication engineering field.		
	2. Improve the technical presentation and communication skills.		
	3. Connect different domains to make intelligent system.		
	4. Maximize their technical knowledge with discussing others.		
	5. Develop solution for mathematical models with respect to Electronics and Communication engineering field.		

PROFESSIONAL ELECTIVES – IV

1903EC016		**MACHINE LEARNING AND PATTERN RECOGNITION**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
		(Common to B.E / B.Tech – CSE, IT & ECE)				
Course Objectives:						
	1. Provide knowledge of models, methods and tools used to solve regression, classification, feature selection and density estimation problems					
	2. Provide knowledge of learning and adaptation in supervised modes of learning					
	3. Provide knowledge of recognition, decision making and statistical learning problems.					
	4. Provide knowledge of current research topics and issues in Pattern Recognition and Machine Learning					
	5. Provide knowledge about linear functions					

Unit I	**BASICS OF PROBABILITY, RANDOM PROCESSES AND LINEAR ALGEBRA**	**9 Hours**

Probability: independence of events- conditional and joint probability-Bayes theorem Random Processes: Stationary and non-stationary processes- Expectation- Autocorrelation, Cross-Correlation-spectra.

Unit II	**BAYES DECISION THEORY**	**9 Hours**

Minimum-error-rate classification. Classifiers-Discriminant functions-Decision surfaces. Normal density and discriminant functions-Discrete features.

Unit III	**PARAMETER ESTIMATION METHODS**	**9 Hours**

Maximum-Likelihood estimation :Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering- Algorithms for clustering: K-Means- Hierarchical and other methods-Cluster validation- Gaussian mixture models- Expectation-Maximization method for parameter estimation- Maximum entropy estimation- Sequential Pattern Recognition- Hidden Markov Models (HMMs)-Discrete HMM- Continuous HMMs-Nonparametric techniques for density estimation- Parzen-window method- K-Nearest Neighbour method.

Unit IV	**DIMENSIONALITY REDUCTION**	**9 Hours**

Principal component analysis - it relationship to eigen analysis- Fisher discriminant analysis - Generalised eigen analysis- Eigen vectors/Singular vectors as dictionaries. Factor Analysis- Total variability space - a dictionary learning methods-Non negative matrix factorisation - a dictionary learning method.		
Unit V	**LINEAR ALGEBRA AND LINEAR DISCRIMINANT FUNCTIONS**	**12 Hours**
Inner product-outer product, inverses- eigen values-eigen vectors-singular values-singular vectors-Gradient descent procedures-Perceptron-Support vector machines - a brief introduction.		
	Total:	**45 + 15 Hours**
Further Reading:		
	Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop	
	The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition…	
Course Outcomes:		
	After completion of the course, Student will be able to	
	1:Identify areas where Pattern Recognition and Machine Learning can offer a solution	
	2: Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems	
	3: Describe genetic algorithms, validation methods and sampling techniques	
	4 :l Describe some discriminative, generative and kernel based techniques	
	5 :Describe and model sequential data	
References:		
R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001 1.		
S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009 2.		
C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006 3.		

1903EC017		**EMBEDDED SYSTEMS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Course Objectives:						
	1. Discuss the concepts of basic embedded systems					
	2. Describe the ARM architecture and Embedded communication protocols					
	3. To use the embedded controllers In real time applications					
Unit I	**Introduction**					**9 Hours**
Introduction to Embedded System, Embedded System Architecture, Embedded hardware, Embedded software, Classifications of Embedded Systems and Characteristics, Challenges and Design issues in Embedded systems, Embedded System on-chip. .						
Unit II	**ARM Processor**					**9 Hours**
ARM processor naming, Types. CISC vs. RISC, Von-Neumann vs. Harvard architecture, ARM M3 features, Architecture, pipeline, Mode of operation, Instruction set, Exception handling						
Unit III	**Embedded Communication Protocols**					**9 Hours**

Communication protocols – USART, I2C, CAN, SPI. Wireless communication protocols: Bluetooth, ZigBee, Z wave.		
Unit IV	**I/O Device Interfacing**	**9 Hours**
C Programming, Interfacing Simple I/O Devices Like LED, Seven Segment, LCD, Switches, Motor (DC, Stepper, Servo), Relays and Sensors. Introduction to IOT		
Unit V	**Embedded controllers Application**	**9 Hours**
Home automation, Wireless sensor monitoring, Environmental monitoring, Gas leakage detection, Elevator design, Alarm clock using timers, Washing machine, Auto focusing Digital camera and Wearable devices		
	Total:	**45Hours**
Further Reading:		
	1. Arduino Machine learning using raspberry pi	
Course Outcomes:		
	After completion of the course, Student will be able to	
	1. Outline the properties of embedded system.	
	2. Point out the functionality of ARM processor	
	3. Make use of the communication protocols in application specific purposes	
	4. Interface I/O device peripherals with microcontroller	
	5. Solve the real life problems using embedded systems	
References:		
1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", Second Edition, Tata McGraw-Hill Publications, 2008.		
2. Julio Sanchez Maria P.Canton, “Microcontroller Programming: The microchip PIC”, CRC Press, Taylor & Francis Group, 2007.		
3. The 8051 Microcontroller and Embedded Systems Using Assembly and C Second Edition Muhammad Ali Mazidi Janice GillispieMazidiRolin D. McKinlay		
4. Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", Newnes Publication, 2006		

1903EC018		**MULTIMEDIA COMMUNICATIONS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Course Objectives:						
	1.To have a detailed knowledge of compression and decompression techniques					
	2.To introduce the concepts of multimedia communication					
	3. To introduce standards of MPEG					
Unit I	**Introduction to Multimedia Communications**					**5 Hours**
Components of multimedia system, Desirable features, Applications of multimedia systems, Introduction to different types, Multimedia storage device.						
Unit II	**Digital audio representation**					**9 Hours**
Digital audio representation and processing-time domain and transform domain representations. Coding standards, transmission and processing of digital audio. Musical instrument synthesizers.						
Unit III	**Image coding algorithms**					**12 Hours**
Still image coding-JPEG. Discrete cosine Transform. Sequential and Progressive DCT based encoding algorithms, lossless coding, hierarchical coding. Basic concepts of discrete wavelet transform coding and embedded image coding algorithms. Introduction to JPEG2000.						
Unit IV	**MPEG**					**9 Hours**
Feature of MPEG 1, structure of encoding and decoding process, MPEG 2 enhancements, and different blocks of MPEG video encoder.						
Unit V	**Video coding**					**10 Hours**
Content based video coding-overview of MPEG 4 video, motion estimation and compensation. Different coding techniques and verification models. Block diagram of MPEG 4 video encoder and decoder. An overview of H261 and H263 video coding techniques						

		Total:	**45**
Further Reading:			
	1. Advanced compression techniques		
	2. Coding Techniques		
Course Outcomes:			
	After completion of the course, Student will be able to		
	1. Describe various multimedia components		
	2. Describe compression and decompression techniques		
	3. Apply the compression concepts in multimedia communication		
	4. Describe the video encoding		
	5. To know the digital audio representation		
References:			
1. Fred Halsall, "**Multimedia Communications**", Pearson education, 2001			
2. J.S. Chitode, **"Information coding techniques"**, Technical publications, 1st edition 2007.			
3. Raif steinmetz, Klara Nahrstedt, "**Multimedia: Computing, Communications and Applications**", Pearson education, 2002			
4. John Billamil, Louis Molina, "**Multimedia : An Introduction**", PHI, 2002			

1903EC019		**WIRELESS COMMUNICATION**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Course Objectives:						
	1. To impart the fundamentals concepts of wireless communication systems.					
	2. To introduce various technologies and protocols involved in wireless cellular communication.					
	3. To understand the concepts of signalling schemes for fading channels and analyze its channel capacity.					
Unit I	**PROPAGATION AND MULTIPLE ACCESS TECHNIQUES**					**9 Hours**
Fading - Multipath propagation mechanisms - Propagation Models: Free space model, Two ray ground reflection model, Macro cell and Micro cell propagation models. Multiple Access Techniques: FDMA, CDMA, TDMA, SDMA.						
Unit II	**CELLULAR MOBILE WIRELESS SYSTEMS**					**9 Hours**
Cellular Systems: Structure - Cell Cluster - Frequency reuse - Channel Interference - Cell splitting and sectoring - Channel Assignment schemes: Fixed, Dynamic and Hybrid - Network Architecture - Mobility Management - Location Management - Resource Management: Microcell Concept.						
Unit III	**WIDEBAND SYSTEMS**					**9 Hours**
GSM Network Architecture - GPRS: Network Architecture, Signaling, Mobility management, Location Management, Roaming. CDMA: IS95 systems, Forward link, Reverse Link, PN sequence related to CDMA - UMTS: Network Architecture and Interface.						
Unit IV	**EQUALIZATION AND DIVERSITY TECHNIQUES**					**9 Hours**
Fundamentals of equalization - Equalizers in communication receivers: Linear equalization, Non-linear equalization: DFE, MLSE Equalizer, Adaptive Equalizer. Diversity Techniques: Time diversity, Antenna diversity, Frequency diversity: Single carrier with ISI, DSSS, OFDM.						
Unit V	**MOBILE TECHNOLOGY**					**9 Hours**
GSM.3G, 4G (LTE), NFC systems, WLAN technology. WLL. Hyper LAN. Ad hoc networks. Bluetooth.						
		Total:				**45 Hours**
Further Reading:						
	3. 5G Communication					
	4. FSOC					
Course Outcomes:						
	After completion of the course, Student will be able to					
	1. Describe the cellular concept and analyze capacity improvement Techniques.					
	2. Design Base Station (BS) parameters and analyze the antenna configurations.					
	3. Explain the various concept of Wideband systems.					
	4. Summarize diversity reception techniques					
	5. Assess the latest wireless technologies.					

References:
1. Cory Beard and William Stallings, "Wireless Communication Networks and Systems" Pearson, 2015.
2. A.F.Molisch, Wireless Communications, Wiley, 2005.
3. T.S.Rappaport, Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
4. ITI Saha Misra, "Wireless Communication and Networks : 3G and beyond", McGraw Hil Education Pvt Ltd., Second edition, 2013.
5. K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies" Wiley, 2012.
6. P.MuthuChidambaraNathan, Wireless Communications, PHI, 2008
7. A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.

1903EC020	**HIGH SPEED SWITCHING NETWORKS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:	
	1. To tell important concepts of multimedia networking.
	2. To study the types of VPN and tunneling protocols for security.
	3. To learn about network security in many layers and network management.

Unit I	**INTRODUCTION**	**9 Hours**
Review of OSI,TCP/IP; Multiplexing, Modes of Communication, Switching, Routing .SONET– DWDM–DSL–ISDN–BISDN,ATM.		
Unit II	**MULTIMEDIA NETWORKING APPLICATIONS**	**9 Hours**
Streaming stored Audio and Video–Best effort service–protocols for real time interactive applications–Beyond best effort–scheduling and policing mechanism –integrated services– RSVP-differentiated services.		
Unit III	**ADVANCED NETWORKS CONCEPTS**	**9 Hours**
VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.		
Unit IV	**TRAFFIC MODELLING**	**9 Hours**
Little's theorem, Need for modeling, Poisson modeling and its failure, Non-poisson models, Network performance evaluation.		
Unit V	**NETWORK SECURITYAND MANAGEMENT**	**9 Hours**
Principles of cryptography –Authentication–integrity–key distribution and certification–Access control and: firewalls–attacks and counter measures–security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration–ASN.1		
	Total:	**45 Hours**

Further Reading:
IP Switching ,Ipv6,Ipv6 over ATM

Course Outcomes:	
	After completion of the course, Student will be able to
	1. know basics of Networks
	2. Understand applications of multimedia networking
	3. Examine advanced networking techniques
	4. illustrate Traffic modelling concepts
	5. know security basics and its management

References:
1. J.F. Kurose &K.W. Ross," Computer Networking- A top down approach featuring the internet", Pearson 2nd edition, 2003.
2. Walrand.J. Varatya ,High performance communication network, Morgan Kauffman– Harcourt AsiaPvt.Ltd.2nd Edition,2000.3.
3. LEOM-GarCIA,WIDJAJA,"Communication networks", TMH seventh reprint2002.

4. Aunurag kumar,D.MAnjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers,1ed2004.5.
5. Hersent Gurle& petit, "IP Telephony ,packet Pored Multimedia communication Systems", Pearsoneducation2003.6.
6. Fred Halsall and Lingana Gouda Kulkarni," Computer Networking and the Internet"fifthedition,Pearson education7
7. Nader F.Mir, Computer and Communication Networks, firstedition.8.
8. Larryl .Peterson & Bruce S.David, "Computer Networks: A System Approach"-1996

PROFESSIONAL ELECTIVES – V

1903EC021		NANOELECTRONICS	L	T	P	C
			3	0	0	3

Course Objectives:

1. To be exposed of basic electronics and quantum electronics.
2. To be familiar with basic Nanoelectronics devices and Plasmonics.
3. To learn about optoelectronics and Spintronics.
4. To know various architecture methodologies

Unit I	**INTRODUCTION TO ELECTRONICS AND QUANTUM DEVICES:**	**9 Hours**

Classification Of Solids-Energy Level-Intrinsic and Extrinsic Semiconductor-Conduction In Metal And Semiconductor-Semiconductor Diodes-Basic Principle Of Led-Charge And Spin In Single Quantum Dots-Coulomb Blockade-Electrons In Mesoscopic Structures-Single Electron Transfer Devices (Sets)-Electron Spin Transistor –resonant tunnel diodes ,tunnel FETs-quantum interference transistors devices(QUITs)-quantum dot cellular automata(QCAs)-quantum bits(qubits).

Unit II	**NANOELECTRONICS DEVICES AND PLASMONICS:**	**9 Hours**

Electronic transport in 1,2 and 3 dimensions-quantum confinement –energy sub bands –effective mass-diode conduction-mean free path in 3D-ballistic conduction –phase coherence length –quantized conductance-buttiker-landauer formula-electron transport in pn junctions-short channel nano transistor - single photon transistor using surface plasmon-nanowire surface plasmons-interaction with matter-channel plasmon-polarising guiding by sub wavelength metal groves-surface plasmon polarizations and localized surface plasmon.

Unit III	**OPTOELECTRONIC CRYSTAL ANS ITS FABRICATION:**	**9 Hours**

Linear optonic crystal –maxwells equations bloch's theorem transmission spectra –non linear optics in linear optonic crystals slab –nonlinear optonic crystal and its application-fabrication of optonic crystals structures(1D,2D&3D)-applications;1D crystals -coupler waveguide-high-Q cavities –optonic crystal fiber-4 tunable optonic crystal filters.

Unit IV	**SPINTRONICS:**	**9 Hours**

Spin tunnelling devices-magnetic tunnel junction –tunnelling spin polarization –giant tunnelling using MgO tunnel barriers-tunnel-based spin injectors-spin injections and spin transport in hybrid nanostructures –spin filters -spin diodes –magnetic tunnel transistor-spin relaxation and spin dephasing-memory devices and sensors-ferroelectric random access memory-MRAMS-field sensors –multferro electric sensors-spintronic biosensors

Unit V	**NANOELETRONIC ARCHITECTURES AND COMPUTATIONS**	**9 Hours**

Architecture principles-mono and multi processor systems-parallel data processing –power dissipation and parallelism –classic systolic arrays –molecular devices-properties –self-organization –size dependent limitations,computation:montecarlo simulations –computational methods and simulations from ab initio multiscale modelling –modelling of nanodevices

Total:	**45 Hours**

Further Reading:

5. Quantum Dots for fiber optic communication
6. Quantum cellular automata

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the theory, principle of basic electronics and quantum electronics.
2. Explain the characteristics of Nanoelectronics and Plasmonic devices.
3. Summarize the various type's Optoelectronic crystals and its working principle.

	4. Explain the characteristics, theory and construction of Spintronics devices.
	5. Design an architecture Nanoelectronics system design
References:	
1.	W.Rainer,Nano electronics and information technology,wiley,.
2.	K.E.Drexlex,Nanosystems,Wiley,(2014).revised edition
3.	M.C.Gupta,J.Balloto the Handbook of photonics.
4.	Nanotechnology for microelectronics and optoelectronics,J.M.Martinez-Durat,RaulJ.Martin-palma.
5.	V.Kochelp,M.stroscio,''Introduction to nano electronics,Cambridge university press(2013).
6.	RainerWaser,''Nano electronics and information technology ;advanced electronic material and novel devices'',Wiley-VCH(2010).

1903EC022		**OPTO ELECTRONICS DEVICES**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
Course Objectives:						
	1. To understand the elements of solid state physics					
	2. To study lighting emitting and detecting devices					
	3. To provide basic knowledge about optical modulators and various applications of optoelectronics					
UNIT I	**Elements of solid state physics**					**9 Hours**
Wave nature of light- Polarization interference- Diffraction- Light Source- Review of quantum mechanical concept - III-V and II-VI Semiconductor.- Electronic and optical properties of III-V and II-VI semiconductors (Energy bandgap and wavelength)						
UNIT II	**Principles of Light emitting devices**					**9 Hours**
Photo luminescence- Cathode luminescence- Electro luminescence- Injection luminescence- LEDS plasma display- Liquid crystal displays- Numeric displays laser emission- Absorption- Radiation- laser and its different classes – applications of laser in various fields.						
UNIT III	**Photodetectors**					**9 Hours**
Photodetectors -performance criteria of a photodectetor- expressions for quantum efficiency -responsivity, photoconductors and photodiodes-PIN diodes - heterojunction diodes and APDs - characteristics and device performance - high speed measurement photoresistors - CCDs, photomultiplier tube- noises in photodetectors, SNR - noise equivalent power.						
UNIT IV	**Optical Modulators**					**9 Hours**
Birefringence, uniaxial and biaxial crystals, index ellipsoid, electro-optic effect, electro optic retardation. Phase and amplitude modulators, transverse electro optic modulators and design considerations- high frequency modulation considerations, transit time limitations in lumped modulators, travelling wave modulators. Acousto-optic effect, Raman-Nath and Bragg regime, acousto-optic modulators, magneto optic effects, spatial light modulators.						
UNIT V	**Applications of optoelectronics**					**9 Hours**
Optical communication sources – Quantum dot laser - Quantum well laser – application of lighting devices in mechatronics and biomedical fields – laser in welding technology- case study: eye operation by laser methodologies.						
		Total:				**45 Hours**
Further Reading:	Integrated optics circuits					
Course Outcomes:						
	After completion of the course, Student will be able to					
	1. Explain the various elements of light emitting devices					
	2. Discuss different light emitting devices					
	3. Explain the working principle of photodetectors					
	4. Reveal the operation of optical modulators					
	5. Discuss the various application of optoelectronics.					
References:						
1. Wilson J and Hawkes J, ―Opto-electronics: An Introduction‖, 3rd Edition, PHI Learning, 2007						

2. Pallab Bhattacharya, ―Semiconductor Opto-electronic Devices‖, 3rd Edition, PHI Learning, New Delhi, 2010
3. http://nptel.ac.in/courses/115102026/

1903EC023		SPEECH PROCESSING	L	T	P	C
			3	0	0	3

Course Objectives:

1. To make the students to understand the digital Speech fundamentals.
2. To study the digital models and processing of speech signal
3. To acquire the basic knowledge in filters, voice enhancement, voice restoration and compression techniques.

Unit I	**DIGITAL MODELS FOR SPEECH SIGNAL**	**9 Hours**
Process and of speech production – Acoustic theory of speech production – Digital models		
Unit II	**TIME DOMAIN METHODS FOR SPEECH PROCESSING**	**9 Hours**
Time domain parameters of Speech – Methods for extracting the parameters – Zero crossings – Auto correlation – Pitch estimation		
Unit III	**FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING**	**9 Hours**
Short Time Fourier analysis – Filter bank analysis – Spectrographic analysis – Formant extraction – pitch extraction – Analysis & synthesis systems		
Unit IV	**LINEAR PREDICTIVE CODING OF SPEECH**	**9 Hours**
Formulation of LPC in time domain – Solution of LPC equations – Interpretation of LP in auto correlation and spectral domains.		
Unit V	**SPEECH ANALYSIS AND SYNTHESIS**	**9 Hours**
Cepstral analysis of speech – Pitch estimation – Speech recognition, Synthesis & Speaker verification		
	Total:	**45 Hours**

Further Reading:

Course Outcomes:

After completion of the course, Student will be able to

6. Identify nature of speech generation and modeling of speech production
7. Discuss digital models and processing of speech signal
8. Classify different methods for speech processing .
9. Apply mathematical tools to module speech
10. Outline various speech parameters with appropriate techniques

References:

5. L.R. Rabiner and R.E Schafer, - Digital processing of speech signals, Dorling Kindersley (India) Pvt. Ltd , 2011
6. L.R. Rabiner and Biling Hwang Juang,- Fundamentals of Speech recognition, Pearson Education,2003
7. J.L Flanagan, - Speech Analysis Synthesis and Perception - 2nd Edition , Springer Berlin Heidelberg, 2012
8. I.H. Witten, - Principles of Computer Speech, Academic press, 2010.
9. Thomas F. Quateri, -Discrete - Time Speech Processing – Principles and Practice, Pearson Education, 2004

1903EC024		**MICROWAVE INTEGRATED CIRCUITS**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:	
	1.To gain knowledge in the area of planar microwave engineering and to make them understand the intricacies in the design of microwave circuits.
	2.To learn about the state of art in MIC technology.

Unit I	**INTRODUCTION TO MICROWAVE CIRCUITS**	**9 Hours**
Definitions – Frequency Bands – Lumped versus Distributed Circuits - Behavior of finite length transmission lines – General Characteristics of PC Boards – Transmission Lines on PC Boards – Passives made from Transmission Lines – Resonators - Combiners, Splitters and Couplers		
Unit II	**MATCHING NETWORKS AND FILTER DESIGN**	**9 Hours**
Circuit Representation of two port RF/Microwave Networks: Low Frequency Parameters, High Frequency Parameters, Transmission Matrix, ZY Smith Chart, Design of Matching Circuits using Lumped Elements, Matching Network Design using Distributed Elements, Filter design.		
Unit III	**AMPLIFIERS AND OSCILLATORS**	**9 Hours**
Amplifiers: Stability considerations in active networks – Gain Consideration in Amplifiers – Noise Consideration in active networks – Broadband Amplifier design – Low Noise Amplifier Design, Oscillators: Oscillator versus Amplifier Design – Oscillation conditions – Design and stability considerations of Microwave Transistor Oscillators		
Unit IV	**MIXERS AND CONTROL CIRCUITS**	**9 Hours**
Mixer Types – Conversion Loss – SSB and DSB Mixers – Design of Mixers: Single Ended Mixers – Single Balanced Mixers - Sub Harmonic Diode Mixers ,Microwave Diodes , Phase Shifters – PIN Diode Attenuators		
Unit V	**MICROWAVE IC DESIGN AND MEASUREMENT TECHNIQUES**	**12 Hours**
Microwave Integrated Circuits – MIC Materials- Hybrid versus Monolithic MICs – Multichip Module Technology - Fabrication Techniques, Miniaturization techniques, Introduction to SOC, SOP, Test fixture measurements, probe station measurements, thermal and cryogenic measurements, Experimental field probing techniques.		
	Total:	**45 + 15 Hours**

Further Reading:	

Course Outcomes:	
	After completion of the course, Student will be able to
	1. Discuss about lumped elements, distributed elements and transmission line parameters in Electronic circuits.
	2. Illustrate the concept of Matching networks and filter design in Microwave Engineering.
	3. Describe about Oscillator and amplifier in Microwave integrated circuits.
	4. Interpret the concept of Mixer circuits in Microwave engineering.
	5. Identify the fabrication techniques of MMIC and HMIC in Microwave engineering.

References:

Thomas H.Lee, “Planar Microwave Engineering”, Cambridge University Press, 2004,

Matthew M. Radmanesh, “Radio Frequency and Microwave Electronics”, Pearson Education, II Edition, 2002.

“Microwave Transistor Amplifiers – Analysis and Design”, II Edition, Prentice Hall, New Jersy

Ravender Goyal, “Monolithic MIC; Technology & Design”, Artech House, 1989.

Gupta K.C. and Amarjit Singh, “ Microwave Integrated Circuits”, John Wiley, New York, 1975.

Ulrich L. Rohde and David P.N., " RF / Microwave Circuit Design for Wireless Applications", John Wiley, 2000.

1903EC025		SATELLITE COMMUNICATION	L	T	P	C
			3	0	0	3

Course Objectives:

1. To impart knowledge about the Satellite communication.
2. To enhance the students' knowledge in astronomy and space

Unit I **SATELLITE ORBITS** **9 Hours**

Introduction - Spectrum allocations for satellite systems -Kepler's Laws - orbital parameters - orbital perturbations - station keeping – Type of orbits - Geo stationary orbits – look angle determination- limits of visibility – eclipse -sub satellite point – sun transit outage - launching procedures - launch vehicles and propulsion.

Unit II **SPACE AND EARTH SEGMENT** **9 Hours**

Spacecraft technology- structure- power supply- attitude and orbit control - thermal control and propulsion - communication subsystems - telemetry, tracking and command - TranspondersAntenna subsystem, Equipment reliability. Earth station technology -Receive only home TV systems - MATV – CATV – Transmit Receive Earth Stations.

Unit III **SATELLITE ACCESS** **9 Hours**

Modulation and Multiplexing-Voice, Data, Video, Analog – digital transmission system-Digital video broadcast - multiple access: FDMA, TDMA, CDMA- assignment methods -spread spectrum communication

Unit IV **SATELLITE LINK DESIGN** **9 Hours**

Introduction- Equivalent isotropic radiated power -Transmission Losses – Link power budget equation - System Noise, Carrier to Noise ratio – uplink – downlink – effects of rain – combined uplink and downlink C/N ratio –inter modulation noise - Interference between satellite.

Unit V **SATELLITE APPLICATIONS** **9 Hours**

Satellite mobile services – VSAT- Radarsat- GSM, GPS,Direct Broadcast satellites (DBS) - Direct to home Broadcast (DTH) -Digital audio broadcast (DAB) – World space services, Business TV (BTV) – GRAMSAT - Specialized services: E mail, Video conferencing, Internet- INTELSAT Series- INSAT – INMARSAT.

Total: 45 Hours

Further Reading:

Latest trend in satellite communication, Recent launching satellites and its application, Communication between satellites, Comparison of satellite

Course Outcomes:

After completion of the course, Student will be able to

1.Describe the basics of orbit and launching methods in satellite communication

ummarize the elements in space segment and link budget calculations

xplain earth station technology and test equipments

nterpret the accessing technique used in satellite communication

5.Differentiate various broadcast services and DTH compression standards. utilizing satellite communication

References:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Bostan London, 1997.
4. Tri T. Ha, "Digital Satellite Communication", II nd edition, 1990.
5. Emanuel Fthenakis, "Manual of Satellite Communications", Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, "Telecommunication Trans Mission Systems", Mc Graw-Hill Book Co., 1983
7. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.

8. G.B.Bleazard, “Introducing Satellite communications“, NCC Publication, 1985.
9. M.Richharia, “Satellite Communication Systems-Design Principles”, Macmillan 2003.