Gondwana University, Gadchiroli

Electronics & Telecommunication Engineering

Model Curriculum

V/VI Semesters (AY: 2021-22)

Syllabus

Board of Studies in Electronics Engineering

Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
First Semester Common to GROUP-B branches of Engineering & Technology

Course Category	Course Code	BoS	Subject	Teaching Scheme				Examination Scheme									
				Hours Per Week			Number of Credits	THEORY						PRACTICAL			
				L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional MSE	Max. Marks Sessional IE	Total	Min. Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min. Passing Marks
BSC	FE201	S&H	Chemistry-I	3	1	0	4	3	80	10	10	100	40	--	--	--	--
BSC	FE102	S&H	Mathematics –I	3	1	0	4	3	80	10	10	100	40	--	--	--	--
ESC	FE203	Computer	Programming for Problem Solving	3	0	0	3	3	80	10	10	100	40	--	--	--	--
HSMC	FE204	S&H	English	2	0	0	2	-	-	40	10	50	20	--	--	--	--
			Laboratory														
BSC	FE205	S&H	Chemistry-I Lab	0	0	3	1	-	-	-	-	-		25	25	50	25
ESC	FE206	Computer	Programming for Problem Solving Lab	0	0	2	1	-	-	-	-	-		25	25	50	25
ESC	FE207	Mechanical	Workshop/ Manufacturing Practices	1	0	4	3	-	-	-	-	-		50	50	100	50
HSMC	FE208	S&H	English	0	0	2	1							50	-	50	25
		Total		**12**	**2**	**11**						**350**				**250**	
		Semester Total		**25**			**19**	**600**									

Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
Second Semester Common to GROUP-B branches of Engineering & Technology

Course Category	Course Code	BoS	Subject	Teaching Scheme				Examination Scheme									
				Hours Per Week			Number of Credits	THEORY						PRACTICAL			
				L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional MSE	Max. Marks Sessional IE	Total	Min. Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min. Passing Marks
BSC	FE101	S&H	Physics	3	1	0	4	3	80	10	10	100	40	--	--	--	--
BSC	FE202	S&H	Mathematics –II	3	1	0	4	3	80	10	10	100	40	--	--	--	--
ESC	FE103	Electrical	Basic Electrical Engineering	3	0	0	3	3	80	10	10	100	40	--	--	--	--
ESC	FE104	Mechanical	Engineering Graphics & Design	2	0	0	2	4	80	10	10	100	40	--	--	--	--
HSMC	FE105	S&H	Soft Skill	2	0	0	2	-	-	40	10	50	20	--	--	--	--
			Laboratory														
BSC	FE106	S&H	Physics Lab	0	0	3	1	-	-	-	-	-	-	25	25	50	25
ESC	FE107	Electrical	Basic Electrical Engineering Lab	0	0	2	1	-	-	-	-	-	-	25	25	50	25
ESC	FE108	Mechanical	Engineering Graphics & Design Lab	0	0	4	2	-	-	-	-	-	-	25	25	50	25
		Total		**13**	**2**	**9**						**450**				**150**	
		Semester Total		**24**			**19**	**600**									

Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
Third Semester Electronics & Telecommunication Engineering

Course Category	Course Code	BoS	Course title	Teaching Scheme				Examination Scheme									
				Hours Per Week			Number of Credits	THEORY						PRACTICAL			
				L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional MSE	Max. Marks Sessional IE	Total	Min. Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min. Passing Marks
BSC/ES C/HSMC	ET301M	Science & Humanities	Mathematics-III	3	1	0	4	3	80	10	10	100	40	--	--	--	--
PCC	ET302M	Electronics	Electronic Devices	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET303M	Electronics	Digital System Design	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET304M	Electronics	Signals and Systems	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET305M	Electrical	Network Theory	3	1	0	4	3	80	10	10	100	40	--	--	--	--
Laboratory																	
PCC	ET306M	Electronics	Electronic Devices Lab	0	0	2	1	-	-	-	-	-	-	25	25	50	25
PCC	ET307M	Electronics	Digital System Design Lab	0	0	2	1	-	-	-	-	-	-	25	25	50	25
PCC	ET308M	Electronics	Signals and Systems Lab	0	0	2	1	-	-	-	-	-	-	25	25	50	25
MC	ET309M	Science & Humanities	Environmental Science	0	0	2	0	Grade A/B/C									
		Total		**15**	**2**	**8**						**500**				**150**	
		Semester Total		**25**			**20**	**650**									

Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
Fourth Semester Electronics & Telecommunication Engineering

Course Category	Course Code	BoS	Course title	Teaching Scheme				Examination Scheme									
				Hours Per Week			Number of Credits	THEORY						PRACTICAL			
				L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional MSE	Max. Marks Sessional IE	Total	Min. Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min. Passing Marks
BSC/ESC/HSMC	ET401M	Management	Business Economics	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET402M	Electronics	Probability, random process and numerical method	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET403M	Electronics	Analog and Digital Communication	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET404M	Electronics	Analog Circuits	3	1	0	4	3	80	10	10	100	40	--	--	--	--
PCC	ET405M	Electronics	Microprocessor and Microcontrollers	3	1	0	4	3	80	10	10	100	40	--	--	--	--
Laboratory																	
PCC	ET406M	Electronics	Analog and Digital Communication Lab	0	0	2	1	-	-	-	-	-		25	25	50	25
PCC	ET407M	Electronics	Analog Circuits Lab	0	0	2	1	-	-	-	-	-		25	25	50	25
PCC	ET408M	Electronics	Microprocessor and Microcontrollers Lab	0	0	2	1	-	-	-	-	-		25	25	50	25
		Total		**15**	**2**	**6**						**500**				**150**	
		Semester Total		**23**			**20**	**650**									

dustrial Training /Internship/Case Studies:-It is to be completed during the summer vacation after completion of fourth semester and/or winter vacation after the completion of Fifth semester and its planning location should be done during the fourth/ fifth semester and its marks will be awarded in the sixth semester for subject code ET608M on submission of the certified relevant report at the end of sixth semester

Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
Fifth Semester Electronics & Telecommunication Engineering

Course Category	Course Code	BoS	Course title	Teaching Scheme				Examination Scheme									
				Hours Per Week			Number of Credits	THEORY						PRACTICAL			
				L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional		Total	Min. Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min. Passing Marks
										MSE	IE						
PEC-1	ET501M	Electronics	Program Elective – 1	3	0	0	3	3	80	10	10	100	40	--	--	--	--
OEC-1	ET502M	Electronics	Open Elective – 1	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET503M	Computer Science	Computer Architecture	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET504M	Computer Science	Data structure & Algorithms	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET505M	Electronics	Digital Signal Processing	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET506M	Electronics	Electromagnetic Waves	3	0	0	3	3	80	10	10	100	40	--	--	--	--
Laboratory																	
PCC	ET507M	Electronics	Digital Signal Processing Lab	0	0	2	1	-	-	-	-	-	-	25	25	50	25
PCC	ET508M	Electronics	Mini Project/Electronic Design workshop	0	0	2	1	-	-	-	-	-	-	25	25	50	25
		Total		**18**	**0**	**4**						**600**				**100**	
		Semester Total		**22**			**20**	**700**									

f Program Elective – 1

ormation Theory and Coding; 2) Power Electronics; 3) Bio-Medical Electronics; 4) Nano electronics;

f Open Elective – 1

imization Techniques; 2) IC Technology; 3) Opto Electronic Devices; 4) Professional Ethics;

lustrial Training /Internship/Case Studies:-It is to be completed during the summer vacation after completion of fourth semester and/or winter vacation after the completion of Fifth semester and its planning ocation should be done during the fourth/ fifth semester and its marks will be awarded in the sixth semester for subject code ET608M on submission of the certified relevant report at the end of sixth semester

Four Year Degree Course in Engineering and Technology
Course and Examination Scheme with Model AICTE Curriculum
Sixth Semester Electronics & Telecommunication Engineering

Course Category	Course Code	BoS	Course title	Teaching Scheme				Examination Scheme									
				Hours Per Week			Number of Credits	THEORY						PRACTICAL			
				L	T	P		Duration of Paper (Hrs.)	Max. Marks ESE	Max. Marks Sessional MSE	Max. Marks Sessional IE	Total	Min. Passing Marks	Max. Marks TW	Max. Marks POE	Total	Min. Passing Marks
PEC-2	ET601M	Electronics	Program Elective – 2	3	0	0	3	3	80	10	10	100	40	--	--	--	--
OEC-2	ET602M	Electronics	Open Elective – 2	3	0	0	3	3	80	10	10	100	40	--	--	--	--
HSMC/BSC	ET603M	Management	Management & Accountancy	3	0	0	3	3	80	10	10	100	40	--	--	--	--
PCC	ET604M	Computer Science	Computer Network	3	0	0	4	3	80	10	10	100	40	--	--	--	--
PCC	ET605M	Electrical	Control Systems	3	0	0	4	3	80	10	10	100	40	--	--	--	--
Laboratory																	
PCC	ET606M	Computer Science	Computer Networks Lab	0	0	2	1	-	-	-	-	-		25	25	50	25
PCC	ET607M	Electronics	Electronic Measurement Lab	0	0	2	1	-	-	-	-	-		25	25	50	25
PCC	ET608M	Electronics	# # Industrial Training /Internship/Case Studies (2 to 4 Weeks)	0	0	2	1	-	-	-	-	-		25	25	50	25
		Total		**15**	**0**	**6**						**500**				**150**	
		Semester Total		**23**			**20**	**650**									

f Program Elective – 2

eech and Audio Processing; 2) Introduction to MEMS; 3) CMOS Design; 4) Scientific computing;

f Open Elective – 2

ftware Engineering and Project Management; 2) Wind and Solar Energy Systems; 3) RF Circuit Design; 4) Mechatronic Systems;

dustrial Training /Internship/Case Studies:-It is to be completed during the summer vacation after completion of fourth semester and/or winter vacation after the completion of Fifth semester and its planning location should be done during the fourth/ fifth semester and its marks will be awarded in the sixth semester for subject code ET608M on submission of the certified relevant report at the end of sixth semester

efinition of Credit:

1 Hr. Lecture (L) per week 1 credit
1 Hr. Tutorial (T) per week 1 credit
2 Hours Practical(Lab)/week 1 credit

ange of credits – A credits of 160 is required for a student to be eligible to get Under Graduate degree in Engineering.

ructure of Undergraduate Engineering program :

S.No	Abbreviations	Category	Suggested Breakup of Credits(Total 160)
1	HSMC	Humanities and Social Sciences including Management courses	12*
2	BSC	Basic Science courses	25*
3	ESC	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24*
4	PCC	Professional core courses	48*
5	PEC	Professional Elective courses relevant to chosen specialization/branch	18*
6	OEC	Open subjects – Electives from other technical and /or emerging subjects	18*
7	PROJ	Project work, seminar and internship in industry or elsewhere	15*
8	MC	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]	(non-credit)
Total			160*

*Minor variation is allowed as per need of the respective disciplines.

Abbreviations

L	Lecture	MC	Mandatory courses
T	Tutorial	PROJ	Project
P	Practical	MSE	Mid Semester Examination
BSC	Basic Science Courses	IE	Internal Evaluation
ESC	Engineering Science Course	ESE	End Semester Examination
HSMC	Humanities and Social Sciences including Management courses	TW	Term work
PCC	Professional core courses	POE	Performance & Oral Examination
PEC	Professional Elective courses	BoS	Board of Studies (Board)
OEC	Open Elective courses		

V SEMESTER B.E.

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

SYLLABUS

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET501M

Title of the Course : Program Elective – 1

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

ET501M	Information Theory and Coding

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources
Markov sources; Shannon's noisy coding theorem and converse for discrete channels
Calculation of channel capacity and bounds for discrete channels; Application to continuous channels
Techniques of coding and decoding; Huffman codes and uniquely detectable codes;
Cyclic codes, convolutional arithmetic codes

Text/Reference Books:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

ET501M	Power Electronics

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT-Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT)
Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuit for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode
Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor
Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control; techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter
Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter – series loaded half bridge DC-DC converter. Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive

Text /Reference Books:

1. Muhammad H. Rashid, "Power electronics" Prentice Hall of India.
2. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
3. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.
4. V.R Moorthi, "Power Electronics", Oxford University P

5. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International Publishers. SCR manual from GE, USA.

Course Outcomes:
At the end of this course students will demonstrate the ability to
1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.

ET501M	Bio-Medical Engineering

Brief introduction to human physiology. Biomedical transducers: displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases
Bio-electrodes and biopotential amplifiers for ECG, EMG, EEG, etc
Measurement of blood temperature, pressure and flow. Impedanceplethysmography.
Ultrasonic, Xray and nuclear imaging. Prostheses and aids: pacemakers, defibrillators
Heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects

Text/Reference Books:
1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling biosubstances.
3. Understand and analyze the biological processes like other electronic processes

ET501M	Nano Electronics

Introduction to nanotechnology, meso structures,Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts
Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones
Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.)
Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Bandstructure and transport, devices, applications
2D semiconductors and electronic devices, Graphene, atomistic simulation

Text/ Reference Books:
1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and theprocesses involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET502M

Title of the Course : Open Elective – 1

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

ET502M	Optimization Techniques

Decision-making procedure under certainty and under uncertainty - Operations ResearchProbability and decision- making- Queuing or Waiting line theory-Simulation and MonteCarlo Technique-Nature and organization of optimization problems-Scope and hierarchy of optimization- Typical applications of optimization
Essential features of optimization problems - Objective function- Continuous functions – Discrete functions - Unimodal functions - Convex and concave functions, Investment costs and operating costs in objective function - Optimizing profitably constraints-Internal and external constraints-Formulation of optimization problems. Continuous functions - Discrete functions
Unimodal functions - Convex and concave functions. Necessary and sufficient conditions for optimum of unconstrained functions-Numerical methods for unconstrained functions - One-dimensional search - Gradient-free search with fixed step size. Linear Programming - Basic concepts of linear programming - Graphical interpretation Simplex method - Apparent difficulties in the Simplex method
Network analysis by linear programming and shortest route, maximal flow problem. Introduction to Non-traditional optimization, Transportation Problem, Loops in transportation table, Methods of finding initial basic feasible solution, Tests for optimality. Assignment Problem, Mathematical form of assignment problem, methods of solution
Computational Complexity – NP-Hard, NPComplete. Tabu Search- Basic Tabu search, Neighborhood, Candidate list, Short term and Long term memory; Genetic Algorithms- Basic concepts, Encoding, Selection, Crossover, Mutation. Simulated Annealing - Acceptance probability, Cooling, Neighborhoods, Cost function. Application of GAand Simulated Annealing in solving sequencing and scheduling problems and Travelling salesman problem

Text Books

1. Rao S.S., Optimization Theory and Applications, Wiley Eastern.
2. Hamdy A. Taha, Operations Research – An introduction, Prentice – Hall India.
3. G. Zapfel, R. Barune and M. Bogl, Meta heuristic search concepts: A tutorial with applications to production and logistics, Springer.

References

1. Gass S. I., Introduction to Linear Programming, Tata McGraw Hill.
2. Reeves C., Modern heuristic techniques for combinatorial problems, Orient Longman.
3. Goldberg, Genetic algorithms in Search, optimization and Machine Learning, Addison Wesley.
4. K. Deb, Optimization for engineering design – algorithms and examples, Prentice Hall of India.

ET502M	IC Technology

Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques. Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles
Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultrathin films. Oxidation technologies in VLSI and ULSI; Characterization of oxide films; High k and low k dielectrics for ULSI
Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI; Mask generation. Chemical Vapour Deposition techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modelling and technology
Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms in metal interconnects; Multi-level metallisation schemes
Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI

Text/Reference Books:

1. C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.
2. S.K. Ghandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.
3. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988
4. J.P.Uyemura,CMOS Logic Circuit Design, Kluwer Academic Publishers,1999

ET502M	Opto Electronic Devices

Optical processes in semiconductors – electron hole recombination, absorption, Franz-Keldysh effect, Stark effect, quantum confined Stark effect, deep level transitions, Auger recombination heat generation and dissipation, heat sources. Lasers – threshold condition for lasing, line broadening mechanisms, axial and transverse laser modes, heterojunction lasers, distributed feedback lasers, DBR lasers, quantum well lasers, tunneling based lasers, modulation of lasers.
Nitride light emitters, nitride material properties, InGaN/GaN LED, structure and working, performance parameters, InGaN/GaN Laser Diode, structure and working, performance parameters. White-light LEDs, generation of white light with LEDs, generation of white light by dichromatic sources, ,generation of white light by trichromatic sources, temperature dependence of trichromatic, 7generation of white light by tetrachromatic and pentachromatic sources, white light sources based on wavelength converters.
Optical modulators using pn junction, electro-optical modulators, acousto-optical modulators, Raman-Nath modulators, Franz-Keldysh and Stark effect modulators, quantum well electro absorption modulators, optical switching and logic devices, optical memory.
Optical detection – PIN, APD, modulated barrier photodiode, Schottky barrier photodiode, wavelength selective detection, micro cavity photodiodes.Optoelectronic ICs, advantages, integrated transmitters and receivers, guided wave devices.
Working of LDR, liquid crystal display, structure, TFT display, structure, polymer LED, organic LED. Introduction to optical components, directional couplers, multiplexers, attenuators, isolators, circulators, tunable filters, fixed filters, add drop multiplexers, optical cross connects, wavelength convertors, optical bistable devices

Text Books:

1. Pallab Bhattacharya: Semiconductor Optoelectronic Devices, Pearson, 2009
2. Yariv, Photonics Optical Electronics in modern communication, 6/e ,Oxford Univ Press,2006.

References:

1. Alastair Buckley, Organic Light-Emitting Diodes, Woodhead, 2013.
2. B E Saleh and M C Teich, Fundamentals of Photonics:, Wiley-Interscience, 1991
3. Bandyopadhay, Optical communicatoion and networks, PHI, 2014.
4. Mynbaev, Scheiner, Fiberoptic Communication Technology, Pearson, 2001.
5. Piprek, Semiconductor Optoelectronic Devices, Elsevier, 2008.
6. Xun Li, Optoelectronic Devices Design Modelling and Simulation, Cambridge University Press, 2009

ET502M	Professional Ethics

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories
Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination
Multinational Corporations – Business Ethics – Environmental Ethics – Computer Ethics – Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

Text Books:

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thompson Learning, 2000.
2. Jayasree Suresh and B. S. Raghavan, Human Values and Professional Ethics, 3rd Edition, S. Chand Publications
3. Mike Martin and Ronald Schinzinger, "Ethics in Engineering", McGraw-Hill, New York, 2005.

References:

1. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 1999.
2. David Ermann and Michele S Shauf, Computers, Ethics and Society, Oxford University Press, 2003
3. Edmund G Seebauer and Robert L Barry, Fundamentals of Ethics for Scientists and Engineers, Oxford University Press, Oxford, 2001.
4. Govindarajan M, Natarajan S, Senthil Kumar V S., Engineering Ethics, Prentice Hall of India, New Delhi 2004.
5. John R Boatright, Ethics and the conduct of Business, Pearson education, New Delhi, 2003.
6. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, Business Ethics – An Indian Perspective, Biztantra, New Delhi, 2004.

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET503M

Title of the Course : Computer Architecture

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queue, Subroutines
Processor organization, Information representation, number formats, Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats
Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit.
Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory. System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces
Microprogrammed computers - CPU control unit, Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network

Text/Reference Books:

1. V.Carl Hammacher, "Computer Organisation", Fifth Edition.
2. A.S.Tanenbum, "Structured Computer Organisation", PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming", II, Englewood Chiffs, N.J., Prentice Hall Edition
4. M.M.Mano, "Computer System Architecture", Edition
5. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition
6. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition

Course Outcomes

At the end of this course students will demonstrate the ability to

1. learn basic principles of computer's working
2. analyze the performance of computers
3. know how computers are designed and built
4. Understand issues affecting modern processors (caches, pipelines etc.).

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET504M

Title of the Course : Data structure & Algorithms

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis
Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis
Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.
Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing
Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis

Suggested books:

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Suggested reference books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET505M

Title of the Course : Digital Signal Processing

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform Algorithm (Decimation in Time, Decimation in Frequency).
The z-Transform, Properties of z-Transform, Rational z-Transform, Inversion of the z-Transform, Analysis of LTI Systems in the z-Domain, one sided z-transform
Implementation of Discrete Time Systems- Structures of FIR Systems, Structures of IIR Systems, Representation of Numbers, Quantization of Filter Coefficients, Round-Off Effects in Digital Filters.
Design of FIR Digital filters: Windowing method, Park-McClellan's method, Design of IIR

Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation.
Multirate Digital Signal Processing : Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Implementation of sampling rate conversion, Applications of multi rate signal processing, Introduction to digital filter banks.

Text Books:

1. Proakis J. G and D. G. Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", Pearson Education, PHI.
2. P. Ramesh Babu, "Digital Signal Processing", Sci- Tech Publications.
3. Digital Signal Processing by S Salivahanan, C Gnanapriya, TMH

Reference Books:

1. S. K. Mitra, "Digital Signal Processing: A Computer based Approach", TMH, 2001.
2. Oppenheim A. V and R. W. Schafer, "Discrete Time Signal Processing", Person Education, India
3. Rabnier, Gold, "Theory and Applications of Digital Signal Processing", TMH

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET506M

Title of the Course : Electromagnetic Waves

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Lossless and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.
Basics of Vectors, Vector calculus, Basic laws of Electromagnetics Electrostatic fields: Introduction to coulomb's law, Gaussian law and its applications in determination of field of spherical and cylindrical geometries, Laplace's and poisson's equation in various coordinate systems. Effect of dielectric on capacitance, Boundary conditions at electric interfaces- Dielectric-Dielectric and Dielectric-Conductor Interfaces, Method of images and its applications.
Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magnetostatic Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Ampere's Force Law. Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer EMF, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms, Boundary Conditions at magnetic interfaces– Dielectric-Dielectric and Dielectric-Conductor Interfaces.
Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting

boundary.
Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Text Books :

1. William H. Hayt, 'Engineering Electromagnetic' Tata Mcgraw Hill, Edition2001
2. John D. Kraus, 'Electromagnetic' Tata Mcgraw Hill, Book Co. New York 4th Edition

Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Use sections of transmission line sections for realizing circuit elements
3. Analyze wave propagation on metallic waveguides in modal form
4. Understand principle of radiation and radiation characteristics of an antenna

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET507M

Title of the Course : Digital Signal Processing Lab

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
0	0	2	2	1	0	0	25	25	50

Hands-on experiments related to the course contents: ET505M

FIFTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET508M

Title of the Course : Mini Project/Electronic Design workshop Lab

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
0	0	2	2	1	0	0	25	25	50

Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional

5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of miniproject.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.

VI SEMESTER B.E.

ELECTRONICS AND TELECOMMUNICATION ENGINEERING SYLLABUS

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET601M

Title of the Course : Program Elective – 2

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

ET601M	Speech and Audio Processing

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness
Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of nonstationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short term linear prediction models; Moving average prediction
Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, alogarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. Scalar Quantization of LPC- Spectral distortion measures
Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model
Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zerostate method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP. Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Text/Reference Books:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students Edition), 2004.
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:
1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

ET601M	Introduction to MEMS

Introduction and Historical Background, Scaling Effects. Micro/Nano Sensors, Actuators and Systems overview: Case studies.
Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching
Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching
Wafer Bonding. Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods
Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8), CRC press, (2005).

3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

Course Outcomes:
At the end of the course the students will be able to
1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices

ET601M	CMOS Design

Review of MOS transistor models, Non-ideal behavior of the MOS Transistor. Transistor as a switch
Inverter characteristics, Integrated Circuit Layout: Design Rules, Parasitics.
Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout
Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic.
Sequential Circuit Design: Static circuits. Design of latches and Flip-flops

Text/Reference Books:
1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, 2011.
2. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
3. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

Course Outcomes:
At the end of the course the students will be able to
1. Design different CMOS circuits using various logic families along with their circuit layout.
2. Use tools for VLSI IC design.

ET601M	Scientific computing

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating Point Arithmetic
Cancellation System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting Eigenvalues and singular values:Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues
Singular Values Decomposition, Application of SVD Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial interpolation
Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Extrapolation Methods, Boundary Value Problems For ODES Method
Finite Runga-Kutta Difference Methods, Finite Element Method, Eigenvalue Problems Partial Differential Equations,Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets,Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

Text/ Reference Books:

2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed.2006
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET602M

Title of the Course : Open Elective – 2

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

ET602M	Software Engineering and Project Management

Introduction to software engineering- scope of software engineering – historical aspects, economic aspects, maintenance aspects, specification and design aspects, team programming aspects. Software engineering a layered technology –processes, methods and tools. Software process models – prototyping models, incremental models, spiral model, waterfall model
Process Framework Models: Capability maturity model (CMM), ISO 9000. Phases in Software development – requirement analysis requirements elicitation for software, analysis principles, software prototyping, specification. Planning phase – project planning objective, software scope, empirical estimation models COCOMO, single variable model, staffing and personal planning. Design phase – design process, principles, concepts, effective modular design, top down, bottom up strategies, stepwise refinement
Coding – programming practice, verification, size measures, complexity analysis, coding standards. Testing – fundamentals, white box testing, control structure testing, black box testing, basis path testing, code walk-throughs and inspection, testing strategies-Issues, Unit testing, integration testing, Validation testing, System testing
Maintenance-Overview of maintenance process, types of maintenance. Risk management: software risks - risk identification-risk monitoring and management. Project Management concept: People – Product-Process-Project
Project scheduling and tracking: Basic concepts relation between people and effort-defining task set for the software project-selecting software engineering task Software configuration management: Basics and standards User interface design - rules. Computer aided software engineering tools - CASE building blocks, taxonomy of CASE tools, integrated CASE environment

References

1. Roger S. Pressman, Software Engineering : A practitioner's approach, McGraw Hill publication, Eighth edition, 2014
2. Walker Royce, Software Project Management : A unified frame work, Pearson Education, 1998
3. Ian Sommerville, Software Engineering, University of Lancaster, Pearson Education, Seventh edition, 2004.
4. K. K.Aggarwal and Yogesh Singh, Software Engineering, New age International Publishers, Second edition, 2005.
5. S.A. Kelkar, Software Project Management: A concise study, PHI, Third edition, 2012

ET602M	Wind and Solar Energy Systems

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power cumulative distribution functions
Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent- Magnet Synchronous Generators
Power electronics converters. Generator-Converter configurations, Converter Control. Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array,
Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances
Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems. Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis

Text / References:

1. T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
2. G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
3. S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
4. H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems" John Wiley and Sons Ltd 2006.
5. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
6. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991

ET602M	RF Circuit Design

Introduction : Importance of radiofrequency design, Dimensions and units, frequency spectrum. RF behavior of passive components : High frequency resistors, capacitors and inductors. Chip components and Circuit board considerations : Chip resistors, chip capacitors, surface mounted inductors
Transmission Line Analysis : Two-wire lines, Coaxial lines and Microstrip lines. Equivalent circuit representation, Basic laws, Circuit parameters for a parallel plate transmission line. General Transmission Line Equation : Kirchhoff voltage and current law representations, Traveling voltage and current waves, general impedance definition, Lossless transmission line model. Microstrip Transmission Lines. Terminated lossless transmission line : Voltage reflection coefficient, propagation constant and phase velocity, standing waves. Special terminated conditions : Input impedance of terminated lossless line, Short circuit transmission line, Open circuit transmission line, Quarter wave transmission line. Sourced and Loaded Transmission Line : Phasor representation of source, Power considerations for a transmission line, input impedance matching, return loss and insertion loss
The Smith Chart : Reflection coefficient in Phasor form, Normalized Impedance equation, Parametric reflection coefficient equation, graphical representation, Impedance transformation for general load, Standing wave ratio, Special transformation conditions. Admittance Transformations : Parametric admittance equation, Additional graphical displays. Parallel and series Connections : Parallel connections of R and L connections, Parallel connections of R and C connections, Series connections of R and L connections, Series connections of R and C connections, Example of a T Network
RF Filter Design : Filter types and parameters, Low pass filter, High pass filter, Bandpass and Bandstop filter, Insertion Loss. Special Filter Realizations : Butterworth type filter, Chebyshev type filters, Denormalization of standard low pass design. Filter Implementation : Unit Elements, Kuroda's Identities and Examples of Microstrip Filter Design. Coupled Filters : Odd and Even Mode Excitation, Bandpass Filter Design, Cascading bandpass filter elements, Design examples
Active RF Components : Semiconductor Basics : Physical properties of semiconductors, PNJunction, Schottky contact Bipolar-Junction Transistors : Construction, Functionality, Temperature behaviour, Limiting values. RF Field Effect Transistors : Construction, Functionality, Frequency response, Limiting values. High Electron Mobility Transistors : Construction, Functionality, Frequency response; Active RF Component Modeling : Transistor Models : Large-signal BJT Models, Small-signal BJT Models, Large-signal FET Models, Small-signal FET Models. Measurement of Active Devices : DC Characterization of Bipolar Transistors, Measurements of AC parameters of Bipolar Transistors, Measurement of Field Effect Bipolar Transistors Transistor Parameters

Reference Books

1. Reinhold Ludwig, "RF circuit design, theory and applications" Pavel Bretchko, "Pearson Asia Education", Edition 2001.
2. D.Pozar, "Microwave Engineering", John Wiley & Sons, New York, 1998.

ET602M	Mechatronic System

Introduction: Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronic approach, Integrated Product Design, Modeling, Analysis and Simulation, Man-Machine Interface
Sensors and transducers: classification, Development in Transducer technology, Optoelectronics Shaft encoders, CD Sensors, Vision System, etc
Drives and Actuators: Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control
Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems; Smart materials: Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators: Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation, etc
Micromechatronic systems: Microsensors, Microactuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology

Text Books:

1) Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.)
2) Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education
3) A Textbook of Mechatronics ,R.K.Rajput, S. Chand & Company Private Limited
4) Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall

Course Outcomes:

Upon completion of this course, students will get an
1. Overview of mechatronics applications
2. Use of micro-sensors and microprocessors.

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET603M

Title of the Course : Management & Accountancy

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

Introduction to Management Challenges for Engineers: Introduction, definitions, employment trend in industries, STEM professionals as effective technical contributors, management and leadership, becoming effective manager in the new millennium. Planning: Introduction, types of planning, who should do planning, inexact nature of strategic planning, planning roles for engineering managers, tools for planning, planning activities, some specific advice on planning
Organizing: Introduction, definitions, activities of organizing, organizing one's own workplace for productivity, developing organizational structure, enhancing corporate performance by organizing examples, concurrent engineering teams, delegating, establishing working relationships, informal organizations. Leading: Introduction, styles of leadership, leading activities, deciding, communicating, motivating, selecting engineering employees, developing people, special topics on leading
Controlling: Introduction, setting performance standards, benchmarking, measuring performance, evaluating performance, correcting performance, means of control, general comments, control of management time, control of personnel, control of business relationships, control of projects, control of quality, control of knowledge. Cost accounting for engineering managers: Introduction, product or service costing, application of ABC in industry, risk analysis and cost estimation under uncertainty, miscellaneous topics
Financial Accounting and Management for Engineering Managers: Introduction, financial marketing principles, key financial statements, fundamentals of financial analysis,

Accounting: Principles, Concepts and conventions, Double entry system of Accounting, Introduction of basis books of accounts of sole proprietary concern, closing of books of accounts and preparation of Trail Balance. Profit and Loss Accounts and Balances Sheet of Sole Proprietary concern with normal closing entries

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET604M

Title of the Course : Computer Network

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts
Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing
Transport layer: Connectionless transport - User Datagram Protocol, Connectionoriented transport – Transmission Control Protocol, Remote Procedure Call
Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service. Network layer: Virtual circuit and Datagram networks
Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing, Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches

Text Reference books:

1. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 5th Edition
2. L. Peterson and B. Davie, "Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, 5th Edition.
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. S. Keshav, "An Engineering Approach to Computer Networking" , Pearson Education
5. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition
6. Andrew Tanenbaum, "Computer networks", Prentice Hall
7. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall
8. William Stallings, "Data and computer communications", Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:
1. Understand the concepts of networking thoroughly.
2. Design a network for a particular application.
3. Analyze the performance of the network

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET605M

Title of the Course : Control Systems

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
3	0	0	3	3	3	80	10	10	100

response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators
Closed-loop systems. Block diagram and signal flow graph analysis.Feedback control systems- Stability, steady-state accuracy,transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feed-forward and multiloop control configurations, stability concept, relative stability, Routh stability criterion
Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design. Lead and lag compensation. Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion
Performance specifications in frequency-domain. Frequency-domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution
State variable Analysis- Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability. Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis

Text/Reference Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Characterize a system and find its study state behavior
2. Investigate stability of a system using different tests
3. Design various controllers
4. Solve liner, non-liner and optimal control problems

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET606M

Title of the Course : Computer Networks Lab

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
0	0	2	2	1	0	0	25	25	50

Hands-on experiments related to the course contents: ET604M

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET607M

Title of the Course : Electronic Measurement Lab

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
0	0	2	2	1	0	0	25	25	50

List of Experiments

1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
2. Designing AC bridge Circuit for capacitance measurement
3. Designing signal Conditioning circuit for Pressure Measurement
4. Designing signal Conditioning circuit for Temperature Measurement
5. Designing signal Conditioning circuit for

7. Experimental study for the characteristics of ADC and DAC
8. Error compensation study using Numerical analysis using MATLAB (regression)

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Design and validate DC and AC bridges
2. Learn about various measurement devices, their characteristics, their operation and their limitations
3. Understand computerized data acquisition

SIXTH SEMESTER B.E. ELECTRONICS AND COMMUNICATION ENGINEERING/ ELECTRONICS AND TELECOMMUNICATION ENGINEERING

Course Code : ET608M

Title of the Course : Industrial Training /Internship/Case Studies

Course Scheme					Evaluation Scheme (Theory)				
Lecture	Tutorial	Practical	Periods /week	Credits	Duration of paper (in hrs)	MSE	IE	ESE	Total
0	0	2	2	1	0	0	25	25	50

2 to 4 week Industrial Training /Internship/Case Studies is to be completed during the summer vacation after completion of fourth semester and/or winter vacation after the completion of Fifth semester and its planning and allocation should be done during the fourth/ fifth semester and its marks will be awarded in the sixth semester for subject code ET608M on submission of the certified relevant report at the end of sixth semester.