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 – Fifth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks			Category
						CA	ES	Total	
Theory Course									
1902EC501	Analog Communication	3	0	0	3	40	60	100	PCC
1902EC502	Digital Signal Processing	2	2	0	3	40	60	100	PCC
1902EC503	Transmission Lines and Wave guides	2	2	0	3	40	60	100	PCC
1902EC504	Control Systems			0	3	40	60	100	PCC
1902EC505	Computer Networks	2	0	0	2	40	60	100	PCC
	Professional Elective – I	3	0	0	3	40	60	100	PEC
Laboratory Course									
1902EC551	Digital Signal Processing Laboratory	0	0	2	1	50	50	100	PCC
1902EC552	Computer Networks Laboratory	0	0	2	1	50	50	100	PCC
1904GE551	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
Total		**18**	**6**	**4**	**20**	**540**	**460**	**1000**	

PROFESSIONAL ELECTIVES – V									
1903EC001	Computer Architecture and Organization	3	0	0	3	40	60	100	PEC
1903EC002	Advanced Microcontrollers	3	0	0	3	40	60	100	PEC
1903EC003	Measurement and Instrumentation	3	0	0	3	40	60	100	PEC
1903EC004	Display Systems	3	0	0	3	40	60	100	PEC
1903EC005	Renewable Energy Engineering	3	0	0	3	40	60	100	PEC

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

Course Objectives:

1. Tointroducetheconceptsofvariousmodulationsandtheirspectralcharacteristics.
2. Tostudyvarioustypesofnoiseandanalyzethenoiseperformanceofvarious receiver.
3. To learn Pulse analog modulation and demodulation techniques.

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 ofAM–Superheterodynereceiver–DoubleSideBandSuppressedCarrier(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 – Antialiasing 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.

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. Analyze the behavior of various analog systems in the presence of noise.
4. Apply the concepts of sampling process and determine the characteristics of Pulse Analog Modulation schemes.
5. Evaluate the efficiency of coding techniques for data compression.

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.RamaKrishnarao, “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**

Course Objectives:	
	1. To learn discrete Fourier transform, properties and its computation
	2. To know the characteristics of IIR filter and to learn the design of IIR filters for filtering undesired signals.
	3. To know the characteristics of FIR filter and to learn the design of FIR filter for filtering undesired signals.
	4. To understand Finite word length effects and DSP Applications.
	5. To study about a programmable Digital signal processor.

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**
Finite word length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.Fixed point and floating-point number representations – Quantization- Truncation and Rounding errors - Quantization noise – quantization error – Overflow error – 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
	Spectrum estimation.
	Linear estimation and prediction

Course Outcomes:	
	After completion of the course, Student will be able to
	1. Apply DFT for the analysis of digital signals & systems.
	2. Design of IIR filters for filtering undesired signals.
	3. Design of FIR filters for filtering undesired signals.
	4. Characterize finite Word length effect on filters
	5. Gain the knowledge about DSP Processors.

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

Course Objectives:

1. To introduce the various types of transmission lines and to discuss the losses associated.
2. To give thorough understanding about impedance transformation and matching.
3. To use the Smith chart in problem solving.
4. To impart knowledge on filter theories and waveguide theories.

Module I	TRANSMISSION LINE THEORY	10 Hours

General solution of transmission line – The two standard forms for voltage and current of a line terminated by an impedance – Physical significance of the equation and the infinite line – Reflection coefficient – Wavelength and velocity of propagation – Waveform distortion – Distortion less transmission line – The telephone cable–Inductance loading of telephone cables – Input impedance of lossless lines – Reflection on a line not terminated by Z_O–Transfer impedance – Reflection facto rand reflection loss.

Module II	THE LINE AT RADIO FREQUENCIES	8 Hours

Standing waves and standing wave ratio on a line – One eighth wave line – Quarter wave line and impedance matching – The half-wave line – 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 impedance of a lossless line terminated by 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 – Velocities of propagation – Component uniform plane waves between parallel planes – Attenuation of TE and TM waves in parallel plane guides –Wave impedances.

Module IV	RECTANGULAR WAVEGUIDES	9 Hours

Transverse magnetic waves in rectangular wave guides – Transverse electric waves in rectangular waveguides – Characteristics of TE and TM waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangular waveguide – Attenuation of TE and TM modes in rectangular waveguide – Wave impedance – Characteristic impedance – Excitation of modes.

Module V	CIRCULAR WAVE GUIDESAND RESONATORS	9 Hours

Bessel functions – Solution of field equations in cylindrical co-ordinates – TM and TE waves in circular guides – Wave impedances and characteristic impedance – Dominant mode in circular waveguide – Excitation of modes – Microwave cavities – Rectangular cavity resonators – Circular cavity resonator – Semicircular cavity resonator –Q factor of a cavity resonator for TE_{101}mode.

	Total:	45Hours

Further Reading: Transmission line equations at radio frequencies - Characteristic impedance of symmetrical networks- The circle diagram for the dissipation less line –composite filters.

Course Outcomes:

After completion of the course, Student will be able to

1. Discuss the propagation of signals through transmission lines.
2. Analyze signal propagation at Radiofrequencies.
3. Explain radio propagation in guided systems.
4. Classify the Guided Wave solutions -TE, TM, and TEM.
5. Utilize cavity resonators.

References:

1. Ryder J. D., “Networks, Lines and Fields”, PHI, 2003.
2. Jordan E. C. and Balmain K. G., “Electro Magnetic Waves and Radiating System”, PHI, 2003.
3. Ramo, Whineery and Van Duzer, “Fields and Waves in Communication Electronics”,JohnWiley, 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

Course Objectives:

1. To introduce to the students the principles and applications of control systems.
2. To the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems.
3. In deals with the different aspects of stability analysis of systems in frequency domain, time domain and stability analysis
4. To have the knowledge on state space analysis and compensators

Unit 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.

Unit 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.

Unit III	FREQUENCY RESPONSE ANALYSIS	9 Hours

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

Unit 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.

Unit 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

Course Outcomes:

After completion of the course, Student will be able to

1. Determine transfer function of mechanical and electrical systems using block diagram reduction technique, signal flow graph.
2. Analyze the system response and stability in both time-domain and frequency domain
3. Design Lead, Lag and Lead-Lag compensators for control systems.
4. Determine the stability of a control system using Routh-Hurwitz Criterion and Root Locus Technique.
5. Analyze the system response and stability of systems represented in state space form and to design compensators for systems modeled in state space form

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

Course Objectives:	
	1. To understand networking concepts and basic communication model
	2. To understand network architectures and components required for data communication.
	3. To analyze the function and design strategy of physical, data link, network layer and transport layer
	4. To acquire basic knowledge of various application protocol for internetsecurity issues and services.

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
Course Outcomes:	
	After completion of the course, Student will be able to
	1. Able to trace the flow of information from one node to another node in the network
	2. Able to Identify the components required to build different types of networks
	3. Able to understand the functionalities needed for data communication into layers
	4. Able to choose the required functionality at each layer for given application
	5. Able to understand the working principles of various application protocols and fundamentals of security issues and services available.

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

LABORATORY COURSES

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

Course Objectives:

1. To make the students understand the behavior and response of the filter using different methods
2. To study the output response of the system, sampling rate conversion and FFT spectrum
3. To know the generation of the signals and arithmetic operations using TMS320C5X DSP Processor

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. Determination of Power Spectrum of a given signal(s)
2. Converting CD DATA to DVD DATA.
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
2. DSP Processor – 5 Nos.
3. CRO – 1 No.

Course Outcomes:

After completion of the course, Student will be able to

1. Design of digital filter and generation of various signals, analysis of signal and system properties.
2. Computation of circular and linear convolution.
3. Determine the frequency transformation and analysis of sampling rate.
4. Design of digital filters using DSP Processor.
5. Experiment the DSP Signal using DSP Processor.

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

Course Objectives:

1. To make students aware about various types of cables used in guided media like coaxial cable, optical fiber cable, twisted pair cables and its categories
2. To understand the working difference between straight cable and cross over cable.
3. To use the packet tracer to simulate various networks.

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

Course Outcomes:

After completion of the course, Student will be able to

1. To explain how communication works in computer networks and to understand the basic terminology of computer networks.
2. To become familiar with the network simulator Packet Tracer.
3. To be able to analyze different protocols used for packet communication like ALOHA Protocol.
4. To understand the working of LAN Card, Hub, TELNET and to understand the working difference between straight cable and cross over cable.
5. To explain the role of protocols in networking and to analyze the services and features of the various layers in the protocol stack.

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.

1904GE551		Life Skills: Aptitude - I	L	T	P	C
			0	0	2	1
		B.E – ECE				
Course Objectives:						
	1. To brush up problem solving skill and to improve intellectual skill of the students					
	2. To be able to critically evaluate various real life situations by resorting to Analysis Of key issues and factors					
	3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.					
	4. To enhance analytical ability of students					
	5. To augment logical and critical thinking of Student					
Module I	**Introduction to Number System, Basic Shortcuts of addition,**					**6 Hours**

	Multiplication, Division	
Classification of numbers – Types of Numbers – Divisibility rules – Finding the Modules of the Digits – 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	
	Spectrum estimation.	
	Linear estimation and prediction	
Course Outcomes:		
	After completion of the course, Student will be able to	
	1. Learners should be able to understand number and solving problems least time using various shortcut	
	2. Solve problems on averages; compare two quantities using ratio and proportion.	
	3. Calculate concept of percentages, implement business transactions using profit and loss.	
	4. Workout concepts of Coding and Decoding, ability to visualize directions and understand the logic behind a sequence.	
	5. Learners should be able to find a series the logic behind a sequence.	

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.

Audit Course

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

Professional Elective – I

1903EC001		**COMPUTER ARCHITECTURE AND ORGANIZATION**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**
		B.E - ECE				

Course Objectives:

1. To understand the key skills of constructing cost-effective computer systems
2. To learn how to quantitatively evaluate different designs and organizations
3. To articulate design issues in the development of processor or other components that satisfy design requirements
4. To familiarize design tools to model various alternatives in computer design.
5. To analysis various Level System Performance

Unit I	**INTRODUCTION OF COMPUTER ORGANIZATION AND DATA REPRESENTATION IN COMPUTER SYSTEM**	**9 Hours**

Main Components of Computers, Standard Organization, Historical Developments, Computer Level Hierarchy, Von Neumann and Non-Von Neumann Model, Positional Numbering Systems, Signed Integer Representation, Fixed and Floating Point Representation, Character Codes, Codes for Data Recording and Transmission, Error Detection and Error Correction.

Unit II	**SIMPLE COMPUTER AND INSTRUCTION SET ARCHITECTURE**	**9 Hours**

Introduction, MARIE, Instruction Processing, Simple Program, Hardwired Control, Micro programmed Control, Real World Example of Computer Architecture, Instruction Formats, Instruction Types, Addressing, Instruction Level Pipelining, Real World Example of ISA.

Unit III	**MEMORY AND STORAGE SYSTEM**	**9 Hours**

Memory - Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization, Memory Hierarchy, Cache and Virtual Memory, Interfacing Memory to a Processor, Real World Example of Memory Management, Amdahl's Law, I/O Architecture, External Memory - Optical Disk, Magnetic Tape, RAID, Solid State Drives, Data Compression, Computer Peripherals, Operating System Support.

Unit IV	**PARALLEL ORGANIZATION AND ALTERNATIVE ARCHITECTURE**	**9 Hours**

Parallel Processing – Multiple Processor Organization, Cache Coherence and MESI Protocol, Multi Core Computer – Hardware and Software Performance Issues, Intel X86 Multicore Organization, RISC Machines, Flynn's Taxonomy, Parallel and Multiprocessor Architecture, Alternative Parallel Processing Approaches.

Unit V	**SYSTEM SOFTWARE AND PERFORMANCE MEASUREMENTS**	**9 Hours**

Operating Systems, Protected Environments, Programming Tools, Database Software, Transaction manager, Computer Performance Equation, Mathematical Preliminaries, Bench Marking, CPU Performance Optimization, Disk Performance.

	Total:	**45 Hours**

Further Reading:

1. Input–Output Design and Organization, Data Formats
2. Modern Computer Systems, Communication Channel Technology

Course Outcomes:

After completion of the course, Student will be able to

1. Describe historical overview of computer and Numerical Representation Techniques.
2. Illustrate different types of Fundamental Computer Organization and Instruction Set.
3. Outline the Basic Memory Concept and External Storing Devices.
4. Explain the various Processing in Emerged in Recent Years.
5. Compare the Various Performance Analysis and System Software.

References:

1.David Tarnoff, "Computer Organization and Design Fundamentals", First Edition, 2007.

2. M. Morris Mano, "Computer System Architecture", 3rd Edition, Publisher: Pearson 2011.

3.MostafaAbd-El-Barr, Hesham El-Rewini, "Fundamentals of Computer Organization and Architecture", Wiley Interscience, John Wiley & Sons, Inc Publication, 2005.

4.Irv Englander, "The Architecture of Computer Hardware, System Software, and Networking", John Wiley & Sons, Inc Publication, 2009.

1903EC002	**ADVANCED MICRO CONTROLLERS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

1. To review the features, architecture and programming of PIC and ARM microcontrollers
2. To know interfacing concepts of peripherals with microcontrollers.
3. To summarize the communication protocols and applications of Microcomputer systems.

UNIT I **PIC MICROCONTROLLERS** **9 Hours**

PIC 16F877a MCU, Architecture, Features, Memory and memory map, I/O ports, Timers and CCP Devices, ADC, Interrupts, Instruction format, Addressing Modes, Instruction Set.

UNIT II **INTERFACING I/O DEVICES** **9 Hours**

LED, liquid crystal display, Motor (DC, Servo, Stepper), Relays, Keypad, Keyboard, Touch screen, Sensors (thermocouple, force, displacement), ESP 8266 Wifi.

UNIT III **ARM BASED MICROCONTROLLERS** **9 Hours**

Introduction to 16 bit Processors, ARM Architecture, ARM cortex M3, 16 bit ARM Instruction set, Thumb Instruction set, Exception Handling in ARM, Assembly and C programming

UNIT IV **PROTOCOLS** **9 Hours**

Bluetooth, XBee, Z wave, Wi-Fi, GSM and Global positioning system receiver, Introduction to IOT, Architecture and Challenges of IOT

UNIT V **APPLICATIONS** **9 Hours**

Home automation, Industrial automation,Smart Lighting, Smart Appliances, Smart Cities, Gas Monitoring, Environment Monitoring, Agricultural field monitoring, Designing Instruments like Smart watch, Calculator, Voltmeter, Vending machine , Elevator.

Total: 45 Hours

Further Reading:

1. IOT based on raspberry pi
2. Machine learning using raspberry pi

Course Outcomes:

After completion of the course, Student will be able to

6. Outline the properties of PIC16F877a micro controllers
7. Review the interfacing I/O for PIC16F877a micro controllers
8. Examine the properties of ARM micro controllers
9. Discuss different types of communication protocols
10. Solve the real life problems using micro controllers

References:

1. Milan Verle, "PIC Microcontrollers- Programming in C", mikroElektronika Publications, 2009.
2. Mohammad Ali Mazidi, Rolin D. Mckinlay and Danny Causey, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18", Pearson India, 2008.
3. Andrew N Sloss, Dominic Symes, Chris Wright “ARM System Developer‘s Guide Designing and Optimizing System Software” Ⅱ, Elsevier /Morgan Kaufmann Publisher, 2008.
4. Julio Sanchez Maria P.Canton, “Microcontroller Programming: The microchip PIC”, CRC Press, Taylor & Francis Group, 2007.
5. Martin Bates, "Interfacing PIC microcontrollers-Embedded Design by Interactive Simulation", Newnes Publication, 2006
6. Yifeng Zhu, “Embedded Systems with ARM Cortex-M3 Microcontrollers in Assembly Language and C”, E-Man Press LLC; 1st edition, 2014
7. PIC 16F877 datasheet-Microchip

E-References:

1. https://www.coursera.org/learn/raspberry-pi-interface (University of California)
2. https://www.coursera.org/learn/raspberry-pi-platform (University of California)

1903EC003		MEASUREMENT AND INSTRUMENTATION	L	T	P	C
			3	0	0	3

Course Objectives:

1. Learn the use of DC and AC bridges for measuring R, L and C.
2. To introduce the concepts of Motion and Ranging Sensors.
3. To study about the knowledge such as Optical, Pressure and Temperature Sensors.
4. Discuss about the different types of Function generator and Wave analyzer.
5. Learn the use of different types of analog meters for measuring electrical quantities such as current, voltage, power, energy, power factor and frequency.

Unit I	MEASUREMENT CONCEPTS	9 Hours

Principles of operation and construction of PMMC-Static and dynamic characteristics-units and standards of measurements-error analysis-moving coil, moving iron meters, multi meters-True RMS Meters-Bridge measurements: Maxwell, Kelvin, Hay, Schering, Anderson and Wien bridge-Q meters.

Unit II	MOTION, PROXIMITY AND RANGING SENSORS	9 Hours

Motion Sensors – Potentiometers, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT , Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

Unit III	OPTICAL, PRESSURE AND TEMPERATURE SENSORS	9 Hours

Photo conductive cell, Photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

Unit IV	FUNCTION GENERATORS	9 Hours

Function generators-RF signal generators-Sweep generators-Frequency synthesizer-wave analyzer-Harmonic distortion analyzer-spectrum analyzer-heterodyne wave analyzer-frequency counters- Time Interval measurement-Measurement of voltage, current, phase and frequency using CRO

Unit V	MODERN MEASUREMENT TECHNIQUES	9 Hours

A/D &D/A converters-Elements of a digital data acquisition system-interfacing of transducers – multiplexing-Use of recorders in digital systems-digital recording system-liquid crystal display-computer controlled instrumentation-IEEE 488 bus-fiber optic measurements for power and system loss.

	Total:	45 Hours

Further Reading:

Distortion meters- functions and libraries-Optical time domains reflect meter.

Course Outcomes:

After completion of the course, Student will be able to

1. Design different Bridge configurations and their applications.
2. Articulate different types of Ranging sensors.
3. Summarize different types of measuring sensors.
4. Outline the different type of function generators.
5. Interface different analog components to a Computer controlled Instrumentation System.

References:

1. Ernest, Doeblin, Dhanesh and N.Manik, Measurement Systems - Application and Design, Tata McGraw - Hill, 2009.

2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

3. Albert D.Helfrick and William D.Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI, 2003

3. B.C.Nakara, K.K.Chaudhry, Instrumentation Measurement and Analysis, Tata McGraw - Hill,2004.

4. Joseph J.Carr, Elements of Electronics Instrumentation and Measurement, PHI, 2003.

5. Alan. S. Morris, Principles of Measurements and Instrumentation, PHI, 2003

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.

1903EC005		**Renewable Energy Engineering**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

1. To impart knowledge on the following Topics
2. Awareness about renewable Energy Sources and technologies.
3. Adequate inputs on a variety of issues in harnessing renewable Energy. Recognize current and possible futureroleofrenewableenergysources.

Unit I	**RENEWABLE ENERGY (RE) SOURCES**	**9 Hours**

Issues in conventional energy source, Significance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

Unit II	**WIND ENERGY**	**9 Hours**

Power in the Wind – Types of Wind Power Plants(WPPs)-Components of WPPs-Working of WPPs- Siting of WPPs-Grid integration issues of WPPs.

Unit III	**SOLAR PV AND THERMAL SYSTEMS**	**9 Hours**

Solar Radiation, Radiation Measurement – Solar Photovoltaic systems : Basic Principle of Solar PV conversion – Types of Solar Cells: Cell, module, array- PV Module I-V Characteristics - Types of PV Systems - Efficiency and Quality of the Cell, series and parallel connections, maximum power point tracking, Applications

Unit IV	**BIOMASS ENERGY**	**9 Hours**

Introduction-Bio mas resources –Energy from Bio mas: conversion process-Biomass Cogeneration-Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

Unit V	**OTHER ENERGY SOURCES**	**9 Hours**

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell : Principle of working- various types-construction and applications. Energy Storage System- Hybrid Energy Systems.

Total:	**45Hours**

Further Reading: Indian Government subsidies for renewable energy under various category

Course Outcomes:

After completion of the course, Student will be able to

1. Ability to create awareness about renewable Energy Sources and technologies.
2. Ability to get adequate inputs on a variety of issues in harnessing renewable Energy. Ability to recognize current and possible future role of renewable energy sources.
3. Ability to explain the various renewable energy resources and technologies and their applications.
4. Ability to understand basics about biomass energy.
5. Ability to acquire knowledge about solar energy.

References:

1. Joshua Earnest Tore Wizeliu, Wind Power Plants and Project Development, PHI Learning Pvt.Ltd, New Delhi, 2011.
2. D.P.Kothari, K.C Singal, Rakesh Ranjan Renewable Energy Sources and Emerging Technologies, PHI Learning Pvt.Ltd, New Delhi, 2013.
3. Scott Grinnell, Renewable Energy and Sustainable Design, CENGAGE Learning, USA, 2016.
4. Richard A. Dunlap, Sustainable Energy Cengage Learning India Private Limited, Delhi, 2015.
5. Chetan Singh Solanki, Solar Photovoltaics : Fundamentals, Technologies and Applications, PHI Learning Private Limited, New Delhi, 2011
6. Bradley A. Striebig,AdebayoA.Ogundipe and Maria Papadakis, Engineering Applications in Sustainable Design and Development, Cengage Learning India Private Limited, Delhi, 2016.
7. Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004.
8. Shobh Nath Singh, Non-conventional Energy resources Pearson Education ,2015.