Master of Technology
(Electronics and Telecommunication Engineering)

Curriculum

(With Effect from academic year 2019-20 onwards)

Department of Electronics and Telecommunication Engineering
Government College of Engineering,
Aurangabad M.S. 431005 India

Department of Electronics and Telecommunication Engineering

Program Education Objectives (PEO)

1) Graduates will build successful career in Electronics and Telecommunication Engineering and interdisciplinary domains.
2) Graduates will accomplish professional responsibilities effectively to solve societal and industrial problems ethically.
3) Graduates will contribute in research and technological developments.
4) Graduates of the program will exhibit capability of lifelong learning for their professional development.

Program Outcomes (POs)

1) **Scholarship of Knowledge:**
   Acquire in depth knowledge in Electronics and Telecommunication Engineering with ability to discriminate, evaluate and synthesize innovative solutions.

2) **Critical Thinking:**
   Analyze and solve complex Electronics and Telecommunication Engineering problems with critical engineering judgment.

3) **Problem Solving:**
   Think laterally and originally, conceptualize and solve Electronics and Telecommunication Engineering problems to provide optimal and feasible solutions considering safety, environmental and societal needs.

4) **Research Skill:**
   Explore new domains of knowledge in Electronics and Telecommunication Engineering through literature survey, problem formulation and application of appropriate research methodology for innovative solutions.

5) **Usage of Modern Tools:**
   Use hardware and software tools for conceptualizing, designing and analyzing the solutions of engineering problems.

6) **Collaborative and Multidisciplinary Work:**
   Work collaboratively to apply domain knowledge for multidisciplinary applications and further dissemination of such knowledge to the others.

7) **Project Management and Finance:**
   Demonstrate knowledge, understanding of engineering and management principles as a member,

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leader in a team and manage project efficiently with techno-commercial aspects.

8) **Communication:**
Document, communicate and present engineering knowledge effectively.

9) **Life-long Learning:**
Engage in life-long learning with continuing educational/professional development.

10) **Ethical Practices and Social Responsibility:**
Acquire professional and intellectual integrity and adopt ethical practices leading to sustainable development of society.

11) **Independent and Reflective Learning:**
Observe and examine critically the outcomes of one's actions and make corrective measures subsequently and learn from mistakes without depending on external feedback.

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GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics and Telecommunication Engineering

Teaching and Evaluation Scheme

M.Tech.(Electronics and Telecommunication Engineering) Full Time CBCS Pattern

(From 2019-20 onwards)

Semester I

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
							Theory			Term Work	Practical/ Viva-voce	Total
			L	T	P		Test	TA	ESE			
1	ET51001	Advanced Digital Signal Processing	3	-	-	3	20	20	60	-	-	100
2	ET51003	Advance Industrial Automation	3	-	-	3	20	20	60	-	-	100
3		Program Elective I	3	-	-	3	20	20	60	-	-	100
4		Program Elective II	3	-	-	3	20	20	60	-	-	100
5	GE51001	Research Methodology	2	-	-	2	20	20	60	-	-	100
6		Audit Course I	2	-	-	--	-	-	-	-	-	-
7	ET51002	Lab- Advanced Digital Signal Processing	-	-	4	2	-	-	-	25	25	50
8	ET51004	Mini Project with Seminar I	-	-	4	2	-	-	-	25	25	50
		Total Semester I	**16**		**08**	**18**	**100**	**100**	**300**	**50**	**50**	**600**

Semester II

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
							Theory			Term Work	Practical/Viva -voce	Total
			L	T	P		Test	TA	ESE			
1	ET51005	Digital Communication System	3	-	-	3	20	20	60	-	-	100
2	ET51007	Modern Computer Network	3	-	-	3	20	20	60	-	-	100
3		Program Elective III	3	-	-	3	20	20	60	-	-	100
4		Program Elective IV	3	-	-	3	20	20	60	-	-	100
5		Program Elective V	3	-	-	3	20	20	60	-	-	100
6	ET51006	Lab. Digital Communication System	-	-	4	2	-	-	-	25	25	50
7	ET51008	Lab. Open Source Software and Simulation	-	-	4	2	-	-	-	25	25	50
8	ET51009	Mini Project with Seminar II	--	-	4	2	-	-	-	50	50	100
		Total Semester II	**15**		**12**	**21**	**100**	**100**	**300**	**100**	**100**	**700**

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GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

Department of Electronics and Telecommunication Engineering

Teaching and Evaluation Scheme

M.Tech.(Electronics and Telecommunication Engineering) Full Time CBCS Pattern

(From 2019-20 onwards)

The student shall select any one of the specialization as per options given below. The option once registered shall not be changed / altered

Sr. No.	Option-I Course code	Option-I (Specialization in Industrial Automation and Control)	Option-II Course code	Option-II (Specialization in Signal and Image Processing)	Option-III Course code	Option-III (Specialization in Computer Applications)	Option-IV Course code	Option-IV (Specialization in Digital Communication)
Program Elective-I	ET51101	Advance Embedded System	ET51201	Digital Image Processing and Applications	ET51301	Cloud Computing	ET51401	Information Theory and Coding
Program Elective-II	ET51112	Robotics	ET51202	Multivariate and Adaptive Signal Processing	ET51302	Web and Information Security	ET51402	Wireless Mobile Communication
Program Elective-III	ET51103	Automotive Electronics	ET51203	Pattern Recognition	ET51303	Big Data Analysis	ET51403	Wireless Sensor Network
Program Elective-IV	ET51104	IOT and Systems	ET51204	Speech and Audio Processing	ET51304	Android Applications	ET51404	Smart Antenna and Arrays
Program Elective-V	ET51105	Digital System Design	ET51205	Biomedical Signal Processing	ET51305	Artificial Intelligence and Machine Learning	ET51405	RF Circuit Design

Student may select any one of the following course for Audit Course I

Sr. No.	Course code	Title of Audit course
1.	SW51001	English for Research Paper Writing
2.	SW51002	Disaster Management
3.	SW51003	Sanskrit for Technical Knowledge
4.	SW51004	Value Education
5.	SW51005	Constitution of India
6.	SW51006	Pedagogy Studies
7.	SW51007	Stress Management by Yoga
8.	SW51008	Personality Development through Life Enlightenment Skills

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SEMESTER III

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
							Theory			Term Work	Practical/Viva-voce	Total
			L	T	P		Test	TA	ESE			
1		Open Elective	3	-	-	3	20	20	60	-	-	100
2	ET61001	Dissertation I	-	-	20	10				50	50	100
		Total Semester III	**3**		**20**	**13**	**20**	**20**	**60**	**50**	**50**	**200**

*Students going for Industrial Project/Thesis will complete these courses through MOOCs.

L-Lectures, T-Tutorials, P-Practical, TA-Teacher Assessment, ESE-End-Semester Examination
Open Elective: ET61003 - Soft Computing

SEMESTER IV

Sr. No.	Course Code	Subject	Scheme of Teaching (Hrs/Week)			Total Credits	Scheme of Evaluation (Marks)					
							Theory			Term Work	Practical/Viva-voce	Total
			L	T	P		Test	TA	ESE			
1	ET61002	Dissertation II	-	-	32	16				100	150	250
		Total Semester IV	-	-	**32**	**16**				**100**	**150**	**250**
		TOTAL OF ALL SEMESTERS	**38**	--	**72**	**68**	**220**	**220**	**660**	**300**	**350**	**1750**

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ET51001: Advance Digital Signal Processing

Compulsory

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To expose the students to the fundamentals of digital signal processing in frequency domain& its application.
- To teach the fundamentals of digital signal processing in time-frequency domain& its application.
- To compare Architectures & features of Programmable DSP processors.
- To discuss on Application development with commercial family of DS Processors.
- To introduced concept of Wavelet transform in context of real time application.
- To implement DSP algorithms using DSP Processors.

Course Outcomes : Students will be able to

- Understand the basic estimate the spectra of signals that are to be processed by a discrete time filter, and to appreciate the performance of a variety of modern and classical spectrum estimation techniques.
- Design of linear and adaptive systems for filtering and linear prediction.
- Apply various real world problems using transforms and Digital Signal Processing, digital filter design, including hands-on experience with important techniques and digital simulation experiments.
- Design of linear and adaptive systems for filtering and linear prediction.
- Understand the importance of signal processing is DSP processor architecture and its application in real time domain in communication, computer network, speech, image
- Understand the basic theory of wavelet transform and the concepts of using simple wavelets for simple application.

UNIT-1

Introduction To Digital Signal Processing

Introduction, A Digital Signal-Processing System, The Sampling Process, Discrete Time Sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear Time-invariant Systems, Decimation and Interpolation, Digital Filters, Random signal.

UNIT-2

1.FIR and IIR Filters

Difference equation for digital filters: Definition and properties. FIR filters, IIR filters. Digital filter design techniques: Impulse invariance. Bilinear transformation, finite difference, window design methods, frequency sampling optimization algorithms.

2.**Adaptive Filters**

Principles of adaptive filter, FIR adaptive filters, Newton Descent algorithm, LMS algorithm, Adaptive noise cancellation, Adaptive equalizer, adaptive echo cancellation.

UNIT-3

1.Spectral Estimation: Non-parametric methods and parametric method.

2.Linear Prediction and Coding

Forward and Backward linear prediction, Filtering-FIR Wiener filter, Filtering and linear prediction, non-causal and causal IIR wiener filter, Discrete Kalman filter.

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UNIT-4

Wavelet Transform

Introduction to continuous wavelet transform- discrete wavelet transform -orthogonal wavelet decomposition- Multiresolution Analysis-Wavelet function-DWT, bases, orthogonal Basis-Scaling function, Wavelet coefficients- ortho normal wavelets and their relationship to filter banks- Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal-Example MRA- Haar and Daubechies wavelet.

UNIT-5

Architectures Of Commercial Digital Signal Processors

Introduction, categorization of DSP Processors, Fixed Point (Black fin),Floating Point (SHARC),TI TMS 320c6xxx & OMAP processors TMS320C54X & 54xx on Basic Architecture – comparison : of functional variations of Computational building blocks, MAC, Bus Architecture and memory, Data Addressing, Parallelism and pipelining, Parallel I/O interface, Memory Interface, Interrupt, DMA (one example Architecture in each of these case studies).

TEXT AND REFERENCE BOOKS

1)Proakis, J. G., Rader, C. M., Ling, F., and Nikias, C. L, Advanced Digital Signal Processing, Macmillan,1992

2)J.G. Proakis& D. G. Manotakis Digital signal Processing, Principles algorithms & applications, PHI

3)Monson H. Hayes, Statistical Digital Signal Processing and Modeling, John Wiley and Sons, Inc,Singapore,2002

4)John J. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Pearson Education,2002

5)Rabiner, L. R. and Schafer, R. W Theory and Application of Speech Processing,PHI,1978

6)Widrow, B. and Stearns, S. D Adaptive Signal Processing,PHI,1985

7)Haykin, S, Adaptive Filter Theory,PHI,2001

8)Emmanuel C Ifeachor, Barrie W Jrevis, Digital Signal Processing, Pearson Education

9)Analog Devices & Texas Instruments Users Manuel of TMS320CX and ADSP2106x.

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

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ET51002: Lab. Advanced Digital Signal Processing

Teaching Scheme

Practical : 4 Hrs/Week
Total Credits : 2

Examination Scheme

Term Work : 25 Marks
Practical Examination & Viva Voice : 25 Marks

Course Educational Objectives:

Real-time signal processing experiments and design projects using special purpose DSP processor. Focus on C programming for embedded platforms. Understand real-time processing system issues including constraints of embedded systems and complexity analysis for improved algorithm design.

Course Outcomes : Students will be able to

- Understanding of the digital signal processing theory (including sampling theory, FIR and IIR filter theory, and spectral analysis) and the ability to apply this theory to real-world signal processing applications.
- Learning real-time signal processing implementation relevant to current industrial practice.
- Obtaining a significant open-ended engineering design experience through learning, applying, and implementing advanced signal processing methods.
- Design of linear and adaptive systems for filtering and linear prediction.
- Design of real time system: code should be optimized so that algorithms run efficiently on the DSP board.

List of Experiments: Perform practical of ADSP

- DSP Starter Kit (C54/C62X) with IDE – Code Composer Studio and an efficient optimizing C/C++ compiler
- Use Tool of MATLAB/Labview / VLSI DSP code. The lab exposes students to FFT implementation using a DSP Simulator

Sr.No.	List of Experiments
1.	Implementation of IIR/FIR filter (LPF/BPF/HPF/BSF) design using a DSP (C50/C54/C62X)/MATLAB/C/Lab.
2.	Design a decimator using FIR filter.
3.	Sampling, Filters and FFTs: Effect of a low pass filter has on a signal that contains a high and low frequency component. Also to use Fourier Transforms to look at the effect that different sampling rates and sampling window sizes have on the frequency composition of signal.
4.	Implementation of an ADPCM system.
5.	Implementation of a BPSK/QPSK/GMSK system.
6.	Demonstrate the effect of decimation in the spectrum of the signal.
7.	Describe the process of decimation and its spectral effects.
8.	Write a code on spectral analysis Show(ECG/ EEG/Speech/Video) *analysis* often involves *estimation of the* power *spectral* density or PSD.

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9.	Perform practical in filtering: Analysis of signal spectrum ,Signal separation through filtering.
10.	LMS finite impulse response (FIR) adaptive filter by using LabVIEW/Matlab/DSP Board.
11.	Demonstrate adaptive filtering.
12.	Perform program on Wavelet Transform DWT and CWT.
13.	Write a program for computing the *Linear Prediction* Coefficients (LPCs) by autocorrelation method using direct matrix solving approach.
14.	Simulation of the LPC Speech Coder.
15.	Simulation of the CELP Speech Coder.
16.	Linear Predictive Coding: Write a code compress or encode the speech/audio data to meet the bandwidth specs.
17.	Design of an *adaptive filter* for active noise cancellation.
18.	Real time Applications of Wavelet Transform.

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ET51003: Advanced Industrial Automation
Compulsory

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To analyze and provide solutions to industrial problems.
- To interact with industry to reciprocate knowledge and innovative ideas to serve the community and economy.
- To Study various Industrial Protocols.
- To use latest technology of controllers.
- To get Involve in high quality research solutions to the needs of the Indian industry.
- To understand plant, sub plant and instrumentation process used in various process industries.

Course Outcomes : Students will be able to

- To understand the principles of Programmable Logic Controllers (PLCs), Virtual Instrumentation, SCADA, MMI (Man Machine Interface).
- To Study Industrial Automation using computer control systems.
- To apply fuzzy controllers in real world industrial processes.
- To use various Industrial Protocols.
- To apply plant, sub plant and instrumentation process used in various process industries.

UNIT-1

Controllers and Distributed Control Systems

Basic concepts, Mathematical modeling, controllers ON/OFF, P,PI,PD,PID controllers, Distributed control systems (DCS): Definition, Local Control (LCU) architecture, LCU communication facilities, configuration of DCS, displays - case studies in DCS.

UNIT-2

Industrial Control System

Data loggers, Data Acquisition Systems (DAS), Direct Digital Control (DDC). Supervisory Control and Data Acquisition Systems (SCADA). Functional block diagram of computer control systems. Alarms, interrupts, controller software, Digital controller modes.

UNIT-3

Industrial Communication Protocols

Use of field buses in industrial plants, functions, international standards, performance, use of Ethernet networks, Field-bus advantages and disadvantages. Field-bus design, installation, sensor networks. Global system architectures, advantages and limitations of open networks, HART network and Foundation field bus network.

UNIT-4

Process and Plant Control

NC, CNC, and DNC machines. Simulation and process control Study of plant, sub plant and instrumentation process used in thermal power station, sugar cement paper and pharmaceutical industries.

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Council, Dated 26 August 20

UNIT-5
Fuzzy Controllers

Fuzzy sets and Basic notions, Fuzzy relation calculations, Fuzzy members, Indices of Fuzziness, comparison of Fuzzy quantities, Methods of determination of membership functions. Fuzzy Logic Based Control: Fuzzy Controllers, case studies.

TEXT AND REFERENCE BOOKS

1) B.G. Liptak, Instrumentation Engineer Handbook
2) B.G. Liptak, Process software and digital networks, CRC press,3rdEdition
3) Noltingk B. E., Instrumentation Reference Book, Butterworth, 2ndEdition
4) Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to Machine Intelligence, PHI
5) Curtis D. Johnson, Process Control Instrumentation Technology, PHI, 4thEdition
6) P.B. Deshpande and Raymond H. Ash Computer Process Control
7) Rolf Insermann, Digital Computer System, Vol I Fundamental Deterministic control

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

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ET51004: Mini Project with Seminar-I
Compulsory

Teaching Scheme			**Examination Scheme**		
Practical	:	4 Hrs/Week	Term Work	:	25 Marks
Total Credits	:	2	Practical Examination & Viva Voice	:	25 Marks

Course Educational Objectives:

- To implement new ideas with suitable testability and analysis.
- To develop proficiency in specific lab techniques.
- To design and build hardware / software for given task.

Course Outcomes : Students will be able to

- Comprehend, illustrate, explain and apply concepts and theories.
- To write analytical technical report.
- To present and discuss the technical work.
- To develop capability to perform lab work in order to gain expertise.

Individual student or group of two (max)student will perform the work as per following and submit the report based on result obtained and/or study perform under the guidance of respective guide (min 25 pages)

The work will be assessed by oral/practical examination of two hours duration by two examiners out of which one will be respective guide or the teacher nominated by head of the department in the absence of respective guide on schedule .second examiner will be eminent teacher or professional / expert from industry.

Work will be carried out by the student:

1) Student will perform experimentation in any subject laboratory of the department/institute as assigned by the respective guide, leading towards concept understanding, development of laboratory set up and/or learning resources.

OR

2) Student will perform literature survey about the topic and /or concerned subject laboratory assign by respective guide, leading towards the details for modernization, research and development or thrust area subject laboratories (Thrust area should be as per Government of Maharashtra / Govt. of India policies and AICTE/UGC/DST/DRDO/ISRO etc guide lines).

OR

3) Student will develop ,specific software using C/C++/VB/VC/JAVA etc which will improve functions of system (Subject Laboratory/ Library /Student Section/ Office/ Exam System etc) as assigned by respective guide.

OR

4) Student will perform detailed hardware and software designing of product /system concerned to the subject laboratory leading towards post graduate dissertation

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ET51005: Digital Communication System
Compulsory

Teaching Scheme		Evaluation Scheme	
Lectures : 3 Hrs/Week		Test	: 20 Marks
Total Credits : 3		Teacher Assessment	: 20 Marks
		End-Semester	: 60 Marks

Course Educational Objectives:

- To give overview of Digital Modulation Techniques.
- To use the concept of entropy to analyze performance of Digital Communication System.
- To study waveform coding techniques.
- To emphasize the conceptual understand of Error control coding and decoding.
- To study Spread Spectrum techniques.

Course Outcomes : Students will be able to

- Analyze Digital modulation techniques and compare.
- Analyze waveform coding techniques and their performance in presence of noise.
- Simulate error control coding.
- Examine performance of Digital Communication System and its limitations.
- Learn efficient utilization of band width and power of Digital Communication Systems.

UNIT-1
Sampling Process
Sampling theorem, Quadrature sampling of band pass signals, Reconstruction of a message processes from its samples, Signal distortion in sampling, Practical aspects of sampling and signal recovery, Pulse amplitude modulation, Time division multiplexing.

UNIT-2
Waveform Coding Techniques
Pulse -code modulation, Channel noise and error probability, Quantization Noise and signal-to-noise ratio, robust quantization, differential PCM, delta modulation, coding speech at low bit rates, applications.

UNIT-3
Digital Modulation Techniques
Digital modulation formats, coherent binary modulation techniques, coherent quadrature modulation technique, non coherent binary modulation technique, comparison of binary and quaternary modulation technique, M-ary modulation techniques, power spectra, Bandwidth efficiency, M-array modulation format viewed in light of the channel capacity theorem, effect of inter symbol interference, bit versus symbol error probabilities, synchronization, applications.

UNIT-4
Error Control Coding
Rationale for coding, types of codes, Discrete memory less channels, linear block codes, cyclic codes, convolution codes, maximum likelihood decoding of convolution codes, distance properties of convolution codes, sequential decoding of convolution codes, Trellis codes, applications.

UNIT-5

Spread Spectrum Modulation

Pseudo noise sequences, a notion of spread spectrum, direct sequence coherent binary phase shift keying, signal space dimensionality and processing gain, probability of error, Frequency Hop spread spectrum, applications.

TEXT AND REFERENCE BOOKS

1) Simon Hykin: Digital Communication ,Wiely Publication
2) J. Das, S. K. Mulliek and P.K Chatterjee: Principal of Digital Communication, Wiley Eastern Ltd. Second Reprint-1992
3) P. Chakrabarti : Principles Of Digital Communication DhanpatRai and Co-FirstEd.1999
4) Bearnard SKLAR : Digital Communication Fundamentals and Applications, Pearson Education Asia,Ed.2001
5) K.Shunmugham- Digital Communication Systems, Wiely Publication

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

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ET51006: Lab. Digital Communication System
Compulsory

Teaching Scheme			**Examination Scheme**		
Practical	:	4 Hrs/Week	Term Work	:	25 Marks
Total Credits	:	2	Practical Examination & Viva Voice	:	25 Marks

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will be able to:

CO1	Perform all modulation and demodulation techniques
CO2	Find out the effect of parameters on performance of modulation and demodulation techniques
CO3	Interpret the performance of coding techniques
CO4	Use modern tools for simulation for modulation

List of Experiments

1.	Perform Pulse Amplitude Modulation and TDMA. Find out the effect of change of sampling frequency on signal recovery
2.	Perform all types of pulse modulations
3.	Interpret the performance of modulation technique in presence of noise by EYE diagram
4.	Perform all types of PSKs and compare their performance
5.	Perform all types of Frequency Shift Keying and compare their performance
6.	Perform PCM . Find out the effect of changing step size
7.	Simulate Spread Spectrum modulation techniques
8.	Find out information entropy of given signal
9.	Perform Haffman coding
10.	Perform Linear block coding
11.	Perform Cyclic coding

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ET51007: Modern Computer Network
Compulsory

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To understand the various error controlling techniques in data communication networks.
- To learn the functions of different protocols.
- To understand TCP/IP & Application layer protocols and its uses in modern communication.
- To identify different components of data communication network & IOT.

Course Outcomes : Students will be able to

- Identify the issues and challenges in the architecture of a computer network and recognize security issues in a network.
- Understand the ISO/OSI seven layers in a network.
- Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
- Choose the required protocol and the communication modes for the given system. Analyze topological and routing strategies for an IP based networking, IOT.

UNIT-1

Data Communication, Networks, Protocols and Standards, Topology, Categories of Networks, OSI & TCP/IP Protocol suites Guided media, Unguided media.

UNIT-2

Data Link Layer Design Issues : Framing, Error control, Flow control, practical data link protocols, Medium Access Technique : Ethernet, CSMA /CD protocol High speed LAN's like FDDI, Ethernet.

UNIT-3

Network Layer & Design Issues: Routing & congestion control algorithms, IP addressing, OSPF & BGP, CIDR & IPV6 Transport Layer: Transport Protocols, Addressing, Establishing & releasing a connection Transport protocol for Internet TCP & UDP.

UNIT-4

Application Layer Protocols. A web server implementation, Study of client-server implementation. Introduction to Network security, firewall, network intrusion detection system.

UNIT-5

Networking simulation and modeling techniques. Case studies. Internet of Things Architecture Introduction, Reference Model Case Study.

TEXT AND REFERENCE BOOKS

1) Behrouz A. Forouzan, Data Communications and Networking, 2nd Edition, Tata McGowan-Hill, New Delhi, 2003.
2) Andrew S. Tanenbaum, Computer Networks, 4th Edition, Prentice-Hall of India, New Delhi, 2000.
3) William Stallings, Data and Computer Communication, 6th Edition, Prentice Hall of India, New Delhi, 1999.
4) Douglas E Comer, Computer Networks and Internet, Pearson Education Asia, 2000.
5) Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, 3rd edition (2003), Morgan Kaufmann Publishers.

List of Reference Sources for Classes and Assignments: Request for Comments, Network Standards, available from
http://www.rfceditor.org/rfcsearch.html;
IEEE Communications Magazine (technical journal)
IEEE Journal on Selected Areas in Communications (technical journal)
IEEE Network (technical journal)
IEEE Spectrum (technical journal)
IEEE Transactions on Communications (technical journal)
Resources available on e-learning site http://www.e-gecaect.com
Computer Networks and ISDN Systems (technical journal)
Cisco Systems Technical Journal

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

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ET51008: Lab. Open Source Software and Simulation

Compulsory

Teaching Scheme			**Examination Scheme**		
Practical	:	4 Hrs/Week	Term Work	:	25 Marks
Total Credits	:	2	Practical Examination & Viva Voice	:	25 Marks

Course Educational Objectives:

- To implement new ideas with suitable testability and analysis.
- To develop proficiency in specific lab techniques.
- To design and build hardware / software for given task.

Course Outcomes : Students will be able to

- Comprehend, illustrate, explain and apply concepts and theories.
- To write analytical technical report.
- To present and discuss the technical work.
- To develop capability to perform lab work in order to gain expertise.

Students shall learn based on following:

1. Introduction to Open sources, Need of Open Sources, Open source operating systems: LINUX: Introduction, Development with any one Linux distributions Ubuntu, Fedora, opens USE, Enterprise Desktop & Server
   Practical will be based on;
   1) Installation
   2) Basic Commands and Utilities
   3) Features of Operating system
2. Open Source Programming Languages
   Java, PHP: Introduction, PHP and SQL database, Python Practical will be based on
   1) PHP and Python operators, Statements, Functions and Scripts
   2) PHP and SQL database connectivity
   3) Small programs in PHP/Python
   4) Java Eclipse IDE and Netbeans
3. Open Source Application Packages: SciLab, Open office, Latex , GCC, NASM, Android SDK Practical will be based on
   1) SciLab
   2) Open office,Latex
   3) GCC,NASM
   4) AndroidSDK

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TEXT AND REFERENCE BOOKS

1. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", WileyPublications,2003
2. Steve Suchring, "MySQL Bible", John Wiley,2002
3. RasmusLerdorf and Levin Tatroe, "Programming PHP", O Reilly,2002
4. Wesley J. Chun, "Core Python Programming", Prentice Hall,2001
5. Martin C. Brown, "JAVA: The Complete Reference" 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint2009
6. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009
7. VikramVaswani, "MYSQL: The Complete Reference", 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint2009

Approved in XXth Academic Council, Dated 26 August 2019

ET51009: Mini Project with Seminar-II
Compulsory

Teaching Scheme			**Examination Scheme**		
Practical	:	4 Hrs/Week	Term Work	:	25 Marks
Total Credits	:	2	Practical Examination & Viva Voice	:	25 Marks

Course Educational Objectives:

- To implement new ideas with suitable testability and analysis.
- To develop proficiency in specific lab techniques.
- To design and build hardware / software for given task.

Course Outcomes : Students will be able to

- Comprehend, illustrate, explain and apply concepts and theories.
- To write analytical technical report.
- To present and discuss the technical work.
- To develop capability to perform lab work in order to gain expertise.

Individual student or group of two (max)student will perform the work as per following and submit the report based on result obtained and/or study perform under the guidance of respective guide (min 25 pages)
The work will be assessed by oral/practical examination of two hours duration by two examiners out of which one will be respective guide or the teacher nominated by head of the department in the absence of respective guide on schedule .second examiner will be eminent teacher or professional / expert from industry.

Work will be carried out by the student:

5) Student will perform experimentation in any subject laboratory of the department/institute as assigned by the respective guide, leading towards concept understanding, development of laboratory set up and/or learning resources.

OR

6) Student will perform literature survey about the topic and /or concerned subject laboratory assign by respective guide, leading towards the details for modernization, research and development or thrust area subject laboratories (Thrust area should be as per Government of Maharashtra / Govt. of India policies and AICTE/UGC/DST/DRDO/ISRO etc guide lines).

OR

7) Student will develop ,specific software using C/C++/VB/VC/JAVA etc which will improve functions of system (Subject Laboratory/ Library /Student Section/ Office/ Exam System etc) as assigned by respective guide.

OR

8) Student will perform detailed hardware and software designing of product /system concerned to the subject laboratory leading towards post graduate dissertation

Approved in XXth Academic Council, Dated 26 August 2019

ET51101: Advanced Embedded Systems
Elective

Teaching Scheme

Lectures : 3 Hrs/Week
Total Credits : 3

Evaluation Scheme

Test : 20 Marks
Teacher Assessment : 20 Marks
End-Semester : 60 Marks

Course Educational Objectives:

- To develop understanding about requirements and general design methodology of Embedded Systems.
- To apply hardware and software knowledge for developing Embedded Systems as per requirements, specifications and constraints.
- To impart knowledge of serial communication protocols, ARM architecture and Real Time Operating Systems.
- To expose the students to development cycle of Embedded System.

Course Outcomes : Students will be able to

- Understand classification, design issues, components and peripherals of embedded systems.
- Understand ARM architecture, serial communication protocols and RTOS concepts.
- Interface different peripherals with assembly and C language programming to processors for engineering solution.
- Design embedded systems for various applications with ARM, cortex and Zynq.

UNIT-1

Introduction to Embedded Systems

Definition of Embedded System, Components of a typical Embedded System, Categories and Specialties of Embedded Systems, Processor, Memory, Peripherals, Software, Microcontroller. Overview of Embedded Processors, Introduction to RISC processors-Berkeley/ Stanford RISC model, Introduction to Real Time non-OS and RTOS systems.

UNIT-2

ARM as Embedded Processor

Overview of ARM based Embedded Systems, ARM Architecture and differentiation in Cortex Series (A, M, R), ARM Assembly Language, Thumb Instruction Set, ARM Basics-Register, Stack, RAM Cache, Memory Management Unit, Memory Protection Unit, Interrupt and Exception Handling, Introduction to Floating Point Unit.

UNIT-3

Basic Peripherals

Introduction to Parallel and Serial I/O, Timers/counters, Real Time Clocks, SPI, USB, Introduction to PCI Express and AXI Bus.

UNIT-4

Embedded System Development

ARM Assembly Language Programming using Keil, Assembly programming using ARM Cortex, Introduction to Embedded C Programming, C Programming for ARM Cortex.

Approved in XXth Academic Council, Dated 26 August 2019

UNIT-5

System on Chip

Introduction to ZynqSoC, Anatomy of Embedded SoC, IP block design, High Level Synthesis, Embedded Processing with ARM Cortex-A9 using High Level Synthesis, Linux and RTOS on Zynq, Case Study- Video Processing and Computer Vision on Zynq.

Text Books

1) ARM System Developer's Guide, Andrew N. Sloss, Dominic Symes, Chris Wright, ELSEVIER, 2005, ISBN 8181476468, 9788181476463
2) ARM System-On-Chip Architecture, 2ND ED, Steve Furber, Pearson Education, 2007, ISBN 8131708403
3) Embedded Systems Design, 2ND ED, Steve Heath, Newnes, 2003, ISBN 0750655461
4) Professional Embedded ARM Development, James A. Lang bridge, John Wiley & Sons, Inc., 2014, ISBN 9781118788943
5) The Zynq Book, 1ST ED, Louise H. Crockett, Ross A. Elliot, Martin A. Enderwitz, Robert W. Stewart, Strathclyde Academic Media, 2014
6) ARM Assembly Language Fundamentals and Techniques, 2ND ED, William Hohl, Christopher Hinds, CRC Press, 2015, ISBN 9781482229868

Reference Books

1) ARM Assembly Language with Hardware Experiments, Ata Elahi, Trevor Arjeski, Springer, 2014, ISBN 9783319117034
2) PCI System Architecture, 4TH ED, Tom Shanley, Don Anderson, MindShare Inc. PEARSON Education, 2006, ISBN 813170100X

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51112: Robotics Elective	
Teaching Scheme **Lectures: 03 Hrs/week** **Total credits: 03**	**Examination Scheme** **Test : 20 Marks** **Teachers' Assessments: 20 Marks** **End Semester Exam: 60 Marks**

Prerequisites: Basic knowledge of Electronics

Course description: The course gives exposure to fundamentals of Robotics- Mechanical Systems, Microprocessors and Microcontrollers, Sensors and Actuators, Image Acquisition and Processing, Speech Processing. This course introduces Robot Operating System and Programming is C. This course discusses the applications of Robot in Industry and Home.

Course objectives: The course has the following objectives:

- To develop understanding Robotics components
- To know the classification of Robots
- To impart knowledge of Microprocessors and Microcontrollers
- To expose the students to Robot control and Robot Operating System

Course Outcomes: After completing the course, the students will able to:

CO1	Learn classification and mechanics and controls involved in Robot	**K1**
CO2	Understand data acquisition and processing	**K2**
CO3	Explore role of Sensors and Actuators in Robotics	**K3**
CO4	Study Machine Learning and AI	**K2**
CO5	Understand the role of Computer Vision in Robotics	**K2**
CO6	Understand various classes of Robots	**K1**

Detailed Syllabus:

Unit	Content
Unit-I	**Mechanical Systems in Robotics** Motion Control Classification, Open and Closed Loop Systems, Mechanical Components, Motors and Motor Drives- Servo Motors and Stepper Motors, Brushless DC Motors, Feedback Sensors- Linear and Rotary Encoders, Magnetic Encoders, Tachometers, Linear and Angular Displacement Transducers, Actuators- Solenoids. Power Transfer Mechanisms- Belts, Chains, Gears, Worm Gears, Rocker and Cam, Rack and Pinion, Walkers- Leg Actuators, Leg Geometry, Walking Techniques
Unit-II	**Data Acquisition and Processing** Sensors- Ultrasonic, Accelerometer, Temperature, Ambient Light, Ambient Temperature, Pressure, Strain Gauges, Smoke sensors, Signal Pre-conditioning, Instrumentation Amplifier, Analog to Digital Conversion, Microprocessors and Microcontrollers for Robotics- their choice, architecture, ATMEGA328p, STM32 Microcontroller, Multicore SOCs, Introduction to C and Robotic Operating System
Unit-III	**Robotic Vision System** Camera Specifications, Camera SOC, .Image Formats, Multiresolution Images, Compression Formats, Image Processing System, introduction to segmentation and classification, introduction to Open CV system. Introduction to Speech acquisition and storage, Speech Synthesis.
Unit-IV	**Robotic Control Systems** Wheeled Robotic System, feedback control systems, study and application of PID controller to motion control, stability analysis Study of Robotic Arm

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Unit-V	**Machine Learning** Introduction to AI and Machine Learning, Data Processing and Storage, Data Mining basics, interface to cloud, introduction to Machine to Machine Communication, Data Interpretation and inference engine

Text and Reference Books

1. Robot Mechanisms and Mechanical Devices – *Paul E. Sandin,* McGraw Hill, New York
2. Embedded C Programming and the Atmel AVR – *Richard H. Barnett, Sarah Cox, Larry O'Cull,* Thomson Delmar Learning, Canada
3. Mastering STM32, *Carmine Noviello*, Learn Pub
4. Robot Operating System (ROS), *AnisKoubaa*, Springer International Publishing

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51103: Automotive Electronics
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To understand the concepts of Automotive Electronics and it's evolution and trends
- Automotive systems & subsystems overview.
- To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
- To understand, design and model various automotive control systems using Model based development technique.
- To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software.
- To describe various communication systems, wired and wireless protocols used in vehicle networking.
- To understand Safety standards, advances in towards autonomous vehicles.
- To understand vehicle on board and off board diagnostics.

Course Outcomes : Students will be able to

- Obtain an overview of automotive components, subsystems, design cycles, communication protocols and safety systems employed in today's automotive industry.
- Interface automotive sensors and actuators with microcontrollers.
- Develop, simulate and integrate control algorithms for ECUs with hardware.

UNIT-1

Automotive Fundamentals - The engine-components-Drive train -Starting &charging systems operation- Ignition system- Suspension systems-brakes -ABS - Steering system.

UNIT-2

Automotive Sensors - Temperature sensor-gas sensor-knock sensor-pressure sensor - flow sensor-torque sensor-crash sensor-Speed sensor and acceleration sensor-micro sensor-smart sensor-operation, types, characteristics, advantages and their applications.

UNIT-3

Smart Sensors - Basic sensor arrangement – Types of sensors. Oxygen Sensor – Cranking Sensor – Position Sensors – Engine cooling water temperature Sensor – Engine oil pressure Sensor – Fuel metering – Vehicle speed sensor and detonation sensor – Stepper motors – Relays - Microprocessor and Micro Computer applications in automobiles.

UNIT-4

Electronic management - Electronic management of chassis systems, Vehicle motion control, anti - lock braking system, Tyre pressure monitoring system, Collision avoidance system, Traction control system, Active suspension system Key less entry system and Electronic power steering system. Fault finding and diagnostics system.

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UNIT-5

Vehicle Intelligence - Introduction -basic structure-vision based autonomous road vehicles-architecture for dynamic vision system features-applications- A visual control system using image processing and fuzzy theory-An application of mobile robot vision to a vehicle information system.-object detection, collision warning and Avoidance system, Tyre

Text Books

1) Williams. B. Ribbens: "Understanding Automotive Electronics", 6th Edition, Elsevier Science, Newnes Publication, 2003.
2) Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.

REFERENCE BOOKS:

1) Ronald K Jurgen: "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2) James D. Halderman: "Automotive Electricity and Electronics", PHI Publication.
3) Terence Rybak& Mark Stefika: "Automotive Electromagnetic Compatibility (EMC)", Springer, 2004.
4) Allan Bonnick: "Automotive Computer Controlled Systems, Diagnostic Tools and Techniques", Elsevier Science, 2001.
5) UweKieneke and Lars Nielsen: "Automotive Control Systems: Engine, Driveline and Vehicle", 2nd Edition, Springer Verlag, 2005.
6) David Alciatore& Michael Histand: "Introduction to Mechatronics and Measurement Systems (SIE)", TMH, 2007.
7) Iqbal Husain: "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
8) Tom Denton: "Advanced Automotive Diagnosis", 2nd Edition, Elsevier, 2006.

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51104: IOT and System
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- Students will understand the concepts of Internet of Things and can able to build IOT applications.
- To explore the principles of IOT, its architecture for IOT systems
- To make the students understand the building blocks of Internet of Things and characteristics.

Course Outcomes : Students will be able to

- Understand the concepts of Internet of Things.
- Analyze basic protocols in serial communication, wireless data transfer and design principles.
- Implement basic IOT applications on embedded platform.

UNIT-1

Automotive Fundamentals - The engine-components-Drive train -Starting &charging systems operation- Ignition system- Suspension systems-brakes -ABS - Steering syste **IOT Platform overview:**

Overview of IoT supported Hardware Platform such as : Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo Boards, Network Fundamentals: Overview and working principle of Wired Networking equipment's-Router, Switches, Access Points, Hubs etc. Linux Network Configuration Concept.

UNIT-2

IOT Architecture:

History of IOT, M2M, Web of Things, IOT protocols, Remote Monitoring & Sensing, Remote Controlling, Performance Analysis, The layering Concept, IOT Communication Pattern, IOT protocols Architecture, The 6LoWPAN.

UNIT-3

Internet/Web and Networking Basics

OSI Model, Data transfer, referred with OSI model, IP Addressing, Point to Point data transfer, Point to Multipoint data transfer and Networking Topologies, Sub-netting network topologies referred with Web, Introduction to Web Servers, Introduction to Cloud Computing.

UNIT-4

Communication Protocols and Design Principles:

SPI, I2C, Firewire, LAN, MAC level, Link Protocols such as point to point protocols, Ethernet, Wi-Fi 802.11, Cellular Internet access and machine to machine, Web thinking for connected devices, Prototyping Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and production, changing embedded platform.

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UNIT-5

Case Studies and Advanced IOT Applications

IOT applications in home, infrastructure, buildings, security, Industries, home appliances, agriculture, environment and other IOT electronic equipment's Sensor and sensor node, interfacing using any target board.

Reference Books:

1) Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"
2) WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
3) Peter Waher, " Learning Internet of Things," PACKT publishing, Birmingham-Mumbai
4) Vijay Madisetti and ArshdeepBahga," Internet Of Things(A Hands-on-Approach)", 1st Edition, VPT, 2014.

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51105: Digital System Design
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To provide experience in designing integrated circuits using software tools.
- To introduce the fundamental principles of VLSI circuit design.
- To model, simulate, verify and synthesize with Hardware Description Languages.
- To examine the basic building blocks of large-scale digital integrated circuits.
- To develop different memory and programmable devices.
- To design for testability concepts.

Course Outcomes : Students will be able to

- Analyze the operation and performance of a finite state machine (FSM)design.
- Simulate hardware description language-based digital systems designs through modern electronic design automation software.
- Design of simple SSI and MSI combinational and sequential circuits for a targeted problem.
- Verify and test digital logic circuits and work upon testability.
- Synthesize large-scale digital systems designs suitable for Implementation on programmable device technologies.

UNIT-1

Analysis of Sequential systems: State tables and Diagrams, latches, flip flops, sequential machine analysis and design, Algorithmic State Machine diagrams, Design using ASM.

UNIT-2

Design using VHDL: Hardware Description Languages, HDL Design Flow, Hardware Simulation, Hardware Synthesis, Levels of Abstraction, Entities and architectures, Data objects, types, design description, libraries, synthesis basics, mapping statements to Gates, model optimization, verification, test benches, Architectural synthesis, optimization.

UNIT-3

Combinational and sequential circuit designs:

Use VHDL to design adders, decoders, multiplexers, comparators, code converters, latches, flip-flops, shift registers, counters, ALU, CPU.

UNIT-4

Memory, PAL, PLA, CPLDs and FPGAs

Design using ROM, Programmable Logic Arrays (PLA) and Programmable Array Logic (PAL).Types of memory devices, Read-Only Memory (ROM), Read / write memory, Static RAM, Dynamic RAM, Introduction to Xilinx XC9500 CPLD family and Xilinx XC 4000 FPGA family.

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UNIT-5

Design for testability

Testing combinational and sequential logic, Boundary scan testing, compression techniques and Built-in self test.

TEXT AND REFERENCE BOOKS

1) William I Fleatcher, An Engineering Approach To Digital Design, PHI
2) Giovanni De Micheli, Synthesis and Optimization of Digital Circuits, McGrawHill
3) Alan B. Marcovitz, Introduction to Logic and Computer Design, Tata McGrawHill
4) Charles H Roth, Jr., Digital System Design using VHDL, Brooks/Cole Thomson learning
5) VHDL Programming by examples, Perry, Tata McGrawHill
6) J.P. Hayes, Computer Architecture and Organization, McGrawHill
7) John F. Wakerley, Digital Design Principles and Practices, Pearson Education
8) Stephen Brown and ZvonkoVranesic, Fundamentals of Digital Logic with VHDL Design, McGrawHill
9)Melvin A Breuer, Arthur D. Friedem, MironAbraMovici, Digital System Design and Testability, JAICO publishing.

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51201: Digital Image Processing and Application
Elective

Teaching Scheme

Lectures : 3 Hrs/Week
Total Credits : 3

Evaluation Scheme

Test : 20 Marks
Teacher Assessment : 20 Marks
End-Semester : 60 Marks

Course Educational Objectives:

- To understand the principles of Digital Image Processing.
- To analyze the image signal in Spatial and Spatial frequency domain.
- To understand various Image Processing techniques for enhancement, segmentation, restoration, compression and implement using MATLAB.
- To apply Image Processing techniques to solve real world problems.

Course Outcomes : Students will be able to

- Apply image processing techniques in spatial and frequency domain.
- To apply various transforms on images and simulate its application to 2 D signals.
- Apply image restoration and encoding techniques.
- Study and implement various image segmentation approaches.
- To perform various images processing tasks and simulates them.
- Apply image processing techniques for real world applications.

UNIT-1
Introduction
Digital Image Representation, Sampling and Quantization, some basic relationship between Pixels, Image Geometry, Image Enhancement in spatial domain, spatial filtering.

UNIT-2
Image Transformation
Fourier Transform, The discrete Fourier Transform, properties of the Two dimensional Fourier Transform, The Fast Fourier Transform, Hadamand-Hough-Hotelling transform, Wavelet transforms, Enhancement in the Frequency Domain, Color Image Processing.

UNIT-3
Image Restoration
Degradation Model, Diagonalisation of Circulant and Block circulant Matrices, Algebraic approach to Restoration, Inverse Filtering, Least Mean Square Filter, Geometric Transformation.
Image Compression: Fundamentals Image Compression Models, Error-free Compression Lossy Compression.

UNIT-4
Image Segmentation
Edge Detection, Thresholding, Region based and motion based Segmentation, Morphology, Representation and Description:- Representation Schemes, Boundary Descriptors, Regional Descriptions, Relation Descriptors.

UNIT-5
Engineering Applications of Image Processing Multimodal Biometrics, Industrial Applications etc.

Approved in XXth Academic Council, Dated 26 August 2019

TEXT AND REFERENCE BOOKS

1) Gonzalez and Woods, Digital Image Processing, Pearson Education
2) A.K. Jain- Fundamentals of Digital Image Processing, PHI1007
3) W.K. Pratt – Digital Image Processing- Wiley New Delhi.1987
4) VasudevBhaskaran- Image and video Coding Standards- Cluwer Academic

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51202: Multivariate and Adaptive Signal Processing
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To provide comprehensive coverage of Gaussian random variables.
- To study multivariate time series: time and spectral domain approach.
- To understand the concept of adaptive signal processing.
- To study applications of multivariate and adaptive signal processing.

Course Outcomes : Students will be able to

- Apply spectral estimation techniques for signals.
- Analyze adaptive filters.
- Apply multivariate time series: time and spectral domain approach to signals.
- Apply multivariate and adaptive signal processing for biomedical applications.

UNIT-1

Gaussian Random Variables

Concept of random variables, Review of univariate Gaussian distributions , Multivariate Gaussian distributions, Assessing the relations among random variables: correlation, multiple correlation and partial correlation.

UNIT-2

Multivariate Time Series: Time Domain Approach

Concept of stochastic processes, Stationarity and ergodicity , Time series models a. AR Models b. ARMA Models , Estimating time series models from data ,Assessing the relations among time series, Information theoretic measures: Mutual information and complexity.

UNIT-3

Multivariate Time Series: Spectral Domain Approach

Spectral representation of stationary time series , Assessing the relations among time series in the spectral domain: coherence, multiple coherence ,and partial coherence, Estimating spectra: data based estimation versus model based estimation.

UNIT-4

Adaptive Filters

Stochastic Processes, Correlation Structure, Convergence Analysis, LMS Algorithm, Vector Space Treatment to Random Variables, Gradient Adaptive Lattice, Recursive Least Squares, Systolic Implementation & Singular Value Decomposition.

UNIT-5

Applications

Adaptive modeling and system identification, Multipath communication channel, geophysical exploration, FIR digital filter synthesis, applications of multivariate signal, biomedical signals, geophysical signals (several sensors monitoring earthquakes),image processing etc.

Approved in XXth Academic Council, Dated 26 August 2019

TEXT AND REFERENCE BOOKS

1)Proakis, J. G., Rader, C. M., Ling, F., and Nikias, C. L, Advanced Digital Signal Processing, Macmillan,1992

2)J.G. Proakis& D. G. Manotakis Digital signal Processing, Principles algorithms & applications, PHI

3)Monson H. Hayes

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation

Approved in XXth Academic Council, Dated 26 August 2019

ET51203: Pattern Recognition

Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To understand concepts of Statistical and Non parametric Decision making.
- To gain knowledge about clustering.
- To learn image analysis techniques.

Course Outcomes : Students will be able to

- Understand and analyze methods for automatic training of classification system.
- Design systems and algorithms for Pattern Recognition.
- Implement typical Pattern Recognition algorithms using MATLAB.
- Implement algorithms for real world problems.

UNIT-1

Introduction to Pattern Recognition

Pattern Recognition, Classification and description, Patterns and Feature extraction, training and learning in PR system, Pattern Recognition approaches.

UNIT-2

Statistical Decision Making

Probability, random variables, Joint Distribution and Densities, Minimum Risk Esimators, Bayes' Theorem, Multiple Features, Conditionally Independent Features, Decision Boundaries, Unequal Costs Of Errors, Estimation Of Error Rates, The Leaving-One-Out Technique, Characteristic Curves, Estimating The Composition Populations.

UNIT-3

Non parametric Decision Making

Histograms, Kernel and Window Estimators, Nearest Neighbor Classification Techniques, Adaptive Decision Boundaries, Adaptive Squared Error Discriminant Functions, Choosing A Decision Making Techniques.

UNIT-4

Clustering

Various clustering techniques, cluster analysis, Hierarchical Clustering, Partitional Clustering, algorithms for clustering data.

UNIT-5

Applications

Applications of Pattern Recognition, typical case studies of Pattern Recognition in data mining, medical imaging, industrial automation.

Approved in XXth Academic Council, Dated 26 August 2019

TEXT AND REFERENCE BOOKS

1) E. Gose, R. Johnson Baugh, S. Jost, Pattern Recognition & Image Analysis, PHI
2) R. O. Duda and P. E. Hart, Pattern classification and scene analysis, Wiley Inter science publications.
3)Robert Schaloff, Pattern recognition: statistical, structural and neural approaches, John Wiley and Sons. Inc

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51204: Speech and Audio Processing
Elective

Teaching Scheme

Lectures : 3 Hrs/Week
Total Credits : 3

Evaluation Scheme

Test : 20 Marks
Teacher Assessment : 20 Marks
End-Semester : 60 Marks

Course Educational Objectives:

- To present fundamentals of speech signal.
- To explain various parameters of speech signal using time domain and frequency domain methods.
- To confer comprehensive understanding of Linear prediction analysis and cepstral analysis.
- To explore the applications of speech and audio processing.

Course Outcomes : Students will be able to

- State fundamentals for speech signal.
- Describe features of speech signal using different analysis methods.
- Understand the speech signal in time domain and frequency domain.
- Interpret applications of speech and audio processing.

UNIT-1
Fundamentals of speech production
Anatomy and physiology of speech production, Human speech production mechanism. LTI model for speech production, Nature of speech signal, linear time varying model, articulatory phonetics, acoustic phonetics, Voiced and Unvoiced speech. Sound intensity and Decibel sound levels. Concept of critical band and introduction to auditory system as a filter bank, Uniform, non-uniform filter bank, mel scale and bark scale. Speech perception: vowel perception.

UNIT-2
Time and frequency domain methods for audio processing
Short-time energy, average magnitude, average zero crossing rate, autocorrelation function, average magnitude difference function. Pitch period estimation using autocorrelation method, Wavelet, Audio feature extraction, Spectral centroid, spread, entropy, flux, and roll-off. Spectrogram.

UNIT-3
Linear prediction analysis
Basic principles of linear predictive analysis. Autocorrelation method, covariance method. Solution of LPC equations: Cholesky decomposition, Durbin's recursive solution, lattice formulations and solutions. Frequency domain interpretation of LP analysis. Applications of LPC parameters as pitch detection and formant analysis.

UNIT-4
Cepstral Analysis
Homomorphic speech processing, Real and complex cestrum, pitch estimation, format estimation, Mel cepstrum.

Approved in XXth Academic Council, Dated 26 August 2019

UNIT-5

Speech and Audio processing applications Speech enhancement, Speech and Speaker recognition, Text to speech conversion, Musical instrument classification, Musical Information retrieval.

TEXT BOOKS:

1) Deller J. R. Proakis J. G. and Hanson J. H., "Discrete Time Processing of Speech Signals", Wiley Interscience
2) Ben Gold and Nelson Morgan, "Speech and audio signal processing" Wiley

REFERENCE BOOKS:

1) L. R. Rabiner and S.W. Schafer, "Digital processing of speech signals" Pearson Education.
2) Thomas F. Quateri , "Discrete-Time Speech Signal Processing: Principles and Practice" Pearson
3) Dr. ShailaApte, "Speech and audio processing", Wiley India Publication
4) L. R. Rabiner and B. H. Juang, "Fundamentals of speech recognition"
5) Theodoros Giannakopoulos and Aggelospikrakis, "Introduction to audio analysis: A MATLAB Approach: Elsevier Publication.

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51205: Biomedical Signal Processing
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To understand the principles of Digital Image Processing.
- To analyze the image signal in Spatial and Spatial frequency domain.
- To understand various Image Processing techniques for enhancement, segmentation, restoration, compression and implement using MATLAB.
- To apply Image Processing techniques to solve real world problems.

Course Outcomes : Students will be able to

- Apply image processing techniques in spatial and frequency domain.
- To apply various transforms on images and simulate its application to 2 D signals.
- Apply image restoration and encoding techniques.
- Study and implement various image segmentation approaches.
- To perform various images processing tasks and simulates them.
- Apply image processing techniques for real world applications.

UNIT-1

Essentials of continuous time signals and systems

Convolution, Fourier transform, system transfer functions; Discrete time signals and systems: sampling and quantization, the sampling theorem and signal reconstruction; Frequency analysis of discrete signals and systems: the discrete Fourier transform, power spectrum estimation and system identification. Discrete and continuous Random variables, Probability distribution and density functions. Gaussian and Rayleigh density functions, Correlation between random variables. Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

UNIT-2

Data Compression Techniques

Lossy and Lossless data reduction Algorithms.ECG data compression using Turning point, AZTEC, CORTES, Hoffman coding, vector quantisation, DCT and the K L transform.

UNIT-3

Cardiological Signal Processing

Pre-processing, QRS Detection Methods. Rhythm analysis. Arrhythmia detection Algorithms, Automated ECG Analysis, ECG Pattern Recognition, Heart rate variability analysis.

UNIT-4

Adaptive Noise Cancelling

Principles of Adaptive Noise cancelling. Adaptive Noise cancelling with the LMS adaptation Algorithm. Noise cancelling Method to Enhance ECG Monitoring. Fatal ECG Monitoring. Signal Averaging, polishing–mean and trend removal, Prony's method. Linear prediction. Yule– walker(Y–W) equations.

Approved in XXth Academic Council, Dated 26 August 2019

UNIT-5

Neurological Signal Processing

Modeling of EEG Signals. Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive(A.R.) modeling of seizure EEG. Sleep Stage analysis. Inverse Filtering. Least squares and polynomial modeling. Original Prony's Method, Prony's Method based on the Least Squares Estimate. Analysis of Evoked

Potentials and PCG .Analysis of non-stationary processes: examples using Wavelet analysis and Time-series models; Examples of physiological signals and systems including feedback systems.

TEXT BOOKS:

1) Cromwell, "Biomedical Instrumentation and Measurement", PHI.
2) Carr and Brown, "Biomedical Instrumentation".
3) Koebmer K R, "Lasers in Medicine", John Wiley & Sons.
4) "Biomedical Engg. System", Cromwell, McGrawHILL

REFERENCE BOOKS:

1) R. S. Khandpur, "handbook Biomedical Instrumentation", by Tata MaGraw Hill
2) Webster, "Application and Design of Medical Instruments"
3) "Biomedical phenomenon', Plonasy Robert, McGrawHILL

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

ET51301: Cloud Computing
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To present fundamentals of cloud computing.
- To explain various parameters of deployment of web services from cloud architecture.
- To confer comprehensive understanding of consistency of services deployed from a cloud architecture
- To explore the significance of cloud computing.

Course Outcomes : Students will be able to

- Analyze the components of cloud computing showing how business agility in an organization can be created.
- Evaluate the deployment of web services from cloud architecture.
- Critique the consistency of services deployed from a cloud architecture.
- Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications.

UNIT-1
Cloud Computing Fundamentals
Cloud Computing definition, Characteristics of Cloud Computing, Components of Cloud Computing.
Models in Cloud Computing-
Deployment models – Private cloud, Public cloud, Hybrid cloud, Community cloud.
Service models- IaaS, PaaS, SaaS
Concept of Tenancy, Multi-Tenancy, Introduction to Grid Computing, Applications of cloud computing, Benefits of cloud computing, Limitations of cloud computing.

UNIT-2
Cloud architecture, Services
Cloud Architecture
Introduction to Services-

a. Infrastructure as a Service
b. Platform as a Service
c. Software as a Service
d. Identity as a Service
e. Security as a Service
f. Compliance as a Service

Approved in XXth Academic Council, Dated 26 August 2019

UNIT-3

Cloud Infrastructure and Virtualization

Infrastructure – Clients, Security, Network and Services, Introduction to Virtualization, Virtualization types

a. Server virtualization
b. Storage virtualization
c. Network virtualization
d. Service virtualization,

Virtualization management, Virtualization technologies and architectures, Introduction to Hypervisors, Types of Hypervisor, Concept of Load balancing.

UNIT-4

Security

Cloud Security, Risks, Privacy, Operating system security, Security of virtualization, Data security.Concept of data privacy and data security, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business consideration, Infrastructure Security, Network level security, Host level security, Application level security.

UNIT-5

Cloud implementation and applications

Cloud Platforms: Amazon EC2 and S3, Cloud stack, Inter cloud, Google App Engine, Open Source cloud Eucalyptus, Open stack, Open Nebulla, etc., Applications.

TEXT BOOKS:

1) Barrie Sosinsky, " Cloud Computing Bible", Wiley
2) GauthamShroff, "Enterprise Cloud Computing", Cambridge.
3) Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions" by John Wiley & Sons, 2011.
   i. Shrinivasan, J. Suresh, "Cloud Computing: A practical approach for learning and implementation", Pearson.
4) RajkumarBuyya, J. Broberg, A. Goscinski, "Cloud Computing Principles and Paradigms", Wiley.
5) Ronald Krutz,"Cloud Security: Comprehensive guide to Secure Cloud Computing", Wiley Publishing.
6) Anthony T. Velte, "Cloud Computing: Practical Approach", McGraw Hill.
7) Tim Mather, "Cloud Security and Privacy", O'REILLY.

Approved in XXth Academic Council, Dated 26 August 2019

List of Reference Sources for Classes and Assignments:

1) Cloud Computing for Dummies by Judith Hurwitz, R. Bloor, M. Kanfman, F. Halper (Wiley India Edition)
2) Enterprise Cloud Computing by GautamShroff, Cambridge
3) Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4) Google Apps by Scott Granneman, Pearson
5) Cloud Security & Privacy by Tim Malhar, S. Kumaraswammy, S. Latif (SPD,O'REILLY)
6) Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,
7) Cloud Computing Bible by Barrie Sosinsky, Wiley India
8) Stefano FerrettietQoS–aware Clouds", 2010 IEEE 3rd International Conference on Cloud Computing
9) Virtualization for Dummies : , Wiley India.

Resources available on e-learning site http://www.e-gecaect.com
Microsoft Technical Journal, Google Cloud Platform resources

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51302: Web and Information Security
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To inculcate fundamental knowledge of Application Layer Protocol.
- To lay a strong base of , Peer-to-Peer network architectures.
- To develop conceptual understanding of Cryptography and security protocols.
- To understand web based bio authentication and legal aspects of data communication.

Course Outcomes : Students will be able to

- Analyze the requirements for a given organizational structure and select the most appropriate Networking architecture.
- Understand client-server, socket programming and develop web applications.
- Have a basic knowledge of the use of cryptography and network security.
- Understand and apply the concepts for administrating security to corporate network.
- Get knowledge of available legal framework such as IT Act2005.

UNIT-1
Client-server, Web, HTTP, FTP, SMTP, POP3, and DNS, Peer-to-peer file sharing networks, Networking simulation and modeling techniques.

UNIT-2
Managing network devices such as switch, Router, Firewall & modems.
Sockets Programming and Implementation. Client-server implementation, Web server implementation, Case Studies.

UNIT-3
Advanced IP multicast, including IPv6 multicast and SSM, Peer-to-Peer network architectures, IP network management and monitoring, Host configuration methods, Trends in network threats Information security principles.

UNIT-4
Cryptography, Goals, Attacks, Services and mechanisms Design principle of Block Ciphers & Block Cipher algorithms, Modern symmetric key ciphers, DES $ AES Public Key Cryptography RSA, Elliptic curve cryptosystems.

UNIT-5
System Security: Computer virus, Firewall and Intrusion detection, Electronic commerce security Introduction to web based bio authentication, Smart card, RF ID, Cyber laws related to E – commerce, IT Act-2005.

Approved in XXth Academic Council, Dated 26 August 2019

TEXT AND REFERENCE BOOKS

1) William Stallings, Data and Computer Communications, 7th edition, PH,2004.
2) Andrew S. Tanenbaum, Computer Networks, 4th edition, PH, Inc.,2003
3) BehrouzForouzan, Cryptography and Network Security, McGraw-Hill.
4) H. Bidgoli, Handbook of Information Security, Vols. 1-3, John Wiley & Sons, January2006.
5) H. Bidgoli, The Internet Encyclopedia, Vols. 1-3, John Wiley & Sons, Jan.2004
6) BehrouzForouzan, Data Communications McGraw-Hill IVth Edition
7)Request For Comments, Network Standards, available from http://www.rfc-editor.org/rfcsearch.html

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved In XXth Academic Council, Dated 26 August 2019

ET51303: Big Data Analysis
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- Understand the big data platform and its use cases.
- Provide HDFS concepts and interfacing with HDFS.
- Provide hands on Hadoop Eco System.
- Apply analytics on structured, unstructured data.
- Exposure to data analytic with R.

Course Outcomes : Students will be able to

- List the components of Hadoop and Hadoop Eco-System.
- Access and process data on distributed file system.
- Manage job execution in Hadoop environment.
- Develop big data solutions using Hadoop Eco System.
- Analyze info sphere big insights big data recommendations.
- Apply Machine Learning Techniques using R.

UNIT-1

Big Data introduction

Big data: definition and taxonomy, Big data value for the enterprise, Setting up the demo environment, First steps with the Hadoop "ecosystem".

UNIT-2

The Hadoop ecosystem

Introduction to Hadoop, Hadoop components: Map Reduce/Pig/Hive/HBase, Loading data into Hadoop, Handling files in Hadoop, Getting data from Hadoop.

UNIT-3

Querying big data with Hive

Introduction to the SQL Language ,From SQL to HiveQL, Introduction to HIVE e HIVEQL, Using Hive to query Hadoop files.

UNIT-4

Big data and Machine learning

Quick into to Machine learning , Big Data and Machine Learning , Machine learning tools.

UNIT-5

Data Analytics

Introduction to R and Python, Spark and SparkML,H2O, Azure ML.

Approved in XXth Academic Council, Dated 26 August 2019

TEXT AND REFERENCE BOOKS

Text Books

1) Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2) SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015.

References

1) Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2) Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
3) Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
4) AnandRajaraman and Jefrey David Ulman, "Mining of Massive Data sets", Cambridge University Press, 2012.
5) Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
6)Request For Comments, Network Standards, available from http://www.rfc-editor.org/rfcsearch.html

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51304: Android Applications
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To understand the architecture of Android applications.
- To provide an overview of life cycle of various components for Android development.
- To provide user interfaces by using extending and creating your own layouts and views.
- To understand Android's Application Framework API to build complex Android applications.
- To apply various techniques on working with menu.

Course Outcomes : Students will be able to

- Understand the architecture of Android applications, life cycle of various components, manifest, Intents and the use of external resources for Android development
- Design and develop Android applications with compelling user interfaces by using extending and creating your own layouts and views and using menus
- Execute Android's Application Framework API to build complex Android applications
- Utilize the power of background services, threads, asynchronous tasks and notifications.
- Apply various techniques on working with menu.

UNIT-1

Introduction to mobile computing, installing of required software and preparing the working environment, **Introduction to ANDROID:** ANDROID SDK Features, Introduction to Development Features.

Basics of ANDROID: Developing for ANDROID, developing for mobile and embedded devices, ANDROID development tools

Creating Applications using ANDROID: Basics of an ANDROID application, introduction to manifest, externalizing resources, application life cycle, ANDROID activities.

UNIT-2

Building user interfaces: Introduction to layouts, introduction to fragments, creating new views, introduction to adapters.

Intents and broadcast receivers: Introduction to intents, creating intents and broadcast receivers.

Using Internet resources: Downloading and parsing internet resources, using the download manager, using internet services.

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UNIT-3

Files, saving state and preferences: Creating, saving and retrieving shares preferences, including static files as resources, working with the file system.

Database and content providers: Introducing ANDROID databases, content values and cursors, working with SQLite databases, creating content providers, using content providers, native ANDROID content providers.

Working in background: Introducing services, using background threads, using alarms.

UNIT-4

Enhancing user experience: Introduction and addition of action bar, menus and dialogs, drawables and gradients, custom animations.

Hardware sensors: Sensors and sensor manager, monitoring devices' movement and orientation.

Maps and location based services: Using location based services, selecting a location provider, finding your current location, creating map based activities.

UNIT-5

Audio, video and using the camera: Playing audio and video, manipulating raw audio, using camera to take pictures, recording video, adding media to media store.

Telephony and SMS: Hardware support for telephony API, using telephony API, introducing, how to send and receive SMS and MMS.

Monetizing, promoting and distributing the applications

Signing and publishing applications, distributing applications, introduction to monetizing applications.

TEXT AND REFERENCE BOOKS

1) Android Programming (Big Nerd Ranch Guide), by Phillips, Stewart, Hardy and Marsican
2) Android Programming – Pushing the limits by Hellman
3) Building Android Apps, IN EASY STEPS, McGraw-Hill Education
4) Professional Android 2 Application Development, Reto Meier ,Wiley India Pvt Ltd
5) Beginning Android, Mark L Murphy,Wiley India Pvt Ltd
6) Pro Android,Sayed Y Hashimi and SatyaKomatineni,Wiley India Pvt Ltd
7) Suggested Readings:

1. Android Studio Development Essentials by Neil Smyth
2. The Definitive Guide to SQL Lite by Michael Owens

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51305: Artificial Intelligence and Machine Learning
Elective

Teaching Scheme

Lectures : 3 Hrs/Week
Total Credits : 3

Evaluation Scheme

Test : 20 Marks
Teacher Assessment : 20 Marks
End-Semester : 60 Marks

Course Educational Objectives:

- To design and implement key component of intelligent agents and expert systems.
- To apply knowledge represents technique and problem solving strategies to common AI application.
- To apply and integrate various artificial intelligence techniques in intelligent system.
- To build rule based and other knowledge intensive problem solvers.
- To apply various classifiers and for real world applications.

Course Outcomes : Students will be able to

- Learn various types of algorithm in artificial intelligence and machine learning.
- Convey the ideas in AI research and programming language related to emerging technology.
- Develop an appreciation for what is involved in learning models from data.
- Understand a wide variety of learning algorithms.
- Understand how to evaluate models generated from data.
- Apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

UNIT-1

Introduction: What is AI? , History, Overview, Intelligent Agents, Performance Measure, Rationality, Structure of Agents, Problem solving agents, Problem Formulation, Uninformed Search Strategies, Informed (Heuristic) Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search.

UNIT-2

Heuristic functions, inventing admissible heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing, Genetic Algorithms, Online search, Knowledge Based Agents, Logic, Propositional Logic, Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining.

UNIT-3

DPLL algorithm, Local search algorithms, First Order Logic, Models for first order logic, Symbols and Interpretations, Terms, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

UNIT-4

Introduction to probability, Classification and K-NN, Decision Trees and Rule Learning, The Naive Bayes algorithm, Linear Regression, Logistic Regression.

UNIT-5

The Perceptron algorithm, Neural networks and Deep Belief Networks, SVMs and Margin Classifiers, SVMs: Duality and kernels, Evaluating and Comparing Classifiers Experimentally, PAC Learning, Clustering,
3 Bias-Variance Decomposition, Ensemble Methods, Bayesian networks, HMMs - inference, HMMs - learning.

Approved in XXth Academic Council, Dated 26 August 2019

TEXT BOOKS

1) Artificial Intelligence: A Modern approach, Stuart Russell and Peter Norvig , Pearson, second Edition
2) ToshinoriMunakata, "Fundamentals of the New Artificial Intelligence", Springer, 2nd edition
3) Jacek M. Zurada, "Introduction to Artificial Neural Network", Tata McGraw-Hill
4) "Machine Learning" by Tom M Mitchell, Tata McGraw-Hill
5) "Machine Learning for Hackers" by Drew Conway and John Myles White, Tata McGraw-Hill
6) "Introduction to Machine Learning" by Alex Smola and S.V.N. Vishwanathan
7) "Introduction to Octave", Dr. P. J. G. Long
8) Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3rd

REFERENCE BOOKS

1) Elaine Rich, Kevin Knight, B. Nair, "Artificial Intelligence", Tata McGraw-Hill, 3rd edition
2) "Artificial Intelligence for Humans" byJeff Heaton

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51401: Information Theory and Coding
Elective

Teaching Scheme

Lectures	:	3 Hrs/Week
Total Credits	:	3

Evaluation Scheme

Test	:	20 Marks
Teacher Assessment	:	20 Marks
End-Semester	:	60 Marks

Course Educational Objectives:

- To give exposure to students about concepts of information, entropy ,coding efficiency.
- To explain need of data compression.
- To give mathematical foundation of compression, error control and security of information.
- To give exposure to students about various source coding and channel coding.

Course Outcomes : Students will be able to

- Describe fundamentals concepts of Information theory and source coding.
- Explain the need of Source coding and Channel coding.
- Describe various types of Source coding and Channel coding and decoding.
- Apply theoretical concepts to derive various codes for real world signal.

UNIT-1

Information Theory, Entropy, Source coding theorem, Channel models, capacity and coding, Information capacity theorem, Shannon"s Limit.

UNIT-2

Linear Block Coding/Decoding , Matrix description of Linear block codes, Hamming codes, optimal linear codes, Maximum Distance Separable codes.

UNIT-3

Cyclic Codes, Polynomials, Generation of Cyclic codes, matrix description of cyclic codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check.

UNIT-4

BCH Coding /Decoding , Primitive elements, Minimal Polynomials, Generator Polynomials, Reed Solomon codes, Nested Codes.

UNIT-5

Convolutional Code, Tree Codes and trellis codes, Polynomial description of Convolutional Codes, Distance Notion, Generating function, Matrix description, Viterbi coding , Distance Bound , Performance bound, Turbo Coding/Decoding.

Text and Reference Books

1) Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication, 2nd Edition
2) R. Avudaiammal, , Information Coding Techniques" Second Edition. Tata McGraw Hill
3) J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition.
4) Simon Haykin, "Communication Systems", John Wiley & Sons, Fourth Edition.

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51402: Wireless Mobile Communication
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To describe different types of diversity and how they improve performance for mobile radio channels.
- To enable the student to synthesis and analyze wireless channel modeling and mobile cellular communication systems.
- To understand the Multicarrier modulation and OFD missues.
- To learn the MIMO communication and its types.
- To explore the Ultra Wide Band modulation and Wireless Standards.

Course Outcomes : Students will be able to

- To identify and know various mobile and Cellular telephony systems with standards and working algorithms
- To understand multiple access schemes in mobile and Wireless networks
- To understand the OFDM and MIMO communication systems.
- To deal with Diversity modeling for Wireless Communications.

UNIT-1

Wireless Communications and Diversity

Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity – Frequency, Time, Space.

UNIT-2

Broadband Wireless Channel Modeling

WSSUS Channel Modeling, RMS Delay Spread, Doppler Fading, Jakes Model, Auto correlation, Jakes Spectrum, Impact of Doppler Fading.

Cellular Communications

Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes -Call Setup, Handover etc, Tele traffic Theory.

UNIT-3 OFDM

Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

UNIT-4 MIMO

Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the MIMO Channel, MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO,OFDM.

UNIT-5UWB (Ultrawide Band)

UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error Rate Performance of UWB

3G and 4G Wireless Standards: GSM, GPRS, WCDMA, LTE, WiMAX.

Approved in XXth Academic Council, Dated 26 August 2019

TEXT AND REFERENCE BOOKS

1) David Tse and PramodViswanath, Fundamentals of Wireless Communications ,Cambridge University Press.
2) Andrea Goldsmith, Wireless Communications, Cambridge University Press.
3) Theodore Rappaport, Wireless Communications: Principles and Practice , Prentice Hall.
4) EzioBiglieri, MIMO Wireless Communications, Cambridge University Press.
5) John G Proakis, Digital Communications, McGraw Hill Science/Engineering/Math.

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

Approved in XXth Academic Council, Dated 26 August 2019

ET51403: Wireless Sensor Network
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To learn the concepts and principles behind WSN.
- To learn WSN network design, sensor node embedded system design and implementation.
- To understand WSN network management, different protocols and architecture.
- To introduce sensor network platforms, operating systems and programming tools for sensor networks.
- To study wireless sensor network solutions with practical implementation examples and case studies.

Course Outcomes : Students will be able to

- Understand the fundamental concepts of wireless and sensor networks.
- Develop simple wireless sensor network applications using actual motes and sensor devices.
- Develop simple wireless sensor network applications using hardware, software platforms.
- Get an overview of the various network level protocols for MAC, routing, time synchronization, aggregation, consensus and distributed tracking.
- Program sensor network platforms using Tiny OS, C and Java and to develop applications on wireless motes, smart phones and other embedded platforms.

UNIT-1
Introduction
Introduction of wireless sensor networks, Comparison of sensor network with ad hoc network, Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and sinks, single hop versus multi-hop networks, multiple sinks and sources, design principles, Development of wireless sensor networks.

UNIT-2
Wireless Sensor Node Architecture
System level -Main components with detailed description ,Microcontroller, Communication (RF) module , Sensors (depending on application) and signal conditioning ,Memory, Power Supply, Battery Management, Energy Harvesting, Topology/Network Structure, Power Management, Physical, MAC, Routing.

UNIT-3 OFDM
Networked Wireless Control Systems
Implementation and Considerations, Design Principles of Wireless Sensor Networks Protocols for Control Applications, Adaptive IEEE 802.15.4, Medium Access Control Protocol for Control and Monitoring Applications.

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UNIT-4

Sensor Network Platforms

Test beds, Operating Systems: Tiny OS, Contiki, Hardware test beds: IITH Motes, Libelium, WASP motes, Crossbow Motes

Case Study: Security in Sensor networks, Localization ,IEEE 802.15.4 low rate WPAN, Practical implementation issues.

UNIT-5

WSN Applications

Target detection tracking, Habitat monitoring, Military battlefield awareness Environmental disaster monitoring, Underwater Acoustic and Deep space networks, Wireless Body Area Networks (WBAN) for health-monitoring, Open issues and Design challenges.

TEXT AND REFERENCE BOOKS

1) Principles of Embedded Networked Systems Design Gregory Pottie, William Kaiser Hardback (ISBN-10: 0521840120 | ISBN-13:9780521840125)
2) Wireless Sensor Networks: An Information Processing Approach, Feng Zhao and Leonidas Guibas
3) Wireless Communications & Networks, 2nd Edition, William Stallings. ISBN:0131918354
4) Elements of network protocol design, Mohammed G. Gouda
5) Elements of distributed computing, Vijay K. Garg

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51404: Smart Antenna and Array
Elective

Teaching Scheme			**Evaluation Scheme**		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- To identify antenna array types.
- To analyze antenna performance parameters.
- To introduce and illustrate antenna pattern synthesis methods.
- To expose to the concept of micro strip antenna.
- To analyze radiation patterns for design of different smart antennas.

Course Outcomes : Students will be able to

- Calculate antenna parameters.
- Analyze and design antenna arrays.
- Explain factors affecting the design of antenna systems.
- Know working of smart antenna and micro strip antenna.
- Simulate the digital beam formation concept.

UNIT-1

Review of wired antennas

Antenna Parameters, Infinitesimal dipole, antenna, half wave half wave dipole antenna, small loop antenna, helical antenna.

UNIT-2

Antenna Arrays

N element linear arrays, uniform amplitude and spacing, Directivity of Broadside and End fire arrays. Three dimensional characteristics, Pattern multiplication- Binomial arrays and olph- Tchebycheff arrays. Circular array, Mutual coupling in arrays, multidimensional arrays, phased arrays and array feeding techniques.

UNIT-3

Antenna Synthesis

Synthesis problem-Line source based beam, synthesis methods, Fourier transform and Woodward-Lawson sampling method, Linear array shaped beam synthesis method, Low side lobe, narrow main beam synthesis methods- discretization of continuous sources. Schelkunoff polynomial method.

UNIT-4

Microstrip antennas

Introduction, Rectangular Patch, Circular Patch, Quality Factor, Bandwidth, and Efficiency, Input Impedance, Coupling, Circular Polarization, Arrays and Feed Networks, Corporate and Series Feeds, Reflect array.

UNIT-5

Smart Antenna

Smart antennas Introduction, Smart-Antenna Analogy, Cellular Radio Systems Evolution, Signal Propagation, Smart Antennas' Benefits and draw backs, Antenna Beam forming, Multiple-Input Multiple-Output (MIMO) System, Re configurable Arrays.

TEXT AND REFERENCE BOOKS

1) Girish Kumar and K.P. Ray, Broad and Microstrip Antennas, Artech House
2) C. A. Balanis Antenna Theory Wiley and Sns
3) John. D. Krauss Antennas TMH References
4) By Randy L, Antenna Arrays: A Computational Approach

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

Approved in XXth Academic Council, Dated 26 August 2019

ET51405: RF-Circuit Design
Elective

Teaching Scheme			Evaluation Scheme		
Lectures	:	3 Hrs/Week	Test	:	20 Marks
Total Credits	:	3	Teacher Assessment	:	20 Marks
			End-Semester	:	60 Marks

Course Educational Objectives:

- Students get introduced to modern Silicon, Silicon Germanium, Gallium Arsenide, and Gallium Nitride Processes.
- Students become familiar to Passive RF Circuits.
- Students study the design principles for Active RF Circuits like LNA, PA, Switch, Mixer, and VCO.
- Students study RF systems like Fractional N Phase Locked Loops.

Course Outcomes : Students will be able to

- Develop the student's core competence in design and analysis CMOS RF design.
- Analyze and examine CMOS analog circuit building blocks.
- Apply analog design methodology and flow for designing integrated circuits.
- Design and verify CMOS analog circuits by using state of art computer aided tools.
- Identify, formulate and model CMOS integrated circuit related engineering problems.
- Apply CMOS analog circuits' knowledge on to analyze advanced analog circuits such as fully integrated compensated multistate OPAMP.

UNIT-1

RF Processes

Introduction to semiconductor material properties- Energy Bandgap, Lattice Constant, Carrier Velocity, Super Lattice Structures; Semiconductor Material Systems; Liquid Phase and Vapor Phase Epitaxy, MBE, GAMBE, MOMBE, MOCVD; Process Back-End of Line (BEOL); Process Front-End of Line (FEOL).

UNIT-2

Free Space and Guided Waves:

Maxwell's Equations and their interpretation; Loss less &lossy materials, Metals; Characteristic Impedance of space; Transmission Lines- Telegraph Equations, Characteristic Impedance, Propagation Constant; Parallel Plate, Microstrip Lines, Coplanar Waveguides, CPWG; Reflection & Transmission- Smith Chart; Impedance Matching- Quarter-Wave Transformer, Low-Pass/ High-Pass Matching, Two Pole Broad Band Matching.

UNIT-3

Network Parameters:

Two Port Network- Z, Y and S-parameters, T and Pi Networks; On-chip Inductors and Capacitors- SPICE Models; Stubs- Open and Short Circuited Stubs; Bias Decoupling Circuits.

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UNIT-4

Passive RF Circuits and devices for active RF circuits

Power Dividers, Couplers, 90 Hybrid, 180 Hybrid, BALUN, RF Filters- Filter design using Insertion Loss Method, Butterworth, Tchebyshev, Elliptic- Low-Pass, High-Pass, Band-Pass and Band-Stop Filters. MOSFET, HEMT (pHEMT), HBT- Operation, Small Signal Model, DC Characteristics, RF Characteristics, Thermal Characteristics.

UNIT-5

Active RF Circuits

Single Ended Gain Stage; Source of Noise in devices; Low Noise Amplifier- Design, Characterization; Design for Manufacturing- Sensitivity, Yield, Monte Carlo Simulations; Power Amplifiers- Characteristics, Design; Mixer- Gilbert Cell & Quadrature Mixer; Voltage Controlled Oscillators- LC VCO Design & Characterization; Introduction to Fractional N PLL Operation.

TEXT AND REFERENCE BOOKS

1) Microwave Engineering, David M. Pozar, John Wiley & Sons
2) RFIC and MMIC Design and Technology, I.D. Robertson, S. Lucyszyn, IEE Circuits Devices and Systems Series, The Institution of Electrical Engineers
3) Analysis and Design of Analog Integrated Circuits, Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Wiley

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini-projects

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ET61001 : DISSERTATION I

Compulsory

Teaching
Total Credits : 10

Evaluation Scheme
Term Work: 50 Marks
Practical 50 Marks

Dissertation I phase will consist of following:

1. Identification of Project title
2. Literature survey and database collection (ifneeded)
3. Preparation of list of components for hardware projects and decision of methodologyfor software projects
4. Feasibility study
5. Scheduling and planning of entireproject

Students will present a seminar on the dissertation work carried out as a part of term work. The department will constitute a committee of minimum two members to evaluate the presentation. The committee will monitor the quality of the dissertation work.

Approximately 40% of the project work will be completed during the dissertation I phase.

ET61002 : DISSERTATION II

Compulsory

Teaching		**Evaluation Scheme**	
Total Credits :	16	Term Work:	100
		Practical/ Viva-voce:	150

This work will be in continuation with the work done in dissertation I phase.

Students will present a progress seminar on the dissertation work carried out as a part of term work. The department will constitute a committee of two members to evaluate the presentation. The committee will monitor the quality of the dissertation work. Minimum one publication is mandatory for students on their project area/work. There will be pre final demonstration of project by the student which is for internal faculty members. After satisfactory completion of project work and dissertation report, student may be permitted for viva-voce.

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ET61003 : Soft Computing
Elective

Teaching			**Evaluation Scheme**	
Lectures	:	03Hrs/Week	Test	20 Marks
			Teacher Assessment	20 Marks
Total Credits	:	03	End-Semester	60 Marks

Prerequisites :

Course Educational Objectives:

- To introduce students about Soft Computing Techniques.
- To explain students Fuzzy sets & its Applications.
- To introduce students to Genetic Algorithm fundamentals.
- To explain students concepts and categories of Neural Network

Course Outcomes : Students will be able to

- Describe Soft Computing Techniques
- Gain knowledge of Fuzzy sets
- Understand the Neural Network concepts.
- Understand and apply Genetic Algorithms.

UNIT-1

Fuzzy Logic

Basic concepts of Fuzzy systems, Conventional and fuzzy sets, fuzzy relations, fuzzy operations, fuzzy operators and operations, fuzzification, defuzzificaztion methods, application of fuzzy logic.

UNIT-2

Neurocomputing

Feed forward, feedback and competitive neural network. Models of Neurocomputing: Perceptron Training, Back propagation learning, Hopfield nets. Additional models.

UNIT 3:

Adaptive Resonance Theory I and II

Self-organizing feature map, ADALINE. Applications in pattern classification and image understanding.

UNIT-4

Genetic Algorithms

The basic operators, Schema theorem, convergence analysis, stochastic models, applications in search and optimization. Learning with GA & NN.

UNIT-5

Composite use of fuzzy logic

Neural network & Genetic Algorithms. Chaos Theory, Fusion of Neuro, Fuzzy, GA and Chaos theory and applications

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TEXT AND REFERENCE BOOKS

1. David E. Goldberg: Genetic Algorithms in search optimization, and machine learning, Addition Wesley,MA
2. S. Haykin, Neural Networks – A comprehensive Foundation, Macmillan College Publishing Company, New York
3. H.J. Zimmermann, Fuzzy set theory and its application, 2nd revised edition, Allied PublishersLtd
4. G.J. Klir, B. Yuan: Fuzzy sets and Fuzzy Logic, Theory and applications,PHI
5. R.L. Devaney, An Introduction to Chaotic Dynamical Systems, Addition Wesley, 2nd ed
6. B. Yegnanarayana, Artificial Neural Networks,PHI
7. Resource available on e-learning sitehttp://www.e-gecaect.com

Teacher Assessment:

Teachers Assessment is based on one of the or combination of few of following

1) Simulation
2) Application Development
3) Power point presentation
4) Question & Answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini projects

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