Autonomous Programme Structure of Third Year B. Tech. AY 2019-2020

T. Y. B. Tech. Electronics and Telecommunication Engineering Semester –II

Course Code	Course Title	Teaching Scheme Hours / Week			Examination Scheme				Marks	Credits
		Lecture	Tutorial	Practical	In Semester	End Semester	Oral	Practical		
EC 3201	Digital Signal Processing	3	1	0	50	50	0	0	100	4
EC 3202	Advanced Processors	3	0	0	50	50	0	0	100	3
EC 3203	Control Systems	3	1	0	50	50	0	0	100	4
PEEC 3201	Programme Elective-II	3	0	0	50	50	0	0	100	3
PEEC 3202	Programme Elective-III	3	0	0	50	50	0	0	100	3
EC 3204	Digital Signal Processing Laboratory	0	0	2	0	0	25	0	25	1
EC 3205	Advanced Processors Laboratory	0	0	4	0	0	0	50	50	2
EC 3206	Mini Project and Seminar	0	0	2	0	0	25	0	25	1
PEEC 3203	Programme Elective-III Laboratory	0	0	2	25	0	0	0	25	1
AC 3102	Audit Course	0	0	2	0	0	0	0	0	0
	Total	**15**	**2**	**12**	**275**	**250**	**50**	**50**	**625**	**22**
	Grand Total	**29**			**625**				**625**	**22**

PEEC 3201: Programme Elective-II

1. Biomedical Electronics
2. Information Theory and Coding Techniques
3. PLC and Automation
4. Artificial Intelligence
5. Swayam Online Course

PEEC 3202: Programme Elective-III
PEEC 3203: Programme Elective-III Lab

1. Embedded Design and RTOS
2. Antenna and Wave Propagation
3. Digital Image Processing
4. Robotics

AC 3102: Audit Course:- Employability Skills and Development

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EC 3201 DIGITAL SIGNAL PROCESSING

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial: 1 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Course Objectives

1. To discuss basics of Digital Signal Processing and analog to digital signal conversion.
2. To apply transform techniques for the analysis of discrete time LTI signals and systems.
3. To compare analog and digital filters, design digital filters and realize using block diagrams.
4. To describe practical DSP systems and relate it to DSP fundamentals.

Course Outcomes
After completion of the course, students will be able to
1. Explain basic elements of Digital Signal Processing
2. Choose an appropriate sampling frequency and apply the sampling theorem to determine discrete time signal from continuous time signal and vice versa
3. Apply the transform techniques such as Z-transform and Discrete Fourier transform on discrete time signals, interpret its frequency domain representation and compare the computational complexities of DFT and FFT algorithms
4. Analyze a given system function in Z-domain to test for system stability and causality from the inspection of the pole-zero plot
5. Design FIR and IIR digital filters for given specifications, assess performance of the digital filters and build the filter structures
6. Explain the real life applications of Digital Signal Processing

Unit I: Introduction to DSP **(06)**
Basic elements of Digital Signal Processing, Advantages of Digital over Analog signal processing, Sampling of analog signals, Sampling theorem in time domain, Recovery of analog signals, Mapping between analog frequencies to digital frequency.

Unit II: Z-Transform **(06)**
Need of transform, Definition of bilateral and unilateral Z-Transform, Properties of ROC, Properties of Z-Transform, Pole-zero plot, Pole locations and time domain behavior, Inverse Z-Transform, Analysis of LTI DT systems, Stability and causality considerations for LTI systems.

Unit III: Discrete Fourier Transform **(08)**
DTFT- Definition, Frequency domain sampling, DFT, Properties of DFT, circular convolution, Computation of linear convolution using circular convolution, FFT algorithms-decimation in time and decimation in frequency using Radix-2 FFT algorithm, Butterfly diagram, Computational complexity of FFT algorithms, Bit-reversal, In-place computation.

Unit IV: FIR Filter Design **(08)**
Ideal filter requirements, Comparison of analog and digital filters, Frequency response of Linear phase FIR filters, Types of FIR filter, Design of linear phase FIR filter using windows method, characteristics and comparison of different window functions, FIR filters realization using direct and cascade forms.

Unit V: IIR Filter Design **(08)**

Characteristics of practical frequency selective filters, Comparison of characteristics of- Butterworth, Chebyshev and elliptic filters, Design of IIR filters from analog filters, IIR filter design by impulse invariance method, bilinear transformation, Frequency warping effect, IIR filter realization using direct form, cascade form and parallel form.

Unit VI: Applications of DSP **(06)**

Overview of DSP in real world applications, Applications of DSP in- Audio Systems, Telecommunication Systems, Biomedical, Image Processing.

Text Books:

1. John G. Proakis, D. G. Manolakis, **"Digital Signal Processing"**, *Pearson Prentice Hall*, (4^{rd} Edition), (1997).
2. Emmanuel C. Ifeachor, B. W. Jervis, **"Digital Signal Processing- A practical approach"**, *Pearson Education*, (2^{nd} Edition), (2002).
3. S. Salivahanan, A. Vallavraj, C. Gnanpriya, **"Digital Signal Processing"**, *McGraw Hill*, (3^{rd} Edition), (2011).

Reference Books:

1. S. K. Mitra, **"Digital Signal Processing- A Computer Based Approach"**, *McGraw Hill*, (4^{th} Edition), (2013).
2. A. Nagoor Kani, **"Digital Signal Processing"**, *Tata McGraw-Hill Education Pvt. Ltd.*, (2^{nd} Edition), (2012).
3. Alan V. Oppenheim, **"Discrete-Time Signal Processing"**, *Pearson Education India*, (3^{rd} Edition), (2013).
4. Vinay K. Ingale, John G. Proakis, **"Digital Signal Processing using MATLAB"**, *Cengage Learning*, (3^{rd} Edition), (2009).
5. S. D. Apte, **"Digital Signal Processing"**, *Wiley India Publication*, (2^{nd} Edition), (2011).

Online Resources:

1. http://freevideolectures.com/Course/2317/Digital-Signal-Processing-IIT-Delhi
2. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/
3. http://www.dspguide.com/

EC 3202 ADVANCED PROCESSOR

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Explain the architecture of ARM 7 and ARM-cortex series microprocessor
2. Describe features of on chip peripherals of ARM 7 processor
3. Interfacing real world input and output devices to ARM 7
4. Explain the need of Operating system for embedded systems
5. Describe features of cortex based Raspberry PI board

Course Outcomes:
After completion of the course, students will be able to

1. Describe the ARM microprocessor family architecture and features
2. Write algorithm / C language program for ARM 7 on chip peripheral
3. Interface external peripherals to ARM 7 and write algorithm/ C program
4. Describe features of Raspberry pi ARM-cortex board and explain concepts of Real Time Operating System

Unit I: Introduction to ARM 7 processor – LPC 2148 **(07)**
Introduction to ARM processor – LPC 2148. LPC2148: Features, GPIO, Pin Connect Block, serial communication programming for transmission and reception from computer, programming for UART, Internal register set, CPSR, SPSR. Interface LED to GPIO.

Unit II: Real world Interfacing - I **(06)**
Introduce GSM AT commands, Interface GSM to LPC 2148 (Hardware / algorithm), Introduce GPS module and interface to LPC 2148, Memory Map.

Unit III: Real world Interfacing - II **(08)**
Architecture and pin configuration of LCD/GLCD and interface to LPC 2148, On chip ADC registers (algorithm), on chip DAC for waveform generation, interface EEPROM using I2C protocol, Programming examples Using timers of LPC2148 to generate delay.

Unit IV: ARM 7 Core **(08)**
ARM7 data flow model, programmers model, modes of operations. ARM7 Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider), timer, Interrupt structure of LPC2148, Interfacing with KEYPAD, ARM versions: ARM7, ARM9 and ARM11 feature comparison.

Unit V: ARM CORTEX **(08)**
Introduction to ARM CORTEX series, improvement over classical series and advantages for embedded system design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features and applications. Firmware development using CMSIS standard for ARM Cortex.

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Unit VI: Introduction of Raspberry-Pi **(05)**

Introduction of Raspberry-Pi – Features, processor. Different OS of Raspberry Pi board. Installation procedure of OS. Booting sequence. Introducing GCC compiler, writing Hello world program.

Text Books:

1. Rajkamal, **"Embedded System Architecture Programming Design",** *Tata Graw Hill Publication,* (2nd Edition), (2008).
2. Dr. K. V. K. K. Prasad **"Embedded / real time System: Concepts, Design, &Programming"***Black Book Dreamtech Press Publication.(*2003)
3. Andrew N. Sloss, DomiicSymes, Chris Wright, **"ARM System Developer's Guide-Designing and Optimizing Software"**, *Elsevier Publication,* (2004).
4. Joseph Yiu, **"The Definitive Guide to the ARM Cortex-M"**, *Newnes, ELSEVIER,* (2007)

Reference Books:

1. Tammy Noergaard, **"Embedded Systems Architecture"** Elsevier, (2nd Edition), (2004).
2. Dr. K. V. K. K. Prasad, Gupta Dass, Verma, **"Programming for embedded system"**,*Wiley – Dreamtech India Pvt. Ltd.*
3. I2C Specification Protocol Standard.
4. ARM7/TDMI (ReV4) – Technical Ref Manual

Online Resources:

1. LPC 214x User manual (UM10139) :- www.nxp.com
2. LPC 17xx User manual (UM10360) :- www.nxp.com
3. ARM architecture reference manual : - www.arm.com

EC 3203 CONTROL SYSTEMS

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial:1 Hour / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Course Objectives:

1. Explain the need of Laplace transform and develop the ability to analyze the system in s domain
2. Explain the components and types of control systems
3. Find response of first order and second order systems using standard input signals
4. To analyze feedback control system stability in time domain using Routh-Hurwitz criterion and Root Locus technique
5. Analyze feedback control system stability in frequency domain using Bode and Nyquist plot
6. Explain state space approach for control system analysis

Course Outcomes:
After completion of the course, students will be able to

1. Find the Laplace transform of signals and determine the transfer function of the system in s domain
2. Classify and explain different systems, interpret transfer function of physical components and construct system transfer function
3. Determine and analyze system response to find time and frequency domain specifications and steady state error
4. Examine system stability in time domain and in frequency domain
5. Examine the stability of system by plotting Root Locus, Bode and Nyquist plots
6. Analyze control system using state space approach

Unit I: Laplace Transform and its Applications (05)
Definition of Laplace Transform (LT), need of Laplace transform, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform, Laplace transform evaluation using properties, Inverse Laplace transform(ILT), stability considerations in s domain, application of Laplace transforms to the LTI system analysis.

Unit II: Basics of Control Systems (08)
Introduction, types of control systems: open loop and closed loop, feedback control system, effect of feedback, concept of transfer function, characteristics equation, poles and zeros, block diagram algebra, signal flow graph, Mason's gain formula.

Unit III: Time Domain Analysis (07)
Type and order of the control systems, types of standard inputs, response of first order system to step, ramp and parabolic inputs, response of second order system to standard input signals, time domain specifications of second order systems, steady state error and error coefficients.

Unit IV: Stability (07)
Concept of stability, absolute, relative, marginal and unstable system in s plane, dominant poles and zeros, Routh-Hurwitz criterion, concept of Root Locus.

Unit V: Frequency Domain Analysis **(09)**

Need of frequency domain analysis, correlation between time and frequency domain, frequency domain specifications, Bode plot, construction of Bode plot, gain and phase margin, determination of relative stability, Nyquist stability criterion.

Unit VI: State Space Analysis **(06)**

Advantages of state space analysis over classical control, concept of state, state variables and state model, state space representation using state model, state transition matrix and its properties, solution of state equations for LTI system, concept of controllability and observability.

Text Books:

1. I. J. Nagrath, M. Gopal, **"Control Systems Engineering"**, *New Age International Publishers, New Delhi,* (5^{th} Edition), (2007).
2. Katsuhiko Ogata, **"Modern Control Engineering"**, *PHI Learning Private Limited, New Delhi,(*5^{th} Edition), (2010).
3. Barry Van Veen, Simon Haykin, **"Signals and Systems"**, *Wiley,* (2^{nd} Edition), (2007).

Reference Books:

1. B. C. Kuo, **"Digital Control Systems"**, Oxford *University Press, New York,* (2^{nd} Edition), (1992).
2. Richard C. Drof, Robert N. Bishop, **"Modern Control Systems"**, *Addison Wesley Pub. Company,* (1^{st} Edition), (2001).

Online Resources:

1. http://nptel.ac.in/courses/108101037/1
2. https://www.tutorialspoint.com/control_systems/index.htm
3. https://www.youtube.com/watch?v=s8rsR_TStaA&list=PLBlnK6fEyqRhG6s3jYIU48CqsT5cyiDTO

PEEC 3201 BIOMEDICAL ELECTRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objective

1. Analysis of biomedical signals, its origin and classification of biosignals
2. Explain characteristics of biosignals and their Acquisition
3. Enhance the students ability in analysis for biomedical signals
4. Explain the functionality of biomedical electronic instruments

Course Outcome
After completion of the course, students will be able to

1. Explain anatomy of cardiovascular and nervous system
2. Describe sources, signal conditioning and processing techniques of biosignals
3. Analyze ECG and EEG signals using transform techniques
4. Design digital filter for removal of artifact and noises from biosignals
5. Explain biomedical instruments for diagnosis with consideration of patient safety

Unit: I Human Anatomy and Biomedical Electronic System (08)
Cell, Nerve cell, Human Anatomy: Body Skeleton, Muscles, Heart, Respiratory System, Nervous System, Introduction to Biomedical Electronics, its advantages and applications.

Unit: II Bioelectric Signals and Recording System (07)
Action Potential, Classification of Biomedical Signals. Bioelectric Signals: ECG, EEG, EMG, EOG, MEG. Sources and Contamination of Noise in Bioelectric signals. Recording Electrodes, Skin impedance measurement, Bio-Amplifiers, Isolation amplifiers, Filtering and Patient safety.

Unit: III Cardiovascular System (06)
Electrical Activity of the Heart, Lead Configuration to measure ECG, Einthoven Triangle, Normal and Abnormal ECG, ECG Machine, Heart Sounds and Blood Pressure Measurement.

Unit: IV Central Nervous System (06)
Electroencephalogram(EEG) – Types and Significance of EEG Signal, 10-20 Electrode Placement, Evoked potential, EEG Machine, EEG amplifier and filters, EEG applications: Epilepsy, sleep disorder and Human Brain Computer Interface.

Unit: V Biosignal Processing (07)
Removal of artifact and noise using digital filter, time frequency analysis of biosignals, event detection of ECG and EEG, cancellation of maternal ECG from fetal ECG using Adaptive filter.

Unit: VI Medical Instruments and Measurements (08)
Blood Flow Measurement, Finger Plethesmography, Echocardiography, Bedside Monitors, Central Monitoring System, X Ray properties, Generation of X Rays, block diagram of X Ray machine image intensifier, Drawbacks of X Ray imaging, CT Scan and MRI

Life Saving Devices: Pacemakers, Defibrillators, Ventilators.

Text Books:

1. Joseph J. Carr and John M. Brown, **"Introduction to Biomedical Equipment Technology",** *Prentice Hall India,* (4th Edition), (2000).
2. R. Rangayan, **"Biomedical Signal Analysis",** *Wiley India Pvt. Limited,* (1st Edition), (2002).
3. R. S. Khandpur, **"Handbook of Biomedical Instrumentation"**, *Tata McGraw Hill New Delhi,* (2nd Edition), (2003).

Reference Books:

1. D. C. Reddy **"Biomedical Signal Processing: Principles and techniques",** *Tata McGraw Hill New Delhi,*(1st Edition), (2005).
2. Bruce, **"Biomedical Signal Processing & Signal Modeling,"** *Wiley India Pvt. Limited,* (Wiley student edition), (2009).
3. John L Semmlow, **"Bio-signal and Medical Image Processing",** *CRC Press,* (2nd Edition), (2009).

online Resources:

1. http://nptelonlinecourses.iitm.ac.in/
2. https://onlinecourses.nptel.ac.in/noc18_ec02/preview

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PEEC 3201 INFORMATION THEORY AND CODING TECHNIQUES

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To introduce the basic concepts of information theory to the students
2. To demonstrate calculation of channel performance using the basic concepts of information theory
3. To learn source coding techniques for data compression
4. To learn channel coding techniques for error detection and correction
5. To write algorithms for source coding and channel coding techniques

Course Outcomes:
After completion of the course, students will be able to

1. Explain entropy, mutual information and channel capacity for Discrete Memoryless Channel, Prefix condition, Kraft's inequality, Hamming Bound, Shannon's Theorem
2. Calculate channel performance in terms of entropy, mutual information and channel capacity for Discrete Memoryless Channel
3. Apply Shannon Fano, Huffman and Lempel Ziv techniques for data compression
4. Apply Linear Block Code, Cyclic Code, Convolution Code, BCH Code and RS Code for error detection and correction
5. Write algorithms for source coding and channel coding techniques

Unit I: Information Theory and Source Coding **(09)**
Introduction to information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm, Run Length Encoding, Discrete memory less channel and Mutual information.

Unit II: Information Capacity and Channel Coding **(08)**
Channel capacity, Channel coding theorem, Information capacity theorem, Linear Block codes: Matrix description, Error detection and correction capability, Encoding and decoding circuit, Single parity check codes, Repetition codes, dual codes, Hamming code and Interleaved code.

Unit III: Cyclic Codes **(07)**
Galois field, Primitive element, Primitive polynomial, Minimal polynomial and generator polynomial, Cyclic Codes: Encoding for systematic and non-systematic cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic code.

Unit IV: BCH and RS Codes **(09)**
Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes.

Unit V: Convolutional Code **(09)**
Convolution code: Introduction of convolution code, Transform domain and Time domain approach, Graphical representation: State diagram, Tree diagram and Trellis diagram, Sequential decoding and Viterbi decoding.

Text Books:

1. Simon Haykin, Michael Moher, **"Communication Systems"**, *Wiley,* (5th Edition), (2009).
2. Ranjan Bose, **"Information Theory Coding and Cryptography"**, *Tata McGraw-Hill*, (3rd Edition), (2016).

Reference Books:

1. Bernard Sklar, **"Digital Communication-Fundamentals and Application"**, *Pearson Education,* (2nd Edition), (2006).
2. Khalid Sayood, **"Introduction to Data Compression"**, *Morgan Kaufmann Publishers,* (3rd Edition), (2006).
3. Shu Lin and Daniel J, Cistello Jr., **"Error control Coding"**, *Pearson Publications India,* (2nd Edition), (2004).
4. Todd Moon, **"Error Correction Coding: Mathematical Methods and Algorithms"**, *Wiley India Pvt. Limited,* (1st Edition), (2006).

Online Resources:

1. http://nptel.ac.in/courses/117101053/1

PEEC 3201 PLC and Automation

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. To recognize industrial control problems suitable for PLC control.
2. To analyze the essential elements and practices needed to develop and implement the Engineering Automation using PLC approach
3. To familiarize advanced topics such as SCADA, DCS Systems, Digital Controller, CNC Machines.

Course Outcomes:
After completion of the course, students will be able to

1. Explain the basics of Process Control System, its components & Automation System.
2. Design the subsystems of a Process Control application.
3. Develop P.L.C. ladder diagram for a process control application.
4. Explain architecture and communications of P.L.C. (Programmable Logic Control), SCADA(Supervisory Control and Data acquisition) and DCS (Distributed Control System).
5. Explain C.N.C. machines and industrial communication standards in modern

Unit I: Process Control & Automation (08)
Process control principles, Servomechanisms, Control System Evaluation, Analog control, Digital control, Types of Automation, Architecture of Industrial Automation Systems, Advantages and limitations of Automation.

Unit II: Transmitters and Signal Conditioning (07)

Need of transmitters, Standardization of signals, Current, Voltage and Pneumatic signal standards, 2-Wire & 3-Wire transmitters, Analog and Digital signal conditioning for R.T.D., Thermocouple, D.PT. (Differential Pressure Transmitter) etc., Smart and Intelligent transmitters.

Unit III: Controllers and Actuators (08)
PID Controller, Cascade PID control, Microprocessor Based control, PAC (Programmable Automation Controller), Mechanical switches, Solid state switches,
Electrical actuators : - Solenoids, Relays and Contactors, A.C. Motor, V.F.D., D.C. Motor, B.L.D.C. Motor, Stepper Motor, Servo Motor, Pneumatic and Hydraulic actuators.

Unit IV: PLC and Human Machine Interface (HMI) (07)
Functions of P.L.C., Types of PLCs, Advantages, Architecture, Working of P.L.C., Selection of P.L.C., Networking of P.L.C.s, Ladder Programming basics, Ladder Programming examples, Interfacing Input and Output devices with P.L.C., P.L.C. programming standard IEC61131.

Unit V: Industrial Automation [Supervisory Control And Data Acquisition (S.C.A.D.A.) & Distributed Control System (D.C.S.)] **(06)**

Introduction to S.C.A.D.A. (Features, MTU- functions of MTU, RTU- Functions of RTU, Applications of S.C.A.D.A., Communications in S.C.A.D.A.- types & methods used, Media used for communication), Introduction to DCS (Architecture, Input and Output modules, communication module, Specifications)

Unit VI: Automation and CNC (Computer Numeric Control) Machines **(06)**

Introduction of C.N.C. Machines : - Basics and need of C.N.C. machines, N.C., C.N.C. and D.N.C. (Direct N.C.) systems, Structure of N.C. systems, Applications of C.N.C. machines in manufacturing, Advantages of C.N.C. machines.

Industrial Communication : - Devicenet, Interbus, Device network : - Foundation Fieldbus-H 1, H.A.R.T., C.A.N., PROFIBUS-PA,

Control network : - ControlNet, FF-HSE, PROFIBUS-DP, Ethernet, T.C.P./ I.P.

Text Books:

1. Curtis Johnson, **"Process Control Instrumentation Technology"**, 8th Edition, Pearson Education.
2. S.Sen, S.Mukhopadhyay, A.K.Deb,**"Industrial Instrumentation Control *and* Automation"**, Jaico publishing house.
3. Madhuchhanda Mitra, Samarjit Sen Gupta, **"Programmable Logic controllers and Industrial Automation"**, Penram International Publishing India Pvt. Ltd.
4. Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication.

Reference Books:

1. John W. Webb, Ronold A Reis, "Programmable Logic Controllers, Principles and Applications", 5th Edition, Prentice Hall of India Pvt. Ltd.
2. Kilian, "Modern control technology: components & systems, Delmar 2nd edition
3. Bela G Liptak, "Process software and digital networks", 3rd edition, (2002).
4. Pollack. Herman, W & Robinson.T. "Computer Numerical Control", Prentice Hall. NJ.
5. Pabla, B.S. & Adithan, M. "CNC Machines", New Age Publishers, New Delhi.

Online Resources:

1. http://www.nptel.ac.in/courses/108105062/
2. https://www.honeywellprocess.com/library/support/Public/Documents/A%20Process%20control%20primer.pdf
3. https://nptel.ac.in/courses/112102011/downloads/faq%20of%20module%201.pdf

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PEEC 3201 Artificial Intelligence

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objective

1. To explain the basics of Artificial Intelligence (AI)
2. To introduce various types of algorithms useful in AI
3. To explain the concepts of machine learning, pattern recognition, and natural language processing.
4. To explain the numerous applications and huge possibilities in the field of AI

Course Outcomes:
After completion of the course, the student will be able to
1. Explain the components of intelligent agents and expert systems.
2. Apply knowledge representation techniques and problem solving strategies to AI applications.
3. Explain and analyze the search and learning algorithms
4. Describe the AI techniques in Expert/intelligent system development

Unit I : Basics of AI and Problem Solving (06)
Categories of AI, applications of AI, intelligent agents, agents and environments, good behavior, the nature of environments, structure of agents, problem solving, problem solving agents, searching for solutions, uninformed search strategies.

Unit II : Problem Solving : Beyond Classical Search, Adversarial Search And Constraint Satisfaction Problems (08)
Informed search strategies, heuristic function, local search algorithms and optimistic problems, local search in continuous spaces, online search agents and unknown environments, Games: optimal decisions in games, Alpha- Beta Pruning, imperfect real-time decision, games that include an element of chance. Constraint satisfaction problems (CSP), Backtracking search and Local search for CSP.

Unit III : Knowledge Representation (08)
Logic, Propositional logic, First order logic, Knowledge engineering in first order logic, inference in first order logic, prepositional versus first order logic, unification and lifting, forward chaining, backward chaining, resolution, knowledge representation, uncertainty and methods,Bayesian probability and belief network, probabilistic reasoning, Bayesian networks, inferences in Bayesian networks.

Unit IV : Learning (07)
Learning from observations: forms of learning, Inductive learning, Learning decision trees, Ensemble learning, Knowledge in learning, Logical formulation of learning, Explanation based learning, Learning using relevant information, Inductive logic programming, Statistical learning methods, Learning with complete data, Learning with hidden variable, EM algorithm, Instance based learning, Neural networks - Reinforcement learning, Passive reinforcement learning, Active reinforcement learning, Generalization in reinforcement

learning.

Unit V : Expert Systems **(07)**

Introduction to Expert System, Architecture and functionality, Examples of Expert system Visual perception-Waltz's algorithm,Basic steps of pattern recognition system, Feature Extraction- Principal Component Analysis, Linear Discriminant Analysis, Object Recognition- Template Matching theory, Prototype Matching Theory, Pattern Mining,Robotics, robot hardware, robotic software architecture, applications.

Unit VI: Natural Language Processing **(06)**

Language Models, text classification, formal grammar for a fragment of English, syntactic analysis, augmented grammars, semantic interpretation, ambiguity and disambiguation, discourse understanding, grammar induction, probabilistic language processing, probabilistic language models.

Text Books:

1. Stuart Russell, Peter Norvig, **"Artificial Intelligence, A Modern Approach"**, *Pearson Education/Prentice Hall of India,* (3^{rd} Edition), (2010).
2. Elaine Rich, Kevin Knight and Shivshankar Nair, **"Artificial Intelligence"**, *Tata McGraw Hill,* (3^{rd} Edition), (2009).

Reference Books:

1. Nils J. Nilsson, **"Artificial Intelligence: A new Synthesis"**, *Morgan Kaufmann Publishers,* (1^{th} Edition), (1998).
2. George F. Luger, **"Artificial Intelligence: Structures and Strategies for Complex Problem Solving"**, *Pearson Education,* (6^{th} Edition) (2008)

Online Resources:

1. NPTEL Lectures on AI : http://nptel.ac.in/courses/106105077/

PEEC 3202 EMBEDDED DESIGN AND RTOS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Explain embedded system design challenges
2. Discuss Operating system (OS) requirement for embedded systems
3. Describe real time operating system concepts
4. Discuss features of Linux OS
5. Interface real world input and output devices

Course Outcomes:
After completion of the course, students will be able to
1. Describe design metrics of embedded systems to design real time applications to match recent trends in technology.
2. Identify appropriate software development model for a given application
3. Apply real time systems concepts for developing embedded system
4. Explain need of open source OS with General Public License (GPL)
5. Explain kernel configuration and boot loader

Unit I : Introduction to Embedded Systems **(07)**
Introduction to Embedded Systems, Architecture, Classification and Characteristics of Embedded System, Design Process, Design Metrics and optimization of various parameters of embedded system. Embedded processor technology - IC technology, Design technology. Software development life cycle (SDLC) models like waterfall, spiral, V , Rapid Prototyping models and comparison,

Unit II: Structure of μCOS –II - Part - I **(07)**
Kernel Structure: Foreground and background systems, Pre-emptive and non-preemptive. Starting the OS. Tasks, Task States, TCB, Ready list, Task Scheduling, Task Level, Multitasking , Context Switching, , Idle Task, Statistics Task, Task Management: Creating/Deleting and Suspending/Resuming Task, Task Stacks and checking, Changing Task's Priority.

Unit III : Synchronization in μCOS-II **(07)**
Critical Session, Shared resources, Inter task communication, Mutual exclusion, Semaphore Management: Creation/Deletion, Pending/Posting/Acceptance/Query. Mutual Exclusion Semaphores: Creation/Deletion, ending/Posting/Acceptance/Query. Event Flag Management: Internals, Creation/ Deletion of Event Flag groups, Waiting/Setting/Clearing/Looking for/Querying an Event Flag Group.

Unit IV: Structure of μCOS –II **(07)**
Static and Dynamic Priorities, Priority inversion, Synchronization, mechanisms, Interrupts: Latency, Response and Recovery, Clock Tick, Memory requirements. Schedulers, Locking and unlocking of scheduler, Interrupts, Clock Tick, Initialization, Time Management: Delaying/Resuming task, System Time

Unit V: Communication in μCOS-II **(07)**

Message Mailbox Management: Creating/Deleting a Mailbox, Waiting/ Sending /Getting without waiting a Message from Mailbox, Status of Mailbox, Alternate uses of Mailbox. Message Queue Management: Creating/Deleting/ Flushing a Message Queue, Waiting/Sending/Getting without waiting a Message from Queue, Status and Alternate use of Message Queue. Memory Management: MCB, Creating a partition, Obtaining /Returning/Waiting for a memory Block, Partition Status. Porting of μCOS-II: Development tools, Directories and Files, Configuration and testing of Port.

Unit VI: Linux Kernel Construction **(07)**

Need of Linux, Embedded Linux Today, Open Source and the GPL, BIOS Versus Boot loader Linux Kernel Background, Linux Kernel Construction, Kernel Build System, Kernel Configuration. Role of a Bootloader, Bootloader Challenges. A Universal Bootloader: Das U-Boot. Porting U-Boot.

Text Books:

1. Jean J. Labrosse, **"MicroC OS II,The Real-Time Kernel"**, *CMP Books*, (2^{nd}Edition), (2011).
2. Christopher Hallinan, **"Embedded Linux Primer - A Practical, Real-World Approach"**,*Prentice Hall Pvt.*, (2^{nd} Edition), (2010)
3. Raj Kamal, **"Embedded Systems –Architecture, Programming and Design"**, *McGraw Hill*, (2^{nd} Edition), (2008).

Reference Books:

1. Dr. K. V. K. K. Prasad **"Embedded / real time System: Concepts, Design, & Programming -Black Book"**.*Dreamtech Press Publication.*(2^{nd} Edition),(2003).
2. Frank Vahid and Tony Givargis, **"Embedded System Design – A Unified hardware/ Software introduction"**, *Wiley Publication*, (3^{rd} Edition),(2006).

PEEC 3202 ANTENNA AND WAVE PROPAGATION

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Introduce and analyze the nature of uniform plane waves
2. Explain the different modes of propagation in uniform plane waves
3. Introduce the basics of antenna theory and analyze different types of antenna arrays
4. Familiarize the students with different types of antenna used for the practical applications

Course Outcomes:
After completion of the course, students will be able to
1. Apply Maxwell's equations to explain the phenomenon of uniform plane waves and analyze the wave propagation mechanism
2. Evaluate the performance of antenna in terms of antenna parameters
3. Identify the need of antenna arrays and analyze its design parameters
4. Design and analyze uniform and non-uniform antenna arrays
5. Select the type of antenna used for the practical applications

Unit: I Electro Magnetic Waves (10)
Maxwell Equations in phasor form, Wave Equation, Uniform Plane wave in homogeneous, free space, dielectric, conducting medium. Polarization: Linear, circular and Elliptical polarization, unpolarized wave. Reflection of plane waves, Normal incidence, oblique incidence, Electromagnetic Power and Poynting vector.

Unit: II Wave propagation (08)
Fundamental equations for free space propagation, Ground, sky and space wave propagations, Structure Of atmosphere, Characteristics of ionized regions, Effects of Earth's magnetic field, Virtual height, MUF, Skip distance, Ionosphere abnormalities, Multi-hop propagation.

Unit: III Antenna Fundamentals (08)
Types of Antenna, Radiation Mechanism, Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity. Radiation Integrals: Vector potentials A, J, F, M.

Unit: IV Wire Antennas and Antenna Arrays (08)
Analysis of Linear wire antennas: Infinitesimal dipole, small dipole, finite length dipole, half Wave length dipole, small circular loop antenna. Antenna Arrays: Two element array, pattern multiplication, N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, non uniform amplitude, array factor, binomial and Dolph Chebyshev array.

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Unit: V LF to SHF Antennas **(08)**

Beverage Antenna, Antenna towers, V, Inverted V and Rhombic antennas, Folded dipole, Yagi-Uda antenna, Loop antenna, Ferrite rod antenna, Log-periodic antennas, Horn, parabolic reflector, Helical antennas, Turnstile and Super Turnstile antennas, Microstrip antennas.

Text Books:

1. Mathew N O Sadiku, **"Elements of Electromagnetics"**, *Oxford University Press,* (3^{rd} Edition), (2001).
2. C. A. Balanis, **"Antenna Theory: Analysis and Design"**, *John Wiley,* (3^{rd} edition), (2011).
3. K. D. Prasad, **"Antenna and Wave Propagation"**, *Satya Prakashan,* (3^{rd} edition), (1996).

Reference Books:

1. E. C. Jordon and E. G. Balmain, **"Electro-magnetic Waves and Radiation Systems"**, *Prentice Hall India,* (2^{nd} Edition), (1993).
2. John D Kraus, **'"Antenna & Wave Propagation"**, *McGraw Hill,* (2^{nd} Edition), (1988).

Online Resources:

1. http://nptel.ac.in/coursesa

PEEC 3202 DIGITAL IMAGE PROCESSING

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Basic concepts of image processing like relations between pixels, distance measures, statistical parameters, colour models and noise models and operations on images
2. Different image enhancement, segmentation, representation and classifier techniques
3. Image analysis in spatial and transform domain for image compression and filtering
4. Different applications of Image processing

Course Outcomes:
After completion of the course, students will be able to

1. Explain basic concepts of image processing, Compute distance measures and perform arithmetic, logical, geometric, set and spatial transformation operations on images
2. Apply spatial domain image enhancement, filtering and grey scale transformation techniques on image
3. Analyze, apply and explain image processing in frequency domain for image filtering and compression
4. Apply morphological image processing on an image and apply image representation and description techniques
5. Apply image representation and description techniques and explain image segmentation and classification
6. Select different image processing modules to develop an image processing application

Unit I : Digital Image Fundamentals (08)
Components of Image Processing System, Element of Visual Perception, Image sensing and acquisition, A Simple Image Model, Sampling and Quantization, Relationship between pixels and Distance Measures, Statistical parameters. Basic operations on images.

Unit II: Image Enhancement (08)
Image Enhancement in Spatial Domain, Basic Gray Level transformations, Histogram processing, Equalization, Local Enhancement, Basics of Spatial Filtering, Smoothing, Mean filter, Ordered Statistic Filter, Sharpening. Image Enhancement in Frequency Domain, Basics of Filtering in Frequency Domain Filters, Low pass, High pass, Correspondence between Filtering in Spatial and Frequency Domain, Homomorphic Filtering.

Unit III : Image Transforms and Colour Models (08)
Color Image Processing, Color Fundamentals, Color Models, Pseudo color Image processing, Converting Colors to different models.2-D Discrete Fourier Transform, Discrete Cosine Transform, Redundancies, Image Compression Model, Lossy and Lossless Predictive Coding, block diagram of JPEG

Unit IV: Image Segmentation, Representation and Classification (10)
Image analysis, Detection of discontinuities, edge linking and boundary detection,

thresholding, region based segmentation, image representation- chain codes, boundary representation by chain codes, Fourier descriptors, Shape number, Signatures.Types of classification algorithms, Minimum distance classifier, Correlation based classifier, Bayes classifier.

Unit V: Morphological Image Processing and Applications of Image processing (08)
Introduction to Logical Operations on Binary Images, Dilation and Erosion, Opening and Closing, Applications on image processing, remote sensing, fingerprint recognition, character recognition, face recognition, medical applications, CBIR etc

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, "**Digital Image Processing**", *Pearson Education,* (2^{nd} Edition), (2012).
2. S. Jayaraman, Esakkirajan, Veerakumar, **"Digital Image Processing"**, *McGraw Hill Education,* (1^{st} Edition,), (2012).

Reference Books:

1. Anil K. Jain, **"Fundamentals of Digital Image Processing"**, *Prentice Hall,* (1^{st} Edition), (1989).
2. Pratt W. K., "**Digital Image Processing**", *John Wiley*, (2^{nd} Edition), (2001).

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PEEC 3202 ROBOTICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Course Objectives:

1. Explain fundamentals of robotic system
2. Introduce kinematics, dynamics and control for robotics systems
3. Introduce trajectory planning for motion
4. Describe application of robots in automation

Course Outcomes:

After completion of the course, students will be able to

1. Explain and classify different components used in developing robotic system
2. Select sensors, actuators and grippers for developing robot.
3. Apply formulations to obtain kinematics, dynamics and trajectory planning of manipulator
4. Explain path planning program for robotic system
5. Develop robot for automation

Unit I: Introduction to Robotics **(06)**

Definition of robotics, components of Robot system-(manipulator, controller, sensors, power conversion unit etc.), Classification of robots based on co-ordinate systems, Robot Architecture, Degrees of freedom, links and joints, progressive advancements in robots, Present trends and future trends in robotics.

Unit II: Robotic Sensors, Actuators and End Effectors **(10)**

Classification of sensors, internal and external sensors, position, acceleration sensors, proximity, velocity sensors, force sensors, tactile sensor, camera and robot vision.
Overview of actuators: electric, pneumatic and hydraulic actuators,
Classification of end effectors, Different types of grippers: vacuum and other methods of gripping.

Unit III: Transforms and Kinematics **(08)**

Pose of rigid body, Position and orientation description, Coordinate transforms, Homogeneous transform, Denavit and Hartenberg (DH) parameters, forward and inverse kinematic analysis.

Unit IV: Dynamics and Trajectory **(08)**

Dynamics and inverse Dynamics of robots, link inertia tensor and manipulator inertia tensor, Newton – Eller formulation. Trajectory planning, joint space planning, Cartesian space planning and position and orientation trajectories.

Unit V: Programming methods **(04)**

Robot language classification, Robot language structure, elements and its functions. Simple programs on Sensing distance and direction, Line Following Algorithms, Feedback Systems Other topics on advance robotic techniques

Unit VI: Application of Robot in Automation **(06)**

Application in Manufacturing: Material Transfer, Material handling, loading and unloading processing, spot and continuous arc welding & spray painting, Assembly Inspection, Robot application in Medical, Industrial Automation, and Security

Text Books:

1. S.K. Saha, "Introduction to Robotics", Tata McGraw Hill, (2^{nd} Edition), (2014).
2. R. K. Mittal, I. J. Nagrath, **"Robotics and Control"** , *Tata McGraw Hill, New Delhi "* , (1^{st} Edition), (2003).
3. K.S. Fu, R.C .Gonzalez, C.S.G.Lee ,**"Robotics Control ,Sensing ,Vision and Intelligence"** , *Tata McGraw Hill* , (2^{nd} Edition), (2008).

Reference Books:

1. Robert schilling, **"Fundaments of Robotics: Analysis and Control"**, *PHI. New Delhi*, (1^{st} Edition), (2003).
2. S. R. Deb, **"Robotics Technology and Flexible Automation"**, S. Deb, Tata McGraw Hill, (1^{st} Edition), (2010).
3. Robert J. Schilling, **"Fundamentals of Robotics- Analysis and Control"**, Prentices Hall India, (1^{st} Edition), (2008).

Online Resources:

1. https://nptel.ac.in/downloads/112101098/
2. https://nptel.ac.in/courses/112103174/module7/lec6/6.html

EC 3204 DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Oral: 25 Marks
Credits: 1

Course Objectives

1. To get familiar with the simulation software and build programming skills for simulating key Digital signal processing operations
2. To apply different sampling frequencies to verify sampling theorem
3. To compare the characteristics of LTI systems from pole-zero plot
4. To discuss frequency domain representation of discrete time signals
5. To verify digital filter design

Course Outcomes
After completion of the course, students will be able to
1. Select appropriate sampling frequency for the given signal to avoid aliasing
2. Simulate and verify the transform (ZT, DFT, FFT) techniques and filter design
3. Analyze LTI system characteristics- pole-zero plot, stability, causality
4. Interpret spectral representation of discrete time signals
5. Design and evaluate performance of digital filters

List of Experiments
1. To write a program to verify the sampling theorem and aliasing effects with various sampling frequencies.
2. To analyze LTI system using pole zero plot, study stability of different transfer functions.
3. To solve the difference equation and find the system response using Z transform.
4. To write a function to find DFT.
5. To write a program to verify DFT properties.
6. To compare the characteristics of different window functions.
7. To design FIR filter for the given specifications using windowing method and interpret the effect of different windows on FIR filter response.
8. To design Butterworth filter using Bilinear transformation method.
9. Design a digital filter to eliminate noise from real life signals, Example: speech or biomedical signals.

EC 3205 ADVANCED PROCESSORLAB

Teaching Scheme
Practical: 4 Hours / Week

Examination Scheme
Practical : 50 Marks
Credits: 2

Course Objectives:

1. Explain on chip peripherals of LPC 2148 processor
2. Interfacing real world input and output devices to LPC2148
3. Use of Operating system in embedded systems

Course Outcomes:
After completion of the course, students will be able to
1. Write assembly or C language program for LPC2148 on chip peripheral
2. Interface external peripherals to LPC2148 and write C code
3. Install OS on Raspberry pi

List of Experiments:
1. Using UART of LPC2148 for serial reception and transmission from/to computer.
2. Interfacing GSM with LPC2148 for sending and receiving message and voice call.
3. Interfacing GPS with LPC2148 for finding current location latitude and longitude values.
4. Interfacing LPC2148 with GLCD to display image on it.
5. Using built-in ADC of LPC2148 for displaying its values (Programming built-in ADC with interrupt and without interrupt) OR Programming of onchip ADC and displaying converted digital values.
6. Generate waveform using DAC of LPC2148.
7. Interfacing EEPROM to LPC2148 using I2C protocol.
8. Write Program for generating delays using timer/counter.
9. Installing OS in Raspberry Pi.
10. Write program in Raspberry pi to display 'hello world' and compile using GCC.

EC3206 MINI PROJECT AND SEMINAR

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
Oral : 25 Marks
Credits: 1

Course Objectives:

1. Undertake and execute a Mini Project through a group of students
2. Explain the Product Development Cycle through Mini Project
3. Inculcate electronic hardware implementation skills by :
    a. PCB artwork design using an appropriate EDA tool
    b. Imbibing good soldering and effective trouble-shooting practices
    c. Knowing the significance of aesthetics and ergonomics while designing electronic product.
4. Identify the importance of technical documentation of mini project work

Course Outcomes:
After completion of the course, students will be able to

1. Select, plan and cost-estimation of the project
2. Design and simulate the project by using EDA tools
3. Test the project circuit for intended output on bread board or general purpose board
4. Develop the art work and layout of the circuit using PCB design software
5. Test the mini project for intended output
6. Compose a technical report and demonstrate the project

Guidelines:

1. Project group shall consist of not more than 3 students per group.
2. Project design ideas should be adopted from recent issues of electronic design magazines,
3. Application notes from well known component manufacturers may also be referred.
4. Hardware component is mandatory.
5. Layout versus schematic verification is mandatory.

Domains for projects may be from the following, but not limited to:

- Electronic Communication Systems
- Power Electronics
- Biomedical Electronics
- Audio , Video Systems
- Mechatronics Systems
- Embedded Systems
- Instrumentation and Control Systems

Note:

1. Microcontroller based projects should preferably use Microchip PIC controllers/ATmega controller/AVR microcontrollers.

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Reference books:

1. Meenakshi Raman, Sangeeta Sharma, " **Technical Communication, Principles and Practice"**, *Oxford University Press,* (2nd Edition), (2012).
2. M. Ashraf Rizvi," **Effective Technical Communication"**, *Tata McGraw Hill Education Pvt. Ltd.* (1st Edition), (2005).
3. C.Muralikrishna, Sunita Mishra," **Communication Skills for Engineers"**, *Pearson Education India,* (2nd Edition), (2011).
4. Thomas C Hayes, Paul Horowitz, **"The Art of Electronics"**, *Cambridge University Press,* (3rd Edition), (2015).
5. Jim Williams, **"Analog Circuit Design: Art, Science and Personalities"**, *Elsevier EDN series for Design Engineers,* (1st Edition), (2013).

PEEC 3203 EMBEDDED SYSTEM AND RTOS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester: 25Marks
Credits: 1

Course Objectives:

1. Interface real world input and output devices
2. Discuss use of μCOS-II RTOS functions in programming
3. Explain porting of Linux OS

Course Outcomes:
After completion of the course, students will be able to
1. Interface real world input and output devices
2. Apply RTOS concepts to external peripheral devices
3. Write C program using RTOS functions
4. Port Linux OS in embedded system

List of Experiments:
1. Port μCOS-II RTOS on ARM-7.
2. Multitasking in μCOS-II RTOS using min 4 tasks on ARM7
3. Semaphore as signaling and Synchronizing on ARM7.
4. Mailbox implementation for message passing on ARM7.
5. Implement MUTEX on ARM 7
6. Use OS service(s) to accept keyboard input and display/transmit
7. Building tool chain for embedded Linux and porting Kernel on ARM9 target board.
8. Write a program 'Hello world; using embedded Linux on ARM9.

PEEC 3203 ANTENNA AND WAVE PROPAGATION LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester: 25Marks
Credits: 1

Course Objectives:

1. To compare various antenna parameters for the different types of antennas
2. To analyze the nature of standing waves for different terminations
3. To design and simulate different antenna arrays

Course Outcomes:
After completion of the course, students will be able to
1. Measure and analyze antenna parameters
2. Explain the importance of impedance matching from the perspective of antenna design
3. Simulate and analyze the performance of antenna arrays
4. Design and analyze antenna arrays using antenna design software

List of Experiments:
1. To measure Radiation pattern, Half power beam width, directivity and Gain for Dipole Antenna.
2. To measure Radiation pattern, Half power beam width, directivity and Gain for Folded Dipole Antenna.
3. To measure Radiation pattern, Half power beam width, directivity and Gain for Yagi Antenna.
4. To measure Radiation pattern, Half power beam width, directivity and Gain for Parabolic Reflector Antenna.
5. To measure Radiation pattern, Half power beam width, directivity and Gain for Horn Antenna.
6. Plot and analyze standing wave pattern for open, short and matched termination.
7. Design Broadside Array using Antenna design software.
8. Design Yagi Antenna design using Antenna design software.

. Simulation of varying length Dipole Antenna.

11. Simulation for Broadside Linear Array and End Fire Linear Array.
12. Simulation for Binomial Array and Dolph Tschebyscheff Array.

PEEC 3203 DIGITAL IMAGE PROCESSING LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester: 25Marks
Credits: 1

Course Objectives:

1. Perform operations of Digital Image
2. Digital image enhancement and filtering techniques
3. Transform domain operations to achieve image compression and filtering
4. Image segmentation and representation techniques

Course Outcomes:

After completion of the course, students will be able to

1. Perform logical, set, arithmetic and geometric operations on images
2. Implement algorithms for image enhancement, filtering in spatial domain and transform domain
3. Develop an algorithm for image segmentation, compression and colour model conversions
4. Perform morphological operations on images

List of Experiments:

1. To read a BMP file and display its information using C.
2. To perform image segmentation using pseudo colouring using C.
3. To create a digital image and to perform basic operations on images.
4. To perform conversion between colour spaces.
5. To perform power law and gamma corrections.
6. To perform image filtering in spatial domain and frequency domain.
7. To perform image compression using DCT transform.
8. To perform edge detection using masks.
9. To apply morphological operators on an image.
10. Demonstration of installation of Open CV platform.
11. To perform digital image processing using Open CV and Python.

PEEC 3203 ROBOTIC LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester: 25Marks
Credits: 1

Course Objectives:

1. Demonstrate robot working and degree of freedom using physical components
2. Demonstrate robot functioning using simulation software
3. Design microcontroller based robotic system for specific task

Course Outcomes:

After completion of the course, students will be able to

1. Describe mechanical configuration of robot manipulation
2. Describe sensors and actuators used in robot manipulation
3. Apply concept to simulate to obtain work space, kinematics, and trajectory path of robot manipulator
4. Develop robots for specified task

List of Experiments:

1. Velocity and Position measurement using optical encoder.
2. Interface Pneumatic system component to actuate single acting and double acting cylinders.
3. Plot of work space of 2-link planer arm using simulation software.
4. Simulation of Forward Kinematics and Inverse Kinematic of
    1. 3-Link Robot
    2. PUMA 560 Robots.
5. Simulation of Trajectory path of :
    1. 3-Link Robot
    2. PUMA 560 Robots.
6. Design and implement Robotics system for any application..

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