

EC420 EMBEDDED SYSTEMS DESIGN

L T P C
3-0-0-3

Objective: *Embedded system provides cost effective solution for industrial, consumer and space applications. The objective of teaching this course to the student is to train them to learn all aspects of hardware of software development to design embedded system for various applications.*

Introduction to Embedded System and Design Concept: Introduction and examples of embedded systems, Concept of embedded system design, design challenges, Processor technology and IC technology, embedded processors trade offs: General Purpose Processors & Custom built single purpose processor hardware, Application Specific instruction processor, Digital Signal Processors, Selection of embedded processor, Development phase of embedded system and use of software tools for development of embedded system.

Embedded Processors Architecture and Programming Language: Overview of 8bits/16 bits/32 bits microcontrollers, microcontroller's hardware-PIC and ARM processor architecture , Memory Organization of an embedded system, Interfacing processor, memory and I/O devices ,Programming concept and embedded programming in C and C++ ,Embedded software development on PIC/ARM microcontrollers platforms.

Embedded Software Architecture Development: Challenges and issues in embedded software development, Real time programming language and embedded operating systems, Embedded software architecture: Round-Robin, Round-Robin with interrupt, RTOS architecture, tasks and task states, priority based scheduling, semaphore and shared data, timer function, memory management, encapsulating semaphore and queue, hard real-time scheduling consideration, saving memory and power.

Network for Embedded Systems: I2C two wire buses, The CAN bus, SHARC link ports, Ethernet, Myrinet, IEEE 1451.1 and IEEE 1451.2 plugs and play standards, Embedded TCP/IP.

Embedded Application Development: Determine the requirements, Design the system architecture, Choose the operating system, Choose processor type , development platform and programming language, input/output, coding issue and code optimization, testing and debugging, Verify the software on the host system and verify the software on the embedded system.

Recommended Books:

1. Embedded/Real-Time System by Dr. K.V.K.K Prasad, Dreamtech Press
2. Embedded Systems-Architecture, Programming and Design by Rajkamal
3. Embedded C Programming and the Microchip PIC by Barnett Cox and O'Cull, Thomson Press.
4. Embedded Real-Time System Programming by S.V Iyer & Gupta, TMH Pub.
5. TCP/IP-Application layer protocol for embedded system by M. Tim Jones, Laxmi Publication.
6. An Embedded Software Primer by David E. Simon, Pearson Education
7. Fundamental of Embedded Software by Daniel W. Lewis, Pearson Education

EC 421 ROBOTICS

L T P C
3- 0-0-3

Objective: *Robotic is concerned with study of machines that can replace human being in execution of tasks, as regard to both physical activity and decision making. Robotics may change our workplace, economy, healthcare and many other aspects of our lives. The course is aimed to introduce the students with the key concepts of robotic system, components, manipulator and motion control, sensing devices and vision systems, actuators, programming concepts and applications.*

Classification of Robotic Systems: Classification of robots, basic robot components, and manipulator end effectors, controller, power unit, sensing devices, specification of robot systems, accuracy precision and repeatability.

Components, Drives and Control: Hydraulic and pneumatic systems, cylinders, control valves, hydro motors, types of mechanical power drives, rotary to linear motion conversion mechanisms, robot manipulator & end effector , manipulator structure, static & dynamic manipulator , trajectory planning & motion control, servo motors, stepper motors, robot controllers, control loop using current and voltage amplifiers, configuration of robot controllers.

Robotic Sensing Devices: Position, velocity and acceleration sensors, proximity and range sensors, touch and slip sensors, tactile sensors, force and torque sensors.

Robotic Vision System: imaging components, picture coding, object recognition, training and vision systems, review of existing vision systems.

Robotics Programming: Methods of robot programming, types of programming, robotics programming languages, artificial intelligence.

Robot Applications: material transfer and machine loading /unloading, processing applications, welding and painting assembly and inspection, future robotic applications and related technologies developments.

Books recommended:

1. Fundamentals of Robotics Analysis and control: Robert J. Schilling, Pearson, Prentice Hall.
2. Industrial robotics : Groover, Weiss Nagel and Odrey,, Mc Graw Hill.
3. Robotics engineering : Klafter, Chmielwski and Nagrin, Prentice Hall.
4. Robotics for engineering : Yorem Korem, Mc Graw Hill.
5. Robotics : Control, Sensing Vision and intelligence : K.S. Fu, R.C.Gonzalez, Mc Graw Hill.

EC 422 ANALOG CMOS VLSI DESIGN

L T P C
3- 0-0-3

Objective: The main course objective is to teach students' about NMOS/PMOS, CMOS parameters, design considerations & related circuitry; MOS transistor parameters & its related characteristics along with FET, JFET, MESFET Technologies.

Introduction: Analog VLSI & Mixed Signal issues in CMOS Technologies, Basic MOS frequency dependant parameters.

Amplifiers: Basic NMOS/CMOS gain stage, Cascade & cascade stability and noise issues in Amplifiers, CMOS analog blocks: Current sources & V amplifier along with Operational amplifier design.

Effects in MOS transistors: Short channel effects in MOS transistor parameters, Scaling & transistor structures for ULSI, Silicon – on – insulator transistors, High field & Radiation effects in transistors .

Transistors: Bipolar junction transistor: Ebers – Moll Model, Charge control model, Small signal & switching characteristics, Graded base & Graded emitter transistors, High – current & high – frequency effects, hetero - junction bipolar transistors, junction FETs, JFET, MESFET & hetero – junction FET

Applications: Data converters, Analog Interconnection issues, Low voltage & low power supplies, Frequency synthesizers & Phase locked loop, Non – linear comparators, charge pump circuits and Multipliers.

Text/ References

1. Philip E. Allen, Douglas R.Hoberg, " CMOS Analog Circuit Design " Second Edition,Oxford Press-2002 (Unit III).
2. Behzad Razavi, " Design of Analog CMOS Integrated Circuits", Tata Mc-Graw Hill.
3. Alan B. Gnebene, "Bipolar and MOS analog integrated circuit design", John Wiley & Sons.

CS 427 ARTIFICIAL INTELLIGENCE

L-T-P-C
3- 0- 0-3

Objective: *Artificial Intelligence is used in solving problems in engineering and to earn different point of view using Expert Systems. At the end of the course students should learn application areas of artificial intelligence and expert system, solving problem using artificial intelligence and expert system techniques.*

Introduction: Artificial intelligence problems, artificial intelligence techniques, production system and characteristics.

Problem Solving: Problem definition, state space search tree, problem characteristics, search strategies for artificial intelligence productions system: backtracking, graph search, uniformed graph search, heuristic graph search techniques-generate and test, hill climbing, best-first search, problem reduction: AO* algorithm for AND/OR graphs.

Understanding Natural Languages: Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammars, Shanks Conceptual Dependency, grammar free analyzers, sentence generation and translation.

Knowledge Representation: Representation and mappings, Approaches and issues in knowledge representation, First order predicate calculus, Horn Clauses , procedural versus declarative knowledge, Matching, Non-monotonic reasoning, Probability theory and Fuzzy logic,

Expert System & Game Theory: Existing Systems (DENDRAL , MYCIN) ,domain exploration ,Meta Knowledge , Expertise Transfer, Self Explaining System, Mini-Max search, Alpha-Beta cutoffs

Programming Language: Introduction to programming LISP and PROLOG

Books:

1. Char nick, Introduction to Artificial Intelligence, Addison Wesley
2. Rich & Knight, Artificial Intelligence.
3. Winston, LISP, Addison Wesley
4. Marcellous, Expert Systems Programming ,PHI
5. Elamie, Artificial Intelligence, Academic Press
6. Lioyed , Foundation of Logic Programming , Springer Verlag

CS 428 MOBILE COMPUTING

L-T-P-C

3- 0- 0-3

Objective: *The objective of teaching this course is to introduce the students with the basic architecture of mobile and cellular communication system starting from 1-G through 3 -G. On completion of this course, Students will able to develop system and application level software for small, battery powered terminals equipped with the wireless network connection.*

Introduction to Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services.

(Wireless) Medium Access Control: Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.

Mobile Network Layer: Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.

Database Issues: Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues.

Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs.

Protocols and Tools: Wireless Application Protocol-WAP (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.

Text Books:

- 1) Jochen Schiller, "Mobile Communications", Addison-Wesley. (Chapters 4, 7, 9,0, 11), second edition, 2004.
- 2)Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028. (Chapters 11, 15, 17, 26 and 27)

Reference Books:

- 1) Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press,October2004,
- 2) Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden , Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw- Hill Professional, 2005.
- 3) Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, Second edition, 2003.
- 4) Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003