EMBEDDED SYSTEMS DESIGN

PROF. ANUPAM BASU
Department of Computer Science & Engineering
IIT Kharagpur

PRE-REQUISITES : Computer Organization, Basic of Microprocessors

INTENDED AUDIENCE : Environmental engineering professionals and students pursuing a degree with emphasis in Environmental engineering.

INDUSTRIES APPLICABLE TO : Any industry working in the area of Embedded Systems

COURSE OUTLINE :
This course on Embedded systems will first the students to the fundamental requirements of embedded systems and the interaction between hardware and software in such systems. Next the course will discuss some basic steps of hardware design, introduce the students to ASIPs, ASICs and FPGAs. Next, the students will be exposed to the very important issue of designing for less power consumption and introduce them to the techniques that are adopted to this end. Since many of the embedded systems will have real time constraints, basic issues of real time operating systems will be discussed. This will be followed by formal specification models and languages, mapping the specification to hardware and software components along with decisions on design tradeoffs and hardware software partitioning. Next, synthesis if hardware and software along with a few of the optimization techniques will be presented. The course will end with a brief overview of design verification methods that are adopted for embedded system design.

ABOUT INSTRUCTOR :
Prof. Anupam Basu is Professor in the Dept. of Computer Science Engineering, IIT Kharagpur, and has been an active researcher in the areas of Cognitive and Intelligent Systems, Embedded Systems and Language Processing, Presently he is acting as the Chairman and Head of the Center for Educational Technology, IIT Kharagpur. He has developed several embedded system based tools empowering the physically challenged and has led several national projects in the area.He has taught at the University of California, Irvine at the Center for Embedded Systems. He is an Alexander von Humboldt Fellow and a Fellow of the Indian National Academy of Engineering. The awards won by him include the State Award for the Best Contribution to the Cause of Empowerment of the Disabled (2014), Universal Design Award 2011, for contributions in design for the disabled, by National Council for Promotion of Employment of Disabled Persons, India, the National Award for the Best Technology Innovation for the Physically Disabled (2007) and the Da-Vinci Award 2004 from the Engineering Society of Detroit.

COURSE PLAN :

 Week 1**:** Introduction to Embedded System, ASICs and ASIPs

 Week 2**:** Designing Single Purpose Processors and Optimization

 Week 3**:** Introduction to FPGAs and Synthesis

 Week 4**:** Verilog Hardware Description Language (Verilog HDL)

 Week 5**:** Microcontrollers and Power Aware Embedded System Design

 Week 6**:** Real Time Operating System

 Week 7**:** Real Time Scheduling Algorithms

 Week 8**:** Modelling and Specification

 Week 9**:** Design Synthesis

 Week 10**:** Digital Camera Design and Hardware Software Partitioning

 Week 11**:** Design Optimization

 Week 12**:** Simulation and Verification