

## MEVD – 301(A) Opto-Electronics Integrated Circuits

### Unit I

**Theory of Optical Wave guides:** Wave guide theory : one dimensional planar wave guides, two dimensional wave guides, transcendental equations, wave guide modes, mode cutoff conditions.

### Unit II

**Optical Wave guide Fabrication and Characterization:** Waveguide fabrication: deposited films; vacuum-deposition and solution-deposition, diffused waveguides, ion-exchange and ion-implanted waveguides, epitaxial growth of III-V compound semiconductor materials, shaping of waveguides by wet and dry etching techniques. Waveguide characterization: surface scattering and absorption losses, radiation and bending losses, measurement of waveguide loss, waveguide profiling.

### Unit III

**Fundamentals of Optical Coupling:** Transverse couplers. Prism couplers. Grating couplers. Fiber to waveguide couplers. Coupling between optical waveguides. Directional couplers. Applications of directional couplers.

### Unit IV

**Guided Wave Modulators and Switches:** Physical effects used in light modulators : electro-optic, acousto-optic and magneto-optic effects. Waveguide modulators and switches.

### Unit V

**Semiconductor Lasers and Detectors:** Laser diodes. Distributed feedback lasers. Integrated optical detectors.

### Unit VI

**Recent Progress in Integrated Optics:** State-of-the-art technology in guided wave devices and applications, e.g. photonic switching, tunable laser diodes, optical integrated circuits.

### Text/ Reference

1. T Tamir, *Guided Wave Optoelectronics*, Springer-Verlag, 1990
2. R Sysm & J Cozens, *Optical Guided Waves and Devices*, McGraw-Hill, 1993

## MEVD 301 (B) - System on Chip (SOC) Design

### UNIT I

Recent advances in semiconductor technology, Programmable logic devices, such as field programmable gate arrays (FPGAs), Programmable chip architectures, logic synthesis, SoC concepts, and the Verilog synthesizable subset, Implementation of a complex system on a single programmable chip.

### UNIT II

Tools and techniques for designing, verifying and implementing System-on-Chip (SoC) designs using programmable logic. Embedded system applications and their system-level hardware-software co-design.

### UNIT III

Implementation Aspects: Adders, ALUs, Multipliers, Dividers, Register Files, Buses, CISC/RISC, Memory hierarchy (caches, MMU, main memory)

### UNIT IV

ARM System-on-chip architecture.

### UNIT V

**Project Orientation:** Concept to Verilog hardware description language (HDL), verification using simulation, synthesis and programmable device implementation on an FPGA development board.

### Text/ Reference

1. Palnitkar, Samir, *Verilog HDL*, Prentice Hall, 2003, 2<sup>nd</sup> Ed., ISBN 0-13-044911-3
2. Bhasker, J., *Verilog HDL Synthesis – A Practical Primer*, Star Galaxy Publishing, Allentown PA, 1998, ISBN 0-9650391-5-3
3. Maxfield, Clive, *The Design Warrior's Guide to FPGAs*, Newnes, 2004, ISBN 0-7506-7604-3
4. Smith, D. J., *HDL Chip Design*, Doone Publications, Madison AL, 1999, ISBN 0-9651934-3-8
5. Sutherland, Stuart, *Verilog 2001 – A Guide to the New Features of the Verilog Hardware*
6. *Description Language*, Kluwer Academic Publishers, 2002, ISBN 0-7923-7568-8
7. Cummings, C., *Nonblocking Assignments in Verilog Synthesis, Coding Styles That Kill*, Synopsys Users Group 2000
8. Cummings, C., *"full\_case parallel\_case", the Evil Twins of Verilog Synthesis*, Synopsys Users Group 1999
9. Mills, D., Cummings, C., *RTL Coding Styles That Yield Simulation and Synthesis Mismatches*, Synopsys Users Group 1999
10. Xilinx *Spartan-3 FPGA Family Data Sheet, DS099-2*
11. Xilinx *PicoBlaze KCPSM3 Microcontroller Users Manual*

## **MEVD 302 (A) - Communication RF IC Design**

### **Unit I**

Basic concepts in RF Design: Analysis & Measurement Techniques. S-Parameter Models, Smith Chart Calculations.

### **Unit II**

Trans-receiver Architecture for Wireless Communication Standards. Non-Linearity, Harmonics, Gain Compression, Desensitization, Cross Modulation, IMD & Inter-symbol Interface.

### **Unit III**

RF IC Design concepts & Device Technologies: Low Noise Amplifiers, Mixers, Frequency Sources, Oscillators & Synthesizers, Power Amplifiers. Noises & Distortions in LNA, PA & Mixer Circuits.

### **Unit IV**

PLL: Theory, Circuits, Distortion & Noises. Microwave Circuit Components & Design Concepts: Single Chip Radio Concepts, Design Issues Surrounding Systems as DECT, GSM, Blue Tooth etc. Case Studies.

### **Text / Reference**

1. Behzad Razavi, *RF Microelectronics*, PHI 1998.
2. R. Ludwig & P. Bretchko, *RF Circuit Design*, PHI 2000.
3. L.E. Larson, *RF & Microwave Circuit Design for Wireless Communication*, Artech House Publishers, 1997.
4. Thomas H. Lee, *The Design of CMOS Radio Frequency Integrated Circuits*, Cambridge University Press, 1998.
5. George Vendelin, *Design of Amplifiers & Oscillators by S-Parameter Method*, J. Wiley & Sons, 1982.

## **MEVD 302 (B) Embedded System Programming**

### **Unit-I**

Introduction to Linux Operating System. Shell Programming, Review of C-Programming and Data Structures.

### **Unit-II**

Overview of Embedded Systems – Sequential and Concurrent Models – Processor Solutions and Types – Types of Memory – Data Representation Formats – Usage of C in Embedded Systems – Programmers view of CPU – IO programming models – Concurrent Software Design – Scheduling – Memory Management – Mixing C & Assembly.

### **Unit-III**

Embedded System Design Issues , Challenges & Trends in Embedded Systems, Assemblers, Compilers, Linkers, Loaders, Debuggers , Profilers & Test Coverage Tools , Utilities like make, ranlib, objcopy & objdump etc.

### **Unit-IV**

Writing device drivers, Writing Time & Space Sensitive Programs, Programming in C for 8051, 68HC11 and 80196 microcontrollers.

### **Text/References**

1. David E. Simon, An Embedded Software Primer, Pearson Education.
2. Michel Barr, Programming Embedded Systems in C & C++, Shroff Publishers & Distributors Pvt. Ltd.
3. Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons, 2002.
4. Daniel W. Lewis, Fundamentals of Embedded Software: Where C and Assembly Meet, Prentice Hall, 2002.
5. Jane Liu, Real-time Systems, Prentice Hall, 2000.