



**Module 1**

**Chapter 1 : Introduction to Embedded Systems**

**1-1 to 1-11**

**Syllabus :** Definition, Characteristics, Classification, Applications. Design metrics of Embedded system and Challenges in optimization of metrics.

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**Module 2**

**Chapter 2 : Embedded Hardware Elements**

**2-1 to 2-79**

**Syllabus :** Features of Embedded cores-  $\mu$ C, ASIC, ASSP, SoC, FPGA, RISC and CISC cores. Types of memories. Case Study: ARM Cortex-M3 Features, Architecture, Programmer’s model, Special Registers, Operating Modes and States, MPU, Memory map and NVIC. Low power - Need and techniques. Case study of Low Power modes in Cortex-M3. Communication Interfaces: Comparative study of Serial communication Interfaces -RS-232, RS-485, SPI, I2C, CAN, USB (v2.0), Bluetooth, Zig-Bee. (Frame formats of above protocols are not expected). Selection Criteria of Sensors and Actuators

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**Module 3**

**Chapter 3 : Embedded Software**

**3-1 to 3-62**

**Syllabus :** Program Modelling concepts: DFG, CDFG, FSM. Real-time Operating system: Need of RTOS in Embedded system software and comparison with GPOS. Task, Task states, Multi-tasking, Task scheduling, and algorithms-Preemptive SJF, Round-Robin, Priority, Rate Monotonic Scheduling, Earliest Deadline First Inter-process communication: Message queues, Mailbox, Event timers. Task synchronization: Need, Issues- Deadlock, Race condition, live Lock, Solutions using Mutex, Semaphores. Shared Data problem, Priority inversion

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**Module 4**

**Chapter 4 : Introduction to FreeRTOS**

**4-1 to 4-8**

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**Module 5****Chapter 5 : Testing and Debugging Methodology****5-1 to 5-28**

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**Module 6**

**Chapter 6 : System Integration (Case Studies)**

**6-1 to 6-17**

**Syllabus :** Embedded Product Design Life-Cycle (EDLC)- Waterfall Model. Hardware-Software Co-design. Case studies for Automatic Chocolate Vending Machine, Washing Machine, Smart Card, highlighting : (i) Specification requirements (choice of components), (ii) Hardware architecture (iii) Software architecture.

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