

Automotive Embedded SW Development

I. Job Title/Job Specialty:

- Automotive SW Engineer
- R&D Automotive SW Engineer

II. Prerequisite:

- Fresh graduate (maximum 5 years from graduation)
- B.Sc. in Electronics Engineering, Mechatronics Engineering, Communication Engineering, Computer Engineering, Computer Science.
- Good Problem-Solving Skills
- Basic Knowledge of Embedded Systems

III. Course Duration: 3 months

IV. Hours/week: 35 hours

V. Course Contents:

1 Introduction

- 1.1 What are Embedded Systems?
- 1.2 Embedded systems in our life
- 1.3 Embedded systems characteristics
- 1.4 Microcontroller Vs. Microprocessor
- 1.5 Memory types (RAM, ROM, EEPROM, ..etc.)
- 1.6 Embedded systems market in Egypt
- 1.7 Introduction into the Automotive Market

2 Embedded C

- 2.1 C Vs. Embedded C
- 2.2 Code Compilation process
- 2.3 Data Types
- 2.4 Pointers
- 2.5 Structure & Union & Bitfields
- 2.6 Enum
- 2.7 Typedef
- 2.8 Declaration vs. Definition and extern
- 2.9 Overflow vs. Underflow
- 2.10 Explicit casting Vs. Implicit casting
- 2.11 Data Type Qualifiers
- 2.12 Storage classes
- 2.13 Program memory segments
- 2.14 HW I/O concepts

3 Make file introduction

- 3.1 What is Make (GNU Make as an example)
- 3.2 makefile structure: Rule structure: Target, Dependencies, Commands
- 3.3 Make variables

- 3.4 Make implicit rules
- 3.5 Creating project hierarchy
- 3.6 Header files issue and Make dependencies
- 4 AVR and ARM HW Interfacing**
- 4.1 AVR & ARM architectures
- 4.2 GPIO
- 4.3 Polling vs. Interrupt
- 4.4 Timer
- 4.5 PWM
- 4.6 Communication protocols
- 4.7 ADC
- 6 Data Structures & Algorithms**
- 6.1 Primitive DS
- 6.2 Non-Primitive DS
- 6.3 Algorithms
- 7 Operating System**
- 7.1 Introduction
- 7.2 OS concepts
- 7.3 RTOS
- 8 System Level Design**
- 8.1 System components
- 8.2 Block Diagram and IO Specification
- 8.3 Flow chart
- 8.4 HW concepts
- 8.5 SW Programming concepts
- 9 Software Testing**
- 9.1 What is testing?
- 9.2 Testing objectives
- 9.3 Testing life-cycle
- 9.4 Validation Vs. Verification
- 9.5 Testing Models
- 9.6 Testing Levels
- 9.7 Static Testing Vs. Dynamic Testing
- 9.8 Testing Types
- 9.9 Code review & Review process
- 9.10 Static analysis
- 10 Software Engineering & Practices**
- 10.1 Software Engineering
- 10.2 Agile Methodology
- 10.3 Requirements Engineering
- 10.4 Project Management
- 10.5 Configuration Management
- 10.6 Defect Management
- 11 AUTOSAR**
- 11.1 AUTOSAR Basics
- 11.2 AUTOSAR Software Components & Application Layer
- 11.3 AUTOSAR basic Software Layer
- 11.4 AUTOSAR MCAL Layer

- 11.5 AUTOSAR Services Layer
- 11.6 Deployed AUTOSAR knowledge of Memory Stack Modules
- 11.7 Deployed AUTOSAR Knowledge of Communication Stack Modules
- 12 Functional Safety**
- 12.1 Introduction to ISO26262
- 12.2 Concept phase
- 12.3 Product development - Systems Level
- 12.4 Product development - Software Level
- 12.5 Summary of Functional Safety Activities.
- 12.6 Introduction to Safety Analysis techniques (FTA, FFI, FMEDA, ... etc.).
- 12.7 Safety Mechanisms and how to read them from safety manual.
- 12.8 Applying Analysis and implementation to achieve technical safety requirements
- 13 Automotive Cybersecurity Fundamentals**
- 13.1 Automotive Cybersecurity Overview
- 13.2 Crypto Attributes and Primitives
- 13.3 Cyber Security Concepts
- 13.4 Cybersecurity Analysis and Verification
- 13.5 Cybersecurity Concepts and Solutions
- 14 Non-Technical Skills**
- 14.1 Communication Skills
- 14.3 Presentation Skills
- 14.4 Business Writing
- 14.5 Email Writing
- 14.6 Employee Key Performance Indicators