CCEK – NSQF ALIGNED PROGRAM

COURSE SYLLABUS

FOR

Embedded system design using Micro controller

CCEK - NATIONAL SKILL DEVELOPMENT TRAINING PROGRAM

Embedded system design using Micro controller

CCEK – NSDC course package covers the following Qualification Packs and leads to the following NSDC certifications. The students who successfully completed the course programs are entitled to get NSDC certification after undergoing the assessment process of NSDC as per the rules and regulations stipulated by NSDC from time to time.

SL. NO.	QUALIFICATIONS PACK	QUALIFICATIONS PACK CODE	NSQF LEVEL
1	**Embedded Product Design Engineer-Technical Lead** **Brief Job Description**: The Embedded Product Design Engineer-Technical Lead designs, develops and debugs embedded systems and related products as per the given requirements, specifications, system architecture and feasibility analysis. The individual leads and performs the assigned responsibilities independently.	**ELE/Q1403**	**6**

COURSE DETAILS

Embedded system design using Micro controller

EXAMINATION DETAILS

COURSE NAME	COURSE CODE	ELIGIBILITY	DURATION
Certificate program in Embedded system design using Micro controller	G21	Completed 3 year UG degree / Completed 2nd year diploma after 12th	310

SL. NO.	EXAM	EXAM CODE	MAXIMUM MARK	INTERNAL	TOTAL MARK
THEORY PAPERS					
1	Introduction to Embedded Systems	T001	100	50	150
2	Microcontroller Fundamentals	T002	100	50	150
3	Embedded C Programming	T003	100	50	150
PRACTICAL PAPERS					
1	Microcontroller Programming Lab	L001	100	50	150
TOTAL MARKS					
1	Total Examination Marks (Theory Online + Practical Examination)				400
2	Total Internal Marks				200
3	**Total Marks (Total Internal Marks + Total Examination Marks)**				**600**

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INTERNAL MARK CRITERIA FOR EACH

SL NO.	MODULE	MODULE CODE	MAXIMUM MARK	INTERNAL MARK	TOTAL MARK
1	Introduction to Embedded Systems	T001	100	50	150
2	Microcontroller Fundamentals	T002	100	50	150
3	Embedded C Programming	T003	100	50	150
4	Microcontroller Programming Lab	L001	100	50	150
	TOTAL		400	200	600

ATTENDANCE	GENERAL PERFORMANCE	INTERNAL EXAMINATIONS/ PROJECTS/ ASSIGNMENTS	TOTAL MARKS
5	5	40	50

COURSE SYLLABUS

FOR

Embedded system design using Micro controller

COURSE	Embedded system design using Micro controller	
TOTAL MARKS	Mark: 600	Internal Mark: 200
TOTAL HOURS	310 Hrs	

DEFENITION OF CREDIT

1 Credit	15Hrs Theory/ 30Hrs Practical
Skill Components	60 – 70 % of Total Credit

MODULES INCLUDED IN THIS SUBJECT

SL NO	MODULE NAME	CREDIT BREAKUP
1	Module 1: Introduction and orientation to the role of an Embedded Product Design Engineer – Technical Lead	**2**
2	Module 2: Process of designing embedded electronic products	**3**
3	Module 3: Process of developing and testing software solutions for embedded products	
4	Module 4: Process of testing and rectifying malfunctions in the prototype of the embedded product	**3**
5	Module 5: Apply health and Safety Practices at Workplace	
6	Module 6: Employability Skills	
7	Module 7: On-the-Job Training	**2**
	Total	**10**

Training Outcomes

- Describe the process of designing embedded electronic products.
- Demonstrate the process of developing and testing software solutions for embedded products.
- Describe the process of testing and rectifying malfunctions in the prototype of the embedded product.
- Demonstrate the process of testing and rectifying malfunctions in the prototype of the embedded product.
- Explain the importance of working effectively at the workplace.
- Demonstrate various practices to be followed to maintain health and safety at work.

MODULES

Module 1: Introduction and orientation to the role of an Embedded Product Design Engineer – Technical Lead

THEORY

- Describe the size and scope of the electronics industry and its subsectors.
- Discuss the role and responsibilities of an Embedded Product Design Engineer – Technical Lead.
- Describe various employment opportunities for an Embedded Product Design Engineer– Technical Lead.

PRACTICAL

- Understanding of the Embedded System
- Applications of the Embedded System
- Develop the Quality to statistical and Quantitative Thinking

Module 2: Process of designing embedded electronic products

THEORY

- Interpret the design requirement and prepare a detail list of requirement specification including software, hardware and firmware as per given specifications and system architecture
- Evaluate the feasibility of the design and prepare a feasibility report of the new product design
- Analyse datasheets of components such as ageing, caveats, constraints like temperature/ pressure affecting normal operational characteristics of the product
- List proper software for designing and testing as per the company standards and requirement
- Apply the processes and approved techniques involved in embedded product designing as per stipulated quality standards and compliances
- Evaluate the design to ensure that the product complies with relevant safety standards, performance and budget requirements
- Evaluate supplier/vendor documentation and apply provided suggested courses of action for all hardware-related components
- Identify the issues with relevant policy and procedure and report them to appropriate authority

PRACTICAL

- Use tools and hardware such as Computer, cross compiler, circuit simulator, device driver, PCB design software/ component library, microprocessor/ microcontroller and other peripherals
- Use testing devices such as oscilloscopes, multimeters, JTAG, Traffic generators/analyzers, signal generators/analyzers, frequency counters, power supply
- Use operating system and language required for developing the new product design and calibrate them
- Develop a work plan and create a design document both high-level and low-level
- Use unit-test cases (UTCs) to test the product according to white box testing method
- Assess that the prototype devices or circuits are built as per required specifications and conduct performance test
- Compare the code with the design document to ensure that it maps to the requirements
- Prepare a document containing hardware specifications, design documentation, hardware-related detailed design documentation, BOMs and Parts Lists, verification tests and reports
- Comply with IP confidentiality rights and configuration management of hardware items

Module 3: Process of developing and testing software solutions for embedded products

THEORY

- Identify extent of code development work required and plan activities accordingly to meet scheduled timelines
- Identify and use software configuration management tools, editor and compiler
- List the range of code generation tools and unit testing tools used to develop software code
- Identify the components which are suitable for re-use and also different sources of information for writing software code
- Apply the principles of embedded software programming and real-time programming, best practices for embedded programming and current practice in the infrastructure design of software code
- Identify the syntax and semantics of the C language for embedded programming, how to access memory-mapped peripherals using C, how to write interrupt handlers in C
- List software requirements specifications including functionality, performance and design constraints
- Implement the key features of the programming language such as use of registers, addressing modes, assembler instructions, subroutines and flags and so on
- Evaluate the working of the product by loading the compiled code in to product

PRACTICAL

- Use appropriate development kit, software and microprocessor or micro controller based on specified requirements and performance standard
- Write efficient, readable and maintainable software code using coding tools, considering purpose of the software solution, type of architecture, potential challenges and how to deal with them
- Test the program by compiling and running the programs to check working of basic input/ output functions, memory organization, peripheral operations (e.g., timers, data ports, etc.) and interrupt operation
- Apply the process for converting technical specifications into code
- Select embedded product development board and compiler/ development environment for the microcontroller/ processor to be programmed
- Create and modify code using embedded product peripherals such as timers, data communication ports and so on
- Develop microprocessor/ microcontroller software to comply with a specified function and operating parameters
- Use digital signal processors and field programmable gate arrays (FGPA) firmware code development
- Develop applications for signal processing, data acquisition, event processing and data management and communication functions
- Develop systems using real-time embedded operating systems
- Create UTCs, execute them and fix the issues
- Apply the steps for testing such as developing testing procedures, analysing inputs from appropriate people, recording corrective actions for identified defects, submitting tested code for approval
- Use defect tracking tools
- Apply debugging techniques to fix the identified issue in the embedded code using assembler/ simulator software packages, emulators, debuggers and so on

Module 4: Process of testing and rectifying malfunctions in the prototype of the embedded product

THEORY

- Identify the malfunctions in the prototype devices/ components
- List the software and hardware used to test malfunctions
- Identify the applications of debugging
- Identify and resolve malfunctions as per standard operating system
- Evaluate end-of-life and component change notifications and sourcing alternate components

PRACTICAL

- Use debugging to analyse and resolve malfunctions in the prototype
- Apply approved techniques to check defects/ malfunctions
- Analyse unit failures and develop corrective actions

- Assess the techniques used for electromagnetic interference or compatibility (EMI/ EMC) testing, thermal testing, scale testing, rate test. KPI test etc.
- Demonstrate working with the testing/QA team to fix identified problems
- Comply with the quality standards defined by the organization
- Prepare a document containing the completed new product design work and submit to relevant authority/ person for approval

Module 5: Apply work and health safety practices

THEORY

- Discuss job-site hazards, risks and accidents.
- Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials.
- Elaborate the electronic waste disposal procedures.
- Describe the process of disposal of hazardous waste
- List the name and location of concerned people, documents and equipment for maintaining health and safety in the workplace.
- Describe how to interpret warning signs while accessing sensitive work areas.
- Explain the importance of good housekeeping.
- Describe the importance of maintaining appropriate postures while lifting heavy objects.
- List the types of fire and fire extinguishers.
- Explain the importance of efficient utilisation of water, electricity and other resources.
- List the common sources of pollution and ways to minimize it.
- Describe the concept of waste management and methods of disposing hazardous waste.
- Explain various warning and safety signs.
- Describe different ways of preventing accidents at the workplace.

PRACTICAL

- Demonstrate the use of protective equipment suitable as per tasks and work conditions.
- Report any abnormal situation/behavior of any equipment/system to the relevant authorities.
- Administer first aid in case of a minor accident.
- Demonstrate the steps to free a person from electrocution safely.
- Administer Cardiopulmonary Resuscitation (CPR).
- Demonstrate the application of defined emergency procedures such as raising alarm, safe/efficient, evacuation, moving injured people, etc.
- Prepare a sample incident report.
- Use a fire extinguisher in case of a fire incident.
- Demonstrate the correct method of lifting and handling heavy objects.

Module 6: Employability Skills

THEORY

- Explain constitutional values, civic rights, responsibility towards society to become a responsible citizen
- Discuss 21st century skills
- Explain use of basic English phrases and sentences.
- Demonstrate how to communicate in a well-behaved manner
- Demonstrate how to work with others
- Demonstrate how to operate digital devices
- Discuss the significance of Internet and Computer/ Laptops
- Discuss the need for identifying business opportunities
- Discuss about types of customers.
- Discuss on creation of bio-data
- Discuss about apprenticeship and opportunities related to it

PRACTICAL

- List different learning and employability related GOI and private portals and their usage
- Show how to practice different environmentally sustainable practices.
- Exhibit 21st century skills like Self Awareness, Behavior Skills, time management, etc.
- Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone
- Demonstrate how to communicate in a well -mannered way with others.
- Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette
- Utilize virtual collaboration tools to work effectively
- Demonstrate how to maintain hygiene and dressing appropriately.
- Perform a mock interview

Module 7: On-the-Job Training

THEORY & PRACTICAL

- Explain the process of preparing a feasibility report of the new product design.
- Use testing devices such as oscilloscopes, multimeters, JTAG, Traffic generators/analyzers, signal generators/analyzers, frequency counters, power supply
- Analyse datasheets of components such as ageing, caveats, constraints like temperature/ pressure affecting normal operational characteristics of the product
- Write efficient, readable and maintainable software code using coding tools.
- Create UTCs, execute them and fix the issues
- Analyse unit failures and develop corrective actions
- Create a sample feedback form to obtain feedback from customers, colleagues etc.
- Demonstrate how to maintain a healthy, safe and secure working environment