QUALIFICATION FILE

Jr. Embedded Developer

☒ **Short Term Training (STT)** ☐ **Long Term Training (LTT)** ☐ **Apprenticeship**

☐Up skilling☐ Dual/Flexi Qualification ☐ForToT☐ For ToA

☐General ☐ Multi-skill (MS) ☒ Cross Sectoral (CS) ☐ Future Skills ☐ OEM

NCrF/NSQF Level: 4.5

Submitted By:

MSME TECHNOLOGY CENTRE

O/o DC MSME, Ministry of Micro, Small and Medium Enterprises

Govt. of India

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Section 1: Basic Details

1.	Qualification Name		Jr. Embedded Developer	
2.	Sector/s		Electronics & HW	
3.	**Type of Qualification:** ☒ **New** ☐ **Revised** ☐ **Has Electives/Options** ☐**OEM**		NQR Code & version of existing/previous qualification: *(change to previous, once approved)* *QG-4.5-EH-02386-2024-V1-MSME*	Qualification Name of existing/previous version: **Advance Embedded Technology (AET)**
4.	a. **OEM Name** b. **Qualification Name** *(Wherever applicable)*		**NA** -	
5.	**National Qualification Register (NQR) Code&Version** *(Will be issued after NSQC approval)*		QG-4.5-EH-02386-2024-V1-MSME	6. **NCrF/NSQFLevel:4.5**
7.	**Award (Certificate/Diploma/Advance Diploma/Any Other***(Wherever applicable specify multiple entry/exits also & provide details in annexure)*		**Certificate**	
8.	**Brief Description of the Qualification**		Learners who attain this qualification will be able to • Develop Programmes for Microcontrollers used in Industrial Applications • Work on Embedded Hardware & Software • Design Printed Circuit Board • Integrate Computer System to IOT devices and products	
9.	**Eligibility Criteria for Entry for Student/Trainee/Learner/Employee**		a) **Entry Qualification & Relevant Experience:** Qualification & Relevant Experience in the field of Electrical, Electronics and Mechatronics Engineering & its Equivalent	

Table within cell 9:

Sr. No.	Academic/Skill Qualification (with Specialization - if applicable)	Required Experience (with Specialization - if applicable)
1	Completed 3-year diploma after 10th	Nil
2	Pursuing 3rd year of 3-year diploma after 10th and continuing education (Only for Internship Program)	Nil
3	Previous relevant Qualification of NSQF Level 4	1.5 year relevant experience

b) **Age: 18 Years**

10.	**Credits Assigned to this Qualification, Subject to Assessment***(as per National Credit Framework (NCrF))*	**20**	11. **Common Cost Norm Category (I/II/III)** *(wherever applicable):***I**

12.	**Any Licensing requirements for Undertaking Training on This Qualification***(wherever applicable)*	NA				
13.	**Training Duration by Modes of Training Delivery** *(Specify **Total Duration** as per selected training delivery modes and as per requirement of the qualification)*	☐Offline ☐Online ☒Blended				

Training Delivery Modes	Theory (Hours)	Practical (Hours)	OJT Mandatory (Hours)	OJT Recommended (Hours)	Total (Hours)
Classroom (offline)	**108**	**360**	60	-	528
Online	72	-	-		72
Total	180	360	60		600

14.	**Aligned to NCO/ISCO Code/s***(if no code is available mention the same)*	*2512.05 (Embedded Software Engineer)*
15.	**Progression path after attaining the qualification** *(Please show Professional and Academic progression)*	***Professional/Career Progress:*** *Developer*
16.	**Other Indian languages in which the Qualification & Model Curriculum are being submitted**	**Hindi**
17.	**Is similar Qualification(s) available on NQR-if yes, justification for this qualification**	☐Yes ☒No URLs of similar Qualifications:
18.	**Is the Job Role Amenable to Persons with Disability**	☒Yes ☐No **If "Yes", specify applicable type of Disability: As Per Government Norms**
19.	**How Participation of Women will be Encouraged**	**Seats are reserved as per government Norms.**
20.	**Are Greening/ Environment Sustainability Aspects Covered** *(Specify the NOS/Module which covers it)*	☒Yes ☐No The said aspect is covered in the module name in Employability Skills
21.	**Is Qualification Suitable to be Offered in Schools/Colleges**	**Schools☐Yes☒No Colleges ☐Yes ☒ No Subject to availability of resources.**
22.	**Name and Contact Details of Submitting / Awarding Body SPOC** *(In case of CS or MS, provide details of both Lead AB & Supporting ABs)*	**Name: Sh. Vijay MahipatraoBankar Contact No. +0755 3501078 Email-msmetcab@gmail.com**

23.	**Final Approval Date by NSQC:30.04.2024**	**24. Validity Duration: 3 years**	**25. Next Review Date: 30.04.2027**

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SECTION 2: MODULE SUMMARY

NOS/S OF QUALIFICATIONS,

(IN EXCEPTIONAL CASES THESE COULD BE DESCRIBED AS COMPONENTS)

MANDATORY NOS/S:

Specify the training duration and assessment criteria at NOS/ Module level, for further details refer curriculum document.

***Th**.-Theory **Pr.**-Practical **OJT**-On the Job **Man.**-Mandatory Training Rec.-Recommended Proj.-Project*

S. No	NOS/Module Name	NOS/ Module Code & Version *(if applicable)*	Core/ Non-Core	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					Weightage (%) *(if applicable)*
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	
1	Embedded Program Development on different microcontroller	MSME/AET/01	Core	4.5	5	30	120		-	150	100	100	-	-	200	
2	IoT application development on R-Pi and Node-MCU	MSME/AET/02	Non Core	4.5	3	30	60		-	90	100	100	-	-	200	
3	Digital Logic design and Programming on FPGA and CPLD	MSME/AET/04	Non Core	4.5	3	30	60	60	-	90	100	100	-	-	200	
4	Layout Design and Fabrication of PCB	MSME/AET/05	Core	4.5	3	30	60		-	90	100	100	-	-	200	
5	PROJECT	MSME/AET/06	Core	4.5	2		60		-	60			100		100	
6	Employability Skills	MSME/ES/02	Non Core	4.5	2	60	-		-	60	100	-			100	
	Duration (in Hours) / Total Credit / Marks				20	180	360	60	-	600	500	500	-	-	1000	

ELECTIVE NOS/S:

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S. No	NOS/Module Name	NOS/ Module Code & Version *(if applicable)*	Core/ Non-Core	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	Weightage (%) *(if applicable)*

OPTIONAL NOS/S:

S. No	NOS/Module Name	NOS/ Module Code & Version *(if applicable)*	Core/ Non-Core	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)					Assessment Marks					
						Th.	Pr.	OJT-Man.	OJT-Rec.	Total	Th.	Pr.	Proj.	Viva	Total	Weightage (%) *(if applicable)*

ASSESSMENT - MINIMUM QUALIFYING PERCENTAGE:

Specify any one of the following:

Minimum Pass Percentage –Aggregate at qualification level: *(Every Trainee should score specified minimum aggregate passing percentage at qualification level to successfully clear the assessment.)*

Minimum Marks to pass Theory Exam:	40%
Minimum Marks to pass Practical Exam:	60%

Minimum Pass Percentage –NOS/Module-wise : *(Every Trainee should score specified minimum passing percentage in each mandatory and selected elective NOS/Module to successfully clear the assessment.)*

Minimum Marks to pass Theory Exam:	40%
Minimum Marks to pass Practical Exam:	60%

SECTION 3: TRAINING RELATED

1.	**Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	Diploma/ Degree in Electronics/ Electronics & Tele. /Computer/ Mechatronics or equivalent with practical skills and knowledge required in the relevant job role at least one level higher i.eNSQFlevel5 and above in related field and minimum 2 years of experience in Training/ Design Department, from any Technology Centre of MSME or any reputed industry will become a trainer, or in accordance with the ToT guideline of NCVET
2.	**Master Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	Degree in Engineering (Electronics/ Electronics & Tele. /Computer/ Mechatronics) or equivalent with 3 to 5 years of experience in Training/ Design Department from any reputed industry will become as a Master Trainer, or in accordance with the ToT guideline of NCVET
3.	**Tools and Equipment Required for Training**	☒Yes ☐No (*If "Yes", details to be provided in Annexure*)
4.	**In Case of Revised Qualification, Details of Any Upskilling Required for Trainer**	Yes

SECTION 4: ASSESSMENT RELATED

1.	**Assessor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	Degree/Diploma in Engineering (Electronics/ Electronics & Tele. /Computer/ Mechatronics) or equivalent with 3 years of experience in Training/ Design Department from any reputed industry. Only (ToA) certified assessors will be able to conduct the assessments.
2.	**Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	Degree in Engineering (Electronics/ Electronics & Tele. /Computer/ Mechatronics) or equivalent with 5 years of experience in Training/ Design Department from any reputed industry
3.	**Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	Post Graduate in the (Electronics/ Electronics & Tele. /Computer/ Mechatronics)with minimum 5 years of experience in Production/ Training/ Design Department from Technology Centre of MSME or any reputed industry.

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4.	**Assessment Mode***(Specify the assessment mode)*	**Blended Type (Online + Offline)**
5.	**Tools and Equipment Required for Assessment**	☒ Same as for training ☒ Yes ☐ No *(details to be provided in Annexure-if it is different for Assessment)*

SECTION 5: EVIDENCE OF THE NEED FOR THE QUALIFICATION

Provide Annexure/Supporting documents name.

1.	**Latest Skill Gap Study (not older than 2years)(Yes/No): Yes,** India Skills Report 2023, " Roadmap to India's Skills and talent Economy 2030"
2.	**Latest Market Research Reports or any other source (not older than 2years) (Yes/No):** **Yes,** "Engineering and capital goods industry" (Feb-2023) by India Brand Equity Foundation –IBEF (Trust established by the Department of Commerce, Ministry of Commerce and Industry, Government of India
3.	**Government /Industry initiatives/ requirement (Yes/No):**Yes
4.	**Number of Industry validation provided:17**
5.	**Estimated nos. of persons to be trained and employed:Approx. 2000 per Year**
6.	**Evidence of Concurrence/Consultation with Line Ministry/State Departments:***Yes* If "No", why:

SECTION 6: ANNEXURE & SUPPORTING DOCUMENTS CHECK LIST

Specify Annexure Name / Supporting document file name

1.	**Annexure:** NCrF/NSQF level justification based on NCrF level/NSQF descriptors *(Mandatory)*	*ANNEXURE-I*

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2.	**Annexure:** List of tools and equipment relevant for qualification *(Mandatory, except in case of online course)*	*ANNEXURE-II*
3.	**Annexure:** Industry Validations Summary	*ANNEXURE-III*
4.	**Annexure:** Training & Employment Details	*ANNEXURE-IV*
5.	**Annexure:** Blended Learning *(Mandatory, in case selected Mode of delivery is "Blended Learning")*	*ANNEXURE-V*
6.	**Annexure:** Detailed Assessment Criteria *(Mandatory)*	*ANNEXURE-VI*
7.	**Annexure:** Assessment Strategy *(Mandatory)*	*ANNEXURE-VII*
8.	**Annexure:** Acronym and Glossary *(Optional)*	*ANNEXURE- VIII*
9.	**Annexure:** Multiple Entry-Exit Details *(Mandatory, in case qualification has multiple Entry-Exit)*	*NA*
10.	**Supporting Document:** Model Curriculum *(Mandatory – Public view)*	*ANNEXURE- IX*
11.	**Supporting Document:** Career Progression *(Mandatory - Public view)*	*THIS ASPECT MENTIONED IN POINT NO. 15*
12.	**Supporting Document:** Occupational Map *(Mandatory)*	*ANNEXURE-X*
13.	**Supporting Document:** Assessment SOP *(Mandatory)*	*ANNEXURE- XI*
14.	Any other document you wish to submit:	*NA*

ANNEXURE: I EVIDENCE OF LEVEL

NCrF/NSQF Level Descriptors	Key requirements of the job role/ outcome of the qualification	How the job role/ outcomes relate to the NCrF/NSQF level descriptor	NCrF/NSQF Level

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Professional Theoretical Knowledge/Process	Job holder Analyse requirements for embedded systems processes based on given specifications and existing reference material. Explain and Demonstrate Professional Knowledge include software setup, hardware setup, compiler knowledge, designing board	Job holders will carry out a broad range of work which requires wide ranging specialized theoretical and practical skills to organize the display of product at the store and guide junior associate to achieve the same in addition to plan and execute visual merchandising in addition to collect and organize information to coordinate for maintaining minimum stock level, they will also solve problems/ challenges by selecting and applying methods, tools, material and information to make choices about the best procedures	4.5
Professional and Technical Skills/ Expertise/Professional Knowledge	Develop creative elements according to specification using existing electronics product. ⬚ Develop electronics product can includes mobile phone, washing machine robots etc	Job holders will be expected to monitor and guide/ aid staff to complete their task in more effective manner and will be responsible for resolving minuscule day to day operational problem/challenge in addition to make choices about the best procedures / communication to adopt the address problems where choices are clear and conduct themselves in ways which show a basic understanding of the social and political environment.	4.5
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	Understand Personal Strengths \ Value,Digital Literacy, Money Matters and Preparing for Employment & Self Employment	Learner can Develop communication competence, report writing skills & preparation of Resumes or Curriculum Vitae, Learner can be able to Interact effectively with co-workers and can apply the Engineering Ethics and Human Values at workplace. Leaner can understand the basic process of becoming an entrepreneur &start up and can get benefits from various government schemes applicable.	4.5

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Broad Learning Outcomes/Core Skill	Evaluate electronics component requirements Manage electronics Production according to specified requirements	Learner will be expected to be able to communicate clearly in speech and writing and may be required to apply mathematical processes and assist big ticket/key client, understand the unsaid requirement of the client and provide guide/ aid client to take inform decision with a motive of attaining customer satisfaction & expected to understand capability of team member and accordingly allocate work and check on the progress of the same, they should be able to guide/ lead teams on work within their capability.	4.5
Responsibility	Check-up procedures to ensure that project objectives are finished within specified time frames are developed. • Checkup procedures to ensure that agreed ethical and legal requirements are met are drawn. • The compliance of electronics products with specified requirements is ensured. Products can include washing machine, robots, mobile phones etc.	Job holders will be responsible for the completion of their own work and expected to learn and improve their performance on the job in familiar situation, but also ones where problems may arise. Job holders will be able to make choices about the best procedure to adopt to address problems where the choices are clear and they will require well developed practical and cognitive skills to complete their work. They may also have some responsibility for others work and learning.	4.5

ANNEXURE: II TOOLS AND EQUIPMENT (LAB SET-UP)

LIST OF TOOLS AND EQUIPMENT FOR BATCH SIZE: 20

Sr. No.	Tool / Equipment Name	Specification	Quantity for specified Batch size
1	PIC Microcontroller Training Kit		10
2	ARM Processor Training Kit		10
3	Raspberry Pi Board		10
4	Arduino Board		10
5	Spartan 3E Development Board	Industry Standard	2
6	Proteus Software		20

7	Keil uvision Software (Latest Version)		20
8	MPLABX IDE (Latest Version)		20
9	Flash Magic Software (Latest Version)		20
10	Arduino IDE		20
11	Python IDLE		20
12	Desktop Computer		20
13	Projector		1
14	Peripherals Development Kit		20
15	Oscillator		5
16	Function Generator		5
17	Power Supply		5
18	Bread Board		20
19	Miscellaneous Components as per requirements		20

CLASSROOM AIDS

The aids required to conduct sessions in the classroom are:

1. Simulator
2. Smart Board
3. Practice Exercise
4. Projector etc.

ANNEXURE III: INDUSTRY VALIDATIONS SUMMARY

Provide the summary information of all the industry validations in table. This is not required for OEM qualifications.

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID	LinkedIn Profile *(if available)*

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1	ALLWIN UNITED ASSOCIATION PVT.LTD	MI PANKAJ	DIRECTOR	ALLWIN UNITED ASSOCIATION PVT.LIMITED	7588537412	CONTACT@TECHNOCADDAPL.COM	
2	ARUSHI ENGINEERING AND BREEZING	VIJAYA PARADE	MANAGER	WALUJ MIDC AURANGABAD	9049596736		
3	MAULI PATTERN AURANGABAD	MR.PANCHAL	PROFESSOR	AURANGABAD	9673067755		
4	R.P INDUSTRIES	PRASHANT PATIL	CEO	MIDC CHIKATHANA AURANGABAD	8007222251	PRASHANTPATIL@GMAIL.COM	
5	PARASON MACHINERY (INDIA) PVT LTD	GHAHU	GM	AURANGABAD	9325202860	AMOIL.MOGAL@PASASEN.COM	
6	PADMA INDUSTRIES	VITTHALKADOM	CEO	MIDC AURANGABAD	9421688212	VITTHALKADOM2525@GMAIL.COM	
7	VANI ENGINEERING CO.PVT LTD	SUBH	GENERAL MANAGER	AURANGABAD	9730729991	SKAPE@GMAIL.COM	
8	GLANCE ENGINEERING -6 PVT.LIMITED CHIKALTHANA	SUBH SK	GENERAL MANAGER	CHIKALTHANA	9730729991	S.KALE@GMAIL.COM	
9	SURAJ TOOLS AND ENGINEERING WORKS	DEIM	CEO	MIDC CHIKATHANA AURANGABAD	7447375273	SURAJTOOLS@GMAIL.COM	
10	JAI BHAVANI ENGINEERING WORKS		GENERAL MANAGER		9370251815		
11	RN INDUSTRIES		CEO	MIDC KALAGRAM AURANGABAD	9890718928	R.N.INDUSTRIES01@GMAIL.COM	
12	MADURA DIE CAST PVT LIMITD	MADHURA	CEO	SHENDRA AURANGABAD	9422204622	MADHRADIECAST@GMAIL.COM	
13	SWAGATI ENGINEERING WIS2		CEO	CHIKALTHNA,AURANGABAD	9763714369	SWAGATIENGG@GMAIL.COM	
14	S N ENGINEERINGWORKS	SNEHA	CEO	CH SAMBHAJINAGAR	9822859974	SNEHAG858@GMAIL.COM	
15	IDEAL ENTERPRISE		GENERAL MANAGER	CHIKALTHANA AURANGABAD	9763785199	IDEAL1993@GMAIL.COM	
16	RMG INDUSTRIES	RAOUAL	CEO	MIDC AURANGABAD WALUJ	9766699611	EAJUQANDA@RMGINDUSTRIES.COM	
17	MIKRONIX GAUGES PVT LTD		MD	B-25 MIDC , CHIKALTHANA, CH. SAMBHAJINAGAR	9822004674	MGPLAY@GMAIL.COM	

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ANNEXURE IV: TRAINING & EMPLOYMENT DETAILS

Training and Employment Projections:

Year	Total Candidates		Women		People with Disability	
	Estimated Training	Estimated Employment Opportunities	Estimated Training	Estimated Employment Opportunities	Estimated Training	Estimated Employment Opportunities
23-24	3000	2500	300	210	-	-
24-25	4000	3000	400	280	-	-
25-26	5000	3500	500	350	-	-

Data to be provided year-wise for next 3 years

Training, Assessment, Certification, and Placement Data for previous versions of qualifications:

Qualification Version	Year	Total Candidates				Women				People with Disability			
		Trained	Assessed	Certified	Placed	Trained	Assessed	Certified	Placed	Trained	Assessed	Certified	Placed
1.0	20-21	437	437	437	393	150	150	150	142	-	-	-	-
1.0	21-22	703	703	703	633	210	210	210	180	-	-	-	-
1.0	22-23	827	827	827	744	340	340	340	280	-	-	-	-

Applicable for revised qualifications only, data to be provided year-wise for past 3 years.

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List Schemes in which the previous version of Qualification was implemented:

1. Fee based Training Program under the Ministry of MSME.

2. ESDP Scheme under the Ministry of MSME.

3. PM DakshtaAurKushaltaSampannHitgrahi Yojana under M/o SJE, GOI

4. Capacity building Training program under National SC/ST Hub, M/o MSME, GOI

5. Schemes under the different state Government.

Content availability for previous versions of qualifications:

☒ Participant Handbook   ☒ Facilitator Guide ☒ Digital Content   ☒ Qualification Handbook ☐ Any Other:

Languages in which Content are available:

English

ANNEXURE V: BLENDED LEARNING

Blended Learning Estimated Ratio &Recommended Tools:

Refer NCVET "Guidelines for Blended Learning for Vocational Education, Training & Skilling" available on:https://ncvet.gov.in/wp-content/uploads/2023/01/Guidelines-for-Blended-Learning-for-Vocational-Education-Training-Skilling.pdf

S. No.	Select the Components of the Qualification	List Recommended Tools – for all Selected Components	Offline : Online Ratio

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1	☐Theory/ Lectures - Imparting theoretical and conceptual knowledge	Books/ e-books, Presentations, Reference Material ,Audio / Video Modules with 2D and 3D animation Self-Learning Videos /Broadcasts /Mobile Learning /Curated Digital content	40:60
2	☐Imparting Soft Skills, Life Skills, and Employability Skills /Mentorship to Learners	Self-Learning Videos , Broadcasts, Mobile Learning , Curated Digital content	40:60
3	☐Showing Practical Demonstrations to the learners	Keil / MPLAB software simulations, Video Content, E-Resource library. Teaching through practical demonstrations of developed example codes.	100:0
4	☐Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training	Hands on practical sessions with Raspberry Pi / ARM/PIC Microcontroller based development kits	100:0
5	☐Tutorials/ Assignments/ Practice	Online Question Bank, Mobile Quick test app, MCQ based tests, Practical Test on Kits	40:60
6	☐Proctored Monitoring/ Assessment/ Evaluation/ Examinations	Assessment engine for Essays, Up-loadable file examinations, Mock test sessions	50:50

ANNEXURE VI: DETAILED ASSESSMENT CRITERIA

Detailed assessment criteria for each NOS/Module are as follows:

NOS/Module Name	Assessment Criteria for PerformanceCriteria/Learning Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
NOS / Module: **MSME/AET/01** **Embedded Program Development on different microcontroller**	PC.1 Explain the difference between a high-level programming language and a low-level programming language. PC.2 What are the key features and characteristics of the C programming language.	100	100	NA	NA

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	PC.3	What are decision-making statements in C, and why are they important in programming?		
	PC.4	Differentiate between the if statement, the else-if statement, and the switch statement in C.		
	PC.5	Provide an example of a C program that uses a conditional statement to determine if a number is even or odd.		
	PC.6	Create a C program that uses a structure to represent a student's information and a pointer to manipulate that information.		
	PC.7	Explain the concept of pointers in C. How are they different from regular variables		
	PC.8	Write a C program that calculates the average of an array of numbers using a user-defined function.		
	PC.9	What is an array in C, and how does it differ from a regular variable? Provide an example.		
	PC.10	What are peripherals in the context of microcontrollers and embedded systems, and why are they essential?		
	PC.11	Write a simple Embedded C program that blinks an LED connected to a PIC microcontroller. Explain the code logic.		
	PC.12	Configure and use a timer in a PIC microcontroller using Embedded C code		
	PC.13	Write an Embedded C program that generates PWM signals to control the brightness of an LED using a PIC microcontroller.		
	PC.14	Provide an example of using a counter to count external events or pulses in a PIC microcontroller.		
	PC.15	The key features and specifications of the LPC2148 microcontroller, including its architecture and clock frequency.		
	PC.16	Describe the characteristics of the ADC, DAC in LPC2148,		

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	including resolution and voltage output range		
PC.17	Functioning of the UART/SPI/I2C communication protocols of the LPC2148 microcontroller.		
PC.18	Introduction to Cortex-M3 series		
PC.19	Some common use cases or applications where the LPC1768 microcontroller (Cortex-M3 series) is typically deployed		
PC.20	The architecture of the Cortex-M3 core, focusing on its key components, such as the pipeline, registers, and execution modes.		
PC.21	Examples of common peripherals that can be interfaced with the LPC1768, such as sensors, displays, and communication modules		
PC.22	What is a real-time operating system (RTOS), and how does it differ from conventional operating systems		
PC.23	Describe the concept of "real-time" in the context of RTOS. What are the different types of real-time systems		
PC.24	How does an RTOS manage and schedule tasks or processes to meet specific timing constraints and deadlines		
PC.25	What is the role of the kernel in an RTOS, and how does it differ from the kernel in a general-purpose OS?		
PC.26	Explain the significance of real-time operating systems in critical applications, such as aviation, automotive, and industrial control.		
PC.27	Compare and contrast the key differences between a general-purpose operating system (OS) and an RTOS.		
PC.28	What are the strengths and limitations of using a general-purpose OS in real-time applications versus an RTOS?		
PC.29	how task scheduling and resource management differ in an		

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	RTOS compared to a traditional OS				
	PC.30 Describe the various task scheduling methods employed in RTOS programming, including preemptive scheduling and cooperative scheduling.				
	PC.31 How does round-robin scheduling work in the context of an RTOS? What are the advantages and limitations of this approach				
	PC.32 Provide an example of a scenario where a priority-based scheduling policy is crucial in an RTOS application.				
NOS / Module: **MSME/AET/02** **IoT application development on R-Pi and Node-MCU**	PC.1 What is the Internet of Things (IoT), and how does it extend the capabilities of connected devices PC.2 The basic concepts of programming and how Python fits into the realm of computer programming. PC.3 The different methods of decision-making in Python, including if statements and switch/case constructs PC.4 Loops like for and while work in Python, and what are their use cases PC.5 The Python environment, including the interpreter and how it executes Python code PC.6 The concept of looping structures in Python and how they enable repetitive tasks. PC.7 The use and characteristics of data structures like lists, tuples, sets, and dictionaries in Python. PC.8 The concept of file handling in Python, including, appending, reading and writing to files. PC.9 Provide code examples demonstrating the use of constructors	100	100	NA	NA

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	and destructors.	
PC.10	Concept of GPIO (General Purpose Input/output) pins and how they can be used to interface with external devices for program execution	
PC.11	The primary development tools and integrated development environments (IDEs) available for programming on a Raspberry Pi.	
PC.12	Example of using port programming to toggle an LED connected to a GPIO pin.	
PC.13	Process of programming the Raspberry Pi to control an LED, LCD, sensors, Actuators etc.	
PC.14	Adding a Bluetooth functionality to a Raspberry Pi, and what types of Bluetooth modules are commonly used	
PC.15	Explain the core components of an IoT system, including sensors, communication protocols, and data processing	
PC.16	What factors should be considered when choosing an IoT platform for a specific project	
PC.17	Example of using the ThingSpeak API to collect and analyze sensor data from an IoT device.	
PC.18	The concept of interfacing IoT devices, like Arduino, with cloud-based web services and databases	
PC.19	What is NodeMCU, and how does it differ from other IoT development platforms like Arduino	
PC.20	How can various sensors, such as temperature, humidity, motion, ultrasonic, infrared, current, sound, and gas sensors, be interfaced with an Arduino board for IoT applications	
PC.21	How are actuators like relay switches, motors interfaced and controlled using an Arduino board	

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NOS / Module : **MSME/AET/03** **Digital Logic design and Programming on FPGA and CPLD**	PC.1	Explain the basic architecture of a CPLD (Complex Programmable Logic Device) and an FPGA (Field-Programmable Gate Array). What differentiates these two devices	100	100	NA	NA
	PC.2	Using Xilinx ISE (Integrated Software Environment), describe the steps involved in creating a simple project for a CPLD or FPGA				
	PC.3	Develop a VHDL program for a full adder circuit and explain the key components of the code.				
	PC.4	Explain the concept of memory blocks in system architecture. How do these blocks store and retrieve data				
	PC.5	Provide an overview of the different types of interfaces found in embedded systems, such as UART, SPI, I2C, and GPIO.				
	PC.6	How do domain-specific languages (DSLs) differ from general-purpose languages? Provide examples of DSLs and their use cases.				
	PC.7	VHDL code snippet for a simple digital circuit, such as a 2-to-1 multiplexer.				
	PC.8	How do you read and interpret HDL or VHDL code for a specific digital design? Describe the syntax and structure of such code.				
	PC.9	How do these tools facilitate various stages of the design process, from conceptualization to final verification?				
	PC.10					
NOS / Module : **MSME/AET/04** **Layout Design and Fabrication of PCB**	PC.1	What is the purpose of creating schematics in PCB design? How do you choose the components and connections in a schematic	100	100	NA	NA
	PC.2	How do you translate a schematic diagram into a physical PCB layout? What software tools are commonly used for this process				

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	PC.3	Discuss the considerations and challenges in arranging components and routing traces on the PCB layout.				
	PC.4	How does component placement impact the overall performance and reliability of a PCB				
	PC.5	Compare and contrast the design considerations for single-layer and multilayer PCBs. What are the advantages of each type				
	PC.6	What types of files are typically generated for PCB manufacturing, and what is the purpose of each file format				
	PC.7	What are the key considerations when planning the design of a circuit schematic before putting it on paper or into software				
	PC.8	Explain the steps involved in creating a new project schematic using PCB design software. What software options are commonly used for this purpose				
	PC.9	Explain the methods and tools used to perform a comprehensive check on a schematic design.				
	PC.10	How do you ensure that the trace widths, pad sizes, and via dimensions in the schematic align with the original PCB design requirements				
	PC.11	Provide an example of creating a wiring diagram for a specific circuit				
NOS / Module: **MSME/ES/01** **Employability Skills**	PC.1	Understand the significance of employability skills in meeting the job requirements	100	NA	NA	NA
	PC.2	Identify constitutional values, civic rights, duties, personal values and ethics and environmentally sustainable practices.				
	PC.3	Explain 21st Century Skills such as Self-Awareness, Behavior Skills, Positive attitude, self-motivation, problem-solving, creative thinking, time management, social and cultural awareness, emotional awareness, continuous learning mindset etc.				

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	PC.4	Speak with others using some basic English phrases or sentences				
	PC.5	Follow good manners while communicating with others				
	PC.6	Work with others in a team				
	PC.7	Communicate and behave appropriately with all genders and PwD				
	PC.8	Report any issues related to sexual harassment				
	PC.9	Use various financial products and services safely and securely				
	PC.10	Calculate income, expenses, savings etc.				
	PC.11	Approach the concerned authorities for any exploitation as per legal rights and laws				
	PC.12	Operate digital devices and use its features and applications securely and safely				
	PC.13	Use internet and social media platforms securely and safely				
	PC.14	Identify and assess opportunities for potential business				
	PC.15	Identify sources for arranging money and associated financial and legal challenges				
	PC.16	Identify different types of customers				
	PC.17	Identify customer needs and address them appropriately.				
	PC.18	Follow appropriate hygiene and grooming standards.				
	PC.19	Create a basic biodata				
	PC.20	Search for suitable jobs and apply				
	PC.21	Identify and register apprenticeship opportunities as per requirement				
	Total Marks		500	500	1000	

ANNEXURE VII: ASSESSMENT STRATEGY

This section includes the processes involved in identifying, gathering, and interpreting information to evaluate the Candidate on the required competencies of the program.

Mention the detailed assessment strategy in the provided template.

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1. Assessment System Overview:

- Batches are assigned to the MSME NSQF Assessment Agency via email for the assessment.

- MSME NSQF Assessment Agency sends the assessment confirmation to respective TC.

- MSME NSQF Assessment Agency deploys the certified Assessor for executing the assessment at respective TC via online / offline mode.

- MSME NSQF Assessment Agency & respective TC Internal Assessment cell monitors the assessment process & records.

2. Testing Environment:

- MSME NSQF Assessment Agency confirms the Assessment location, date and time

- For number of candidates more than 30 separate assessors are assigned for the assessment.

- MSME NSQF Assessment Agency & respective assessor confirms that the allotted time to the candidates to complete Theory & Practical Assessment is correct.

3. Assessment Quality Assurance levels/Framework:

- Each TC Submits the Question Bank for the individual subject Theory &Practice separately, submits to MSME NSQF Assessment Agency and it is verified by the MSME NSQF Assessment Agency Committee members.

- Questions are mapped to the specified assessment criteria

- All the assessors & Trainers are well qualified & trained to carry out the specified task.

4. Types of evidence or evidence-gathering protocol:

- Online Link is send by MSME NSQF Assessment Agency to respective TC & Assessor. Reporting of the assessor from assessment location is verified by the MSME NSQF Assessment Agency through the online Meeting Link. Students are also required to join for the online link for verification by the MSME NSQF Assessment Agency.

- Assessment Photographs are shared with the MSME NSQF Assessment Agency & are also with the respective TC.

5. Method of verification or validation:

- Online Link is send by MSME NSQF Assessment Agency to respective TC & Assessor. Reporting of the assessor from assessment location is verified by the MSME NSQF Assessment Agency through the online Meeting Link. Students are also required to join for the online link for verification by the MSME NSQF Assessment Agency.

6. Method for assessment documentation, archiving, and access:

- The Assessment records are shared with MSME NSQF Assessment Agency & also stored at respective TC.

- Assessor fills the assessment report and shares with the MSME NSQF Assessment Agency.

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On the Job Training:

- Each module will be assessed separately.

- The candidate must score 60% marks to successfully complete the OJT.

- Learner will be assessed on the basis of OJT report followed by Viva

- Assessment will ensure that the Learner is able to:

  ✓ Effective engagement with the customers / Subordinates and team
  ✓ Understand the working of various tools and equipment
  ✓ Understand the working environment of the industry

ANNEXURE VIII: ACRONYM AND GLOSSARY

ACRONYM

Acronym	Description
AA	Assessment Agency
AB	Awarding Body
ISCO	International Standard Classification of Occupations
NCO	National Classification of Occupations
NCrF	National Credit Framework
NOS	National Occupational Standard(s)
NQR	National Qualification Register

NSQF	National Skills Qualifications Framework
OJT	On the Job Training

GLOSSARY

Term	Description
National Occupational Standards (NOS)	NOS define the measurable performance outcomes required from an individual engaged in a particular task. They list down what an individual performing that task should know and also do.
Qualification	A formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards
Qualification File	A Qualification File is a template designed to capture necessary information of a Qualification from the perspective of NSQF compliance. The Qualification File will be normally submitted by the awarding body for the qualification.
Sector	A grouping of professional activities on the basis of their main economic function, product, service or technology.
Short Term Training (STT)	STT/ Short -term skilling means any vocational training program undertaken for less than a year (Theory + Practical + OJT). https://ncvet.gov.in/sites/default/files/NCVET.pdf

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