Qualification Pack

Automotive Battery Management System (BMS) Design Engineer

QP Code: ASC/Q8315

Version: 1.0

NSQF Level: 5.5

Automotive Skills Development Council || 153, Gr Floor, Okhla Industrial Area, Phase – III, Leela Building, New Delhi – 110020

Contents

ASC/Q8315: Automotive Battery Management System (BMS) Design Engineer

Brief Job Description

Individual at this job should benchmark, understand, release design and architecture of BMS system & its components for Electric Vehicle (EV) as per the specified norms and standards. BMS engineer also supports manager and core team during implementation and field issue resolution after implementation.

Personal Attributes

He/she must have the ability to plan, analyse and assess the solutions co-work with stakeholders, have clarity and clear understanding of safety, recycle and reuse standards and latest government Policies and regulations, work in a team, good communication skills, tech-savvy individual as well.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ASC/N9810: Manage work and resources (Manufacturing)
2. DGT/VSQ/N0103 - Employability Skills (90 hours)
3. ASC/N8335: Review the targeted design architecture of EV
4. ASC/N8336: Develop prominent options of BMS architecture, infrastructure and solutions
5. ASC/N8337: Conduct simulation for verification & validate of various architectures
6. ASC/N8338: Support manager to execute implementation of BMS system

Qualification Pack (QP) Parameters

Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Product Development
Country	India
NSQF Level	5.5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/NIL
Minimum Educational Qualification & Experience	3 years Diploma (Mechanical/Automobile/ Electrical / Electronics) after class 10th from recognized regulatory body with 3 years of relevant experience OR Pursuing 4th year of B.E./B.Tech in the relevant field and continuous education OR Certificate-NSQF (Electric Vehicle Product Design Engineer/ Automotive Prototype Manufacturing Lead

	Technician Level 5) with 2 Years of relevant experience
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	22 Years
Last Reviewed On	28/02/2023
Next Review Date	28/02/2026
Deactivation Date	28/02/2026
NSQC Approval Date	28/02/2023
Version	1.0

ASC/N9810: Manage work and resources (Manufacturing)

Description

This NOS unit is about implementing safety, planning work, adopting sustainable practices for optimising the use of resources.

Scope

The scope covers the following:

- Maintain safe and secure working environment
- Maintain Health and Hygiene
- Effective waste management practices
- Material/energy conservation practices

Elements and Performance Criteria

Maintain safe and secure working environment

To be competent, the user/individual on the job must be able to:

PC1. identify hazardous activities and the possible causes of risks or accidents in the workplace

PC2. implement safe working practices for dealing with hazards to ensure safety of self and others

PC3. conduct regular checks of the machines with support of the maintenance team to identify potential hazards

PC4. ensure that all the tools/equipment/fasteners/spare parts are arranged as per specifications/utility into proper trays, cabinets, lockers as mentioned in the 5S guidelines/work instructions

PC5. organise safety drills or training sessions to create awareness amongst others on the identified risks and safety practices

PC6. fill daily check sheet to report improvements done and risks identified

PC7. ensure that relevant safety boards/signs are placed on the shop floor for the safety of self and others

PC8. report any identified breaches in health, safety and security policies and procedures to the designated person

Maintain Health and Hygiene

To be competent, the user/individual on the job must be able to:

PC9. ensure workplace, equipment, restrooms etc. are sanitized regularly

PC10. ensure team is aware about hygiene and sanitation regulations and following them on the shop floor

PC11. ensure availability of running water, hand wash and alcohol-based sanitizers at the workplace

PC12. report advanced hygiene and sanitation issues to appropriate authority

PC13. follow stress and anxiety management techniques and support employees to cope with stress, anxiety etc

PC14. wear and dispose PPEs regularly and appropriately

Effective waste management practices

To be competent, the user/individual on the job must be able to:

PC15. ensure recyclable, non-recyclable and hazardous wastes are segregated as per SOP

PC16. ensure proper mechanism is followed while collecting and disposing of non-recyclable, recyclable and reusable waste

Material/energy conservation practices

To be competent, the user/individual on the job must be able to:

PC17. ensure malfunctioning (fumes/sparks/emission/vibration/noise) and lapse in maintenance of equipment are resolved effectively

PC18. prepare and analyze material and energy audit reports to decipher excessive consumption of material and water

PC19. identify possibilities of using renewable energy and environment friendly fuels

PC20. identify processes where material and energy/electricity utilization can be optimized

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation procedures for health, safety and security, individual role and responsibilities in this context

KU2. the organisation's emergency procedures for different emergency situations and the importance of following the same

KU3. evacuation procedures for workers and visitors

KU4. how and when to report hazards as well as the limits of responsibility for dealing with hazards

KU5. potential hazards, risks and threats based on the nature of work

KU6. various types of fire extinguisher

KU7. various types of safety signs and their meaning

KU8. appropriate first aid treatment relevant to different condition e.g. bleeding, minor burns, eye injuries etc.

KU9. relevant standards, procedures and policies related to 5S followed in the company

KU10. the various materials used and their storage norms

KU11. importance of efficient utilisation of material and water

KU12. basics of electricity and prevalent energy efficient devices

KU13. common practices of conserving electricity

KU14. common sources and ways to minimize pollution

KU15. categorisation of waste into dry, wet, recyclable, non-recyclable and items of single-use plastics

KU16. waste management techniques

KU17. significance of greening

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. read safety instructions/guidelines
GS2. modify work practices to improve them
GS3. work with supervisors/team members to carry out work related tasks
GS4. complete tasks efficiently and accurately within stipulated time
GS5. inform/report to concerned person in case of any problem
GS6. make timely decisions for efficient utilization of resources
GS7. write reports such as accident report, in at least English/regional language

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Maintain safe and secure working environment	20	13	-	8
PC1. identify hazardous activities and the possible causes of risks or accidents in the workplace	4	2	-	2
PC2. implement safe working practices for dealing with hazards to ensure safety of self and others	3	1	-	2
PC3. conduct regular checks of the machines with support of the maintenance team to identify potential hazards	2	2	-	1
PC4. ensure that all the tools/equipment/fasteners/spare parts are arranged as per specifications/utility into proper trays, cabinets, lockers as mentioned in the 5S guidelines/work instructions	3	2	-	1
PC5. organise safety drills or training sessions to create awareness amongst others on the identified risks and safety practices	2	-	-	-
PC6. fill daily check sheet to report improvements done and risks identified	2	2	-	-
PC7. ensure that relevant safety boards/signs are placed on the shop floor for the safety of self and others	2	2	-	1
PC8. report any identified breaches in health, safety and security policies and procedures to the designated person	2	2	-	1
Maintain Health and Hygiene	13	7	-	5
PC9. ensure workplace, equipment, restrooms etc. are sanitized regularly	3	2	-	1
PC10. ensure team is aware about hygiene and sanitation regulations and following them on the shop floor	2	1	-	-
PC11. ensure availability of running water, hand wash and alcohol-based sanitizers at the workplace	2	2	-	1
PC12. report advanced hygiene and sanitation issues to appropriate authority	1	1	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. follow stress and anxiety management techniques and support employees to cope with stress, anxiety etc	2	1	-	1
PC14. wear and dispose PPEs regularly and appropriately	3	-	-	1
Effective waste management practices	6	4	-	1
PC15. ensure recyclable, non-recyclable and hazardous wastes are segregated as per SOP	3	2	-	-
PC16. ensure proper mechanism is followed while collecting and disposing of non-recyclable, recyclable and reusable waste	3	2	-	1
Material/energy conservation practices	11	6	-	6
PC17. ensure malfunctioning (fumes/sparks/emission/vibration/noise) and lapse in maintenance of equipment are resolved effectively	2	2	-	1
PC18. prepare and analyze material and energy audit reports to decipher excessive consumption of material and water	3	2	-	1
PC19. identify possibilities of using renewable energy and environment friendly fuels	3	1	-	2
PC20. identify processes where material and energy/electricity utilization can be optimized	3	1	-	2
NOS Total	**50**	**30**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N9810
NOS Name	Manage work and resources (Manufacturing)
Sector	Automotive
Sub-Sector	Generic
Occupation	Generic
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	NA
Next Review Date	NA
NSQC Clearance Date	

DGT/VSQ/N0103: Employability Skills (90 Hours)

Description

This unit is about employability skills, Constitutional values, becoming a professional in the 21st Century, digital, financial, and legal literacy, diversity and Inclusion, English and communication skills, customer service, entrepreneurship, and apprenticeship, getting ready for jobs and career development.

Scope

The scope covers the following:

- Introduction to Employability Skills
- Constitutional values - Citizenship
- Becoming a Professional in the 21st Century
- Basic English Skills
- Career Development & Goal Setting
- Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy
- Essential Digital Skills
- Entrepreneurship
- Customer Service
- Getting ready for Apprenticeship & Jobs

Elements and Performance Criteria

Introduction to Employability Skills

To be competent, the user/individual on the job must be able to:

PC1. understand the significance of employability skills in meeting the current job market requirement and future of work

PC2. identify and explore learning and employability relevant portals

PC3. research about the different industries, job market trends, latest skills required and the available opportunities

Constitutional values - Citizenship

To be competent, the user/individual on the job must be able to:

PC4. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.

PC5. follow environmentally sustainable practices

Becoming a Professional in the 21st Century

To be competent, the user/individual on the job must be able to:

PC6. recognize the significance of 21st Century Skills for employment

PC7. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life

PC8. adopt a continuous learning mindset for personal and professional development

Basic English Skills

To be competent, the user/individual on the job must be able to:

PC9. use basic English for everyday conversation in different contexts, in person and over the telephone

PC10. read and understand routine information, notes, instructions, mails, letters etc. written in English

PC11. write short messages, notes, letters, e-mails etc. in English

Career Development & Goal Setting

To be competent, the user/individual on the job must be able to:

PC12. identify career goals based on the skills, interests, knowledge, and personal attributes

PC13. prepare a career development plan with short- and long-term goals

Communication Skills

To be competent, the user/individual on the job must be able to:

PC14. follow verbal and non-verbal communication etiquette while communicating in professional and public settings

PC15. use active listening techniques for effective communication

PC16. communicate in writing using appropriate style and format based on formal or informal requirements

PC17. work collaboratively with others in a team

Diversity & Inclusion

To be competent, the user/individual on the job must be able to:

PC18. communicate and behave appropriately with all genders and PwD

PC19. escalate any issues related to sexual harassment at workplace according to POSH Act

Financial and Legal Literacy

To be competent, the user/individual on the job must be able to:

PC20. identify and select reliable institutions for various financial products and services such as bank account, debit and credit cards, loans, insurance etc.

PC21. carry out offline and online financial transactions, safely and securely, using various methods and check the entries in the passbook

PC22. identify common components of salary and compute income, expenses, taxes, investments etc.

PC23. identify relevant rights and laws and use legal aids to fight against legal exploitation

Essential Digital Skills

To be competent, the user/individual on the job must be able to:

PC24. operate digital devices and use their features and applications securely and safely

PC25. carry out basic internet operations by connecting to the internet safely and securely, using the mobile data or other available networks through Bluetooth, Wi-Fi, etc.

PC26. display responsible online behaviour while using various social media platforms

PC27. create a personal email account, send and process received messages as per requirement

PC28. carry out basic procedures in documents, spreadsheets and presentations using respective and appropriate applications

PC29. utilize virtual collaboration tools to work effectively

Entrepreneurship

To be competent, the user/individual on the job must be able to:

PC30. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research

PC31. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion

PC32. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity

Customer Service

To be competent, the user/individual on the job must be able to:

PC33. identify different types of customers and ways to communicate with them

PC34. identify and respond to customer requests and needs in a professional manner

PC35. use appropriate tools to collect customer feedback

PC36. follow appropriate hygiene and grooming standards

Getting ready for apprenticeship & Jobs

To be competent, the user/individual on the job must be able to:

PC37. create a professional Curriculum vitae (Résumé)

PC38. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively

PC39. apply to identified job openings using offline /online methods as per requirement

PC40. answer questions politely, with clarity and confidence, during recruitment and selection

PC41. identify apprenticeship opportunities and register for it as per guidelines and requirements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. need for employability skills and different learning and employability related portals

KU2. various constitutional and personal values

KU3. different environmentally sustainable practices and their importance

KU4. Twenty first (21st) century skills and their importance

KU5. how to use English language for effective verbal (face to face and telephonic) and written communication in formal and informal set up

KU6. importance of career development and setting long- and short-term goals

KU7. about effective communication

KU8. POSH Act

KU9. Gender sensitivity and inclusivity

KU10. different types of financial institutes, products, and services

KU11. components of salary and how to compute income and expenditure

KU12. importance of maintaining safety and security in offline and online financial transactions

KU13. different legal rights and laws

KU14. different types of digital devices and the procedure to operate them safely and securely

KU15. how to create and operate an e- mail account

KU16. use applications such as word processors, spreadsheets etc.
KU17. how to identify business opportunities
KU18. types and needs of customers
KU19. how to apply for a job and prepare for an interview
KU20. apprenticeship scheme and the process of registering on apprenticeship portal

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. read and write different types of documents/instructions/correspondence in English and other languages
GS2. communicate effectively using appropriate language in formal and informal settings
GS3. behave politely and appropriately with all to maintain effective work relationship
GS4. how to work in a virtual mode, using various technological platforms
GS5. perform calculations efficiently
GS6. solve problems effectively
GS7. pay attention to details
GS8. manage time efficiently
GS9. maintain hygiene and sanitization to avoid infection

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to Employability Skills	1	1	-	-
PC1. understand the significance of employability skills in meeting the current job market requirement and future of work	-	-	-	-
PC2. identify and explore learning and employability relevant portals	-	-	-	-
PC3. research about the different industries, job market trends, latest skills required and the available opportunities	-	-	-	-
Constitutional values - Citizenship	1	1	-	-
PC4. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
PC5. follow environmentally sustainable practices	-	-	-	-
Becoming a Professional in the 21st Century	1	3	-	-
PC6. recognize the significance of 21st Century Skills for employment	-	-	-	-
PC7. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
PC8. adopt a continuous learning mindset for personal and professional development	-	-	-	-
Basic English Skills	3	4	-	-
PC9. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
PC11. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
Career Development & Goal Setting	1	2	-	-
PC12. identify career goals based on the skills, interests, knowledge, and personal attributes	-	-	-	-
PC13. prepare a career development plan with short- and long-term goals	-	-	-	-
Communication Skills	2	2	-	-
PC14. follow verbal and non-verbal communication etiquette while communicating in professional and public settings	-	-	-	-
PC15. use active listening techniques for effective communication	-	-	-	-
PC16. communicate in writing using appropriate style and format based on formal or informal requirements	-	-	-	-
PC17. work collaboratively with others in a team	-	-	-	-
Diversity & Inclusion	1	1	-	-
PC18. communicate and behave appropriately with all genders and PwD	-	-	-	-
PC19. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
Financial and Legal Literacy	2	3	-	-
PC20. identify and select reliable institutions for various financial products and services such as bank account, debit and credit cards, loans, insurance etc.	-	-	-	-
PC21. carry out offline and online financial transactions, safely and securely, using various methods and check the entries in the passbook	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC22. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
PC23. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
Essential Digital Skills	3	5	-	-
PC24. operate digital devices and use their features and applications securely and safely	-	-	-	-
PC25. carry out basic internet operations by connecting to the internet safely and securely, using the mobile data or other available networks through Bluetooth, Wi-Fi, etc.	-	-	-	-
PC26. display responsible online behaviour while using various social media platforms	-	-	-	-
PC27. create a personal email account, send and process received messages as per requirement	-	-	-	-
PC28. carry out basic procedures in documents, spreadsheets and presentations using respective and appropriate applications	-	-	-	-
PC29. utilize virtual collaboration tools to work effectively	-	-	-	-
Entrepreneurship	2	3	-	-
PC30. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
PC31. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
PC32. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
Customer Service	1	2	-	-
PC33. identify different types of customers and ways to communicate with them	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC34. identify and respond to customer requests and needs in a professional manner	-	-	-	-
PC35. use appropriate tools to collect customer feedback	-	-	-	-
PC36. follow appropriate hygiene and grooming standards	-	-	-	-
Getting ready for apprenticeship & Jobs	2	3	-	-
PC37. create a professional Curriculum vitae (Résumé)	-	-	-	-
PC38. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
PC39. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
PC40. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
PC41. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	DGT/VSQ/N0103
NOS Name	Employability Skills (90 Hours)
Sector	Cross Sectoral
Sub-Sector	Professional Skills
Occupation	Employability
NSQF Level	5
Credits	3
Version	1.0
Last Reviewed Date	NA
Next Review Date	27/05/2024
NSQC Clearance Date	27/05/2021

ASC/N8335: Review the targeted design architecture of EV

Description

This NOS unit is about performing tasks related to review target vehicle design architecture, its various systems, Battery pack design, applications & customer usage requirements.

Scope

The scope covers the following:

- Assess the requirements
- Assessing battery system, cell design & its Thermal Management System design

Elements and Performance Criteria

Assess the requirements

To be competent, the user/individual on the job must be able to:

PC1. Evaluate the type of EV that is 2W/3W/4W for information about vehicle design architecture, its components, and operational parameters to be received from the customer/OEM for the BMS infrastructure

PC2. Obtain the benchmarking data of previous project and evaluate the targeted applications and market requirements for the current project

PC3. Check the types of BSS solution to be deployed to meet the customer requirement

PC4. Identify prominent E/E issues & current leakages in the architecture

PC5. Identify required hardware & software for BMS with estimated budgeting

PC6. Propose the best suitable solutions to manager for the selection

Assessing battery system, cell design & its Thermal Management System design

To be competent, the user/individual on the job must be able to:

PC7. Prepare the outline for proposed battery swapping system and cell design packaging

PC8. Evaluate proposed battery thermal management system design considering applications and vehicle architecture

PC9. Evaluate E component packaging space & location to check for temperature & safety

PC10. Review several market solutions and latest trends for the similar applications and best practices to carefully choose from available best solutions

PC11. Benchmark BMS in the market comparing target vehicle

PC12. Review SOC, SOH, Cell Chemistry & cell design, Safety measurements for similar applications

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation policies, procedures, and guidelines that relate to designing and maintaining networks

KU2. market trends of latest technologies, types of EVs, types of EV Batteries

KU3. E/E drawings & vehicle layout architectures

KU4. BMS System & EV basics, its components & working principals
KU5. range of standard templates and tools available and how to use them
KU6. process layouts, drawings & other technical details
KU7. energy consumptions & usage
KU8. energy controlling & monitoring systems, its types & limitations
KU9. updated internal and external regulations for systems design
KU10. impact of organisational processes & products on the environment and human health safety guidelines

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. read instructions/guidelines
GS2. modify work practices to improve them
GS3. work with supervisors/team members to carry out work related tasks
GS4. complete tasks efficiently and accurately within stipulated time
GS5. inform/report to concerned person in case of any problem
GS6. make timely decisions for efficient utilization of resources
GS7. write reports such as accident report, in at least English/regional language

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Assess the requirements	**20**	**20**		**10**
PC1. Evaluate the type of EV that is 2W/3W/4W for information about vehicle design architecture, its components, and operational parameters to be received from the customer/OEM for the BMS infrastructure	4	4		3
PC2. Obtain the benchmarking data of previous project and evaluate the targeted applications and market requirements for the current project	3	3		2
PC3. Check the types of BSS solution to be deployed to meet the customer requirement	3	3		1
PC4. Identify prominent E/E issues & current leakages in the architecture	4	4		1
PC5. Identify required hardware & software for BMS with estimated budgeting	3	3		1
PC6. Propose the best suitable solutions to manager for the selection	3	3		2
Assessing battery system, cell design & its Thermal Management System design	**20**	**20**		**10**
PC7. Prepare the outline for proposed battery swapping system and cell design packaging	3	3		1
PC8. Evaluate proposed battery thermal management system design considering applications and vehicle architecture	4	4		2
PC9. Evaluate E component packaging space & location to check for temperature & safety	4	4		2
PC10. Review several market solutions and latest trends for the similar applications and best practices to carefully choose from available best solutions	4	4		2
PC11. Benchmark BMS in the market comparing target vehicle	3	3		2
PC12. Review SOC, SOH, Cell Chemistry & cell design, Safety measurements for similar applications	2	2		1
NOS Total	**40**	**40**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8335
NOS Name	Review the targeted design architecture of EV
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Product Development
NSQF Level	5.5
Credits	TBD
Version	1.0
Last Reviewed Date	28/02/2023
Next Review Date	28/02/2026
NSQC Clearance Date	28/02/2023

ASC/N8336: Develop prominent options of BMS architecture, infrastructure and solutions

Description

This NOS unit is about performing task related to defining & prepare various concepts for BMS systems, and choose most prominent options based on design requirements. This also include design of Hardware. Software, UI/UX & Control System, its parameters, safety structure, operational parameters, SOC, SOH, cell balancing & battery life estimations, budgetary requirements.

Scope

The scope covers the following:

- Prepare hardware, software & Control system components required for BMS

Elements and Performance Criteria

Prepare hardware, software & Control system components required for BMS

To be competent, the user/individual on the job must be able to:

PC1. Analyse & initiate concept for BMS, Hardware & Software configurations

PC2. Follow government norms for EV, legal requirements, safety requirements per ISO 26262 & compliances for designing BMS

PC3. Conduct core team interactions to define boundaries for BMS architectures

PC4. Prepare hardware requirement for BMS system configurations along with ECU & Sensor integration mapping)

PC5. Define / Develop Software architecture using MBD approach

PC6. Define control system algorithms using Coulomb Counting Method or Kalman Filter Method for estimating SOC, SOH, SOP, SOS, Fault Detection code & diagnostics, Battery Life Estimation, Charging & Discharging monitoring & Controlling mechanisms

PC7. Prepare estimated budget requirements

PC8. Submit the same for approval to the management

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Product portfolio of organization

KU2. Basics of SOH, SOC, SOP, SOS

KU3. Standard Operation Procedures (SOP) recommended by manufacturer for using different components

KU4. MBD approach & Simulation software like Simulink, MATLAB

KU5. Batter designs, cell design, cell balancing , Types of Microcontrollers, PCB Design

KU6. Impact of Thermal & external parameters on performance of BMS systems

KU7. Thermal Management of Battery System & its requirements,

KU8. Different types of Sensors, Integrations Policies, CAN Bus, J1939, J1772 Protocol,

KU9. Communication data protocols referring ISO 15118, OCPP, OCPI and other protocols

KU10. Types of Charging Stations, connector types & protocols

KU11. Government Norms, Legal Requirements, Safety requirements as per ISO 26262 or similar &

international compliance requirements

KU12. using system design software like Simulia, Ansys Medini Analyse, SCADA, etc.

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. follow instructions, guidelines, procedures, rules, and service level agreements
GS2. listen effectively and communicate information accurately
GS3. follow rule-based decision-making processes
GS4. make decisions on suitable courses
GS5. plan and organize the work to achieve targets and meet deadlines
GS6. apply problem-solving approaches to different situations
GS7. analyse the business impact and disseminate relevant information to others
GS8. apply balanced judgments to different situations
GS9. check the work is complete and free from errors

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare hardware, software & Control system components required for BMS	**40**	**40**		**20**
PC1. Analyse & initiate concept for BMS, Hardware & Software configurations	5	5		3
PC2. Follow government norms for EV, legal requirements, safety requirements per ISO 26262 & compliances for designing BMS	5	5		2
PC3. Conduct core team interactions to define boundaries for BMS architectures	6	6		2
PC4. Prepare hardware requirement for BMS system configurations along with ECU & Sensor integration mapping)	5	5		3
PC5. Define / Develop Software architecture using MBD approach	6	6		3
PC6. Define control system algorithms using Coulomb Counting Method or Kalman Filter Method for estimating SOC, SOH, SOP, SOS, Fault Detection code & diagnostics, Battery Life Estimation, Charging & Discharging monitoring & Controlling mechanisms	7	7		4
PC7. Prepare estimated budget requirements	4	4		2
PC8. Submit the same for approval to the management	2	2		1
NOS Total	**40**	**40**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8336
NOS Name	Develop prominent options of BMS architecture, infrastructure and solutions
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Product Development
NSQF Level	5.5
Credits	TBD
Version	1.0
Last Reviewed Date	28/02/2023
Next Review Date	28/02/2026
NSQC Clearance Date	28/02/2023

ASC/N8337: Conduct simulation for verification & validate of various architectures

Description

This NOS unit is about performing simulations using software, planning various performance, durability & safety testing for BMS system, support testing & validation activities, comparing results and proposing most suitable BMS system for target vehicle application.

Scope

The scope covers the following:

- Verify design options and plan for Design validation and planning (DVP) requirements
- Publish technical verification / validations results and architectures options

Elements and Performance Criteria

Verify design options and plan for Design validation and planning (DVP) requirements S

To be competent, the user/individual on the job must be able to:

PC1. Complete design simulations using software like MATLAB or Simulink reflecting vehicle applications, loading conditions, Charging & Discharging Profiles, SOC estimations based on Coulomb counting or Kalman Filter algorithms etc.

PC2. Review simulation results for Cell Voltage, Temperature, SOC, SOH, cell balancing

PC3. Discuss with superior & perform design improvements for BMS architecture

PC4. Benchmark technical guidelines TGR/TGW for similar BMS

PC5. Get the design Validation Plan (DVP) considering design requirements, loading conditions, vehicle applications, usage patterns, Governing legal regulations & Safety standards & requirements, ASIC C/D Compliance, EMI/EMC Requirements

PC6. Support testing & planning team to complete testing / validations on technical topics

Publish technical verification / validations results and architectures options

To be competent, the user/individual on the job must be able to:

PC7. Prepare comparison study with verification & testing results outcomes

PC8. Discuss & prepare most suitable BMS architecture option recommendation considering design parameters, adaption complexity, cost

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Product portfolio of organization

KU2. Product Benchmarking & Market technology analysis

KU3. Standard Operation Procedures (SOP) recommended by manufacturer for using equipment / machinery in use

KU4. Internal Responsible departments and team members

KU5. Leading component suppliers and competition designs

KU6. Use of Simulation software like MATLAB or Simulink

KU7. SOC Estimations using Coulomb counting or Kalman Filter Algorithms

KU8. Standard testing requirements & testing procedures, DVP for various components & systems

KU9. Limitations of various BMS architectures & its possible resolutions

KU10. System Fault codes & its Diagnostics, FMEA methodology, Predictive Cell Diagnosis & Remaining Useful life estimations

KU11. Change Management, Stakeholder review, results analysis

KU12. Integrated Reporting to all stakeholders

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. follow instructions, guidelines, procedures, rules, and service level agreements

GS2. listen effectively and communicate information accurately

GS3. follow rule-based decision-making processes

GS4. make decisions on suitable courses

GS5. plan and organize the work to achieve targets and meet deadlines

GS6. apply problem-solving approaches to different situations

GS7. analyse the business impact and disseminate relevant information to others

GS8. apply balanced judgments to different situations

GS9. check the work is complete and free from errors

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Verify design options and plan for Design validation and planning (DVP) requirements	**32**	**24**		**16**
PC1. Complete design simulations using software like MATLAB or Simulink reflecting vehicle applications, loading conditions, Charging & Discharging Profiles, SOC estimations based on Coulomb counting or Kalman Filter algorithms etc.	7	7		5
PC2. Review simulation results for Cell Voltage, Temperature, SOC, SOH, cell balancing	5	5		3
PC3. Discuss with superior & perform design improvements for BMS architecture	5	5		2
PC4. Benchmark technical guidelines TGR/TGW for similar BMS	4	4		2
PC5. Get the design Validation Plan (DVP) considering design requirements, loading conditions, vehicle applications, usage patterns, Governing legal regulations & Safety standards & requirements, ASIC C/D Compliance, EMI/EMC Requirements	7	7		2
PC6. Support testing & planning team to complete testing / validations on technical topics	4	4		2
Publish technical verification / validations results and architectures options	**8**	**8**		**4**
PC7. Prepare comparison study with verification & testing results outcomes	4	4		2
PC8. Discuss & prepare most suitable BMS architecture option recommendation considering design parameters, adaption complexity, cost	4	4		2
NOS Total	**40**	**40**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8337
NOS Name	Conduct simulation for verification & validate of various architectures
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Product Development
NSQF Level	5.5
Credits	TBD
Version	1.0
Last Reviewed Date	28/02/2023
Next Review Date	28/02/2026
NSQC Clearance Date	28/02/2023

ASC/N8338: Support manager to execute implementation of BMS system

Description

This NOS unit is about preparing detail planning for the selected BMS architecture, releasing drawings & specification books, safety requirements, fault codes and diagnosis plan. This is also about providing system implementation support to the core team and manager, field issue resolution support.

Scope

The scope covers the following:

- Prepare for implementation of BMS
- Support manager & project teams to execute implementation of BMS

Elements and Performance Criteria

Prepare for implementation of BMS

To be competent, the user/individual on the job must be able to:

PC1. Obtain the approval from the management on the selected proposal

PC2. Prepare detailed design for H/W & Software Interfaces, UI/UX interfaces

PC3. Prepare control system detailed design with defined architecture & strategies

PC4. Release detail design, architecture Drawings for development

PC5. Prepare & release specification book for various components & system

Support manager & project teams to execute implementation of BMS

To be competent, the user/individual on the job must be able to:

PC6. Participate in design reviews with the team internally & externally

PC7. Support the core team for necessary technical clarifications & resolutions from R&D network

PC8. Support for vehicle integration & series implementation

PC9. Participate quality meetings & receive BMS performance feedback

PC10. Understand field issues regarding BMS related to various architecture, durability or control system issues

PC11. Propose & provide necessary technical resolution for the issues during deployment

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Vehicle application & Market usage patterns

KU2. Electrical connection layout, energy maps, energy costs

KU3. Various materials used in BMS and their environmental impacts

KU4. Battery power cycles and prevalent energy efficient devices

KU5. Types of Batteries used in EV, Loading cycles and its impacts on battery life, Safety requirements for selected battery types

KU6. Communicating with internal & external stakeholders

KU7. Preparation of Design & Drawings for system and various components, Conventions used in E/E drawings, Product design management & release

KU8. EMI/EMC requirements

KU9. Updated internal and external regulations for system and component designs
KU10. Latest technology discussion forums and future technology study
KU11. Understanding Field issues, its relationship with BMS system & its resolutions
KU12. Team working & communications
KU13. Latest Automotive trends & development strategies

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. follow instructions, guidelines, procedures, rules, and service level agreements
GS2. listen effectively and communicate information accurately
GS3. follow rule-based decision-making processes
GS4. make decisions on suitable courses
GS5. plan and organize the work to achieve targets and meet deadlines
GS6. apply problem-solving approaches to different situations
GS7. analyse the business impact and disseminate relevant information to others
GS8. apply balanced judgments to different situations
GS9. check the work is complete and free from errors

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for implementation of BMS	**19**	**19**		**9**
PC1. Obtain the approval from the management on the selected proposal	2	2		1
PC2. Prepare detailed design for H/W & Software Interfaces, UI/UX interfaces	5	5		2
PC3. Prepare control system detailed design with defined architecture & strategies	4	4		2
PC4. Release detail design, architecture Drawings for development	3	3		2
PC5. Prepare & release specification book for various components & system	3	3		2
Support manager & project teams to execute implementation of BMS	**21**	**21**		**11**
PC6. Participate in design reviews with the team internally & externally	4	4		2
PC7. Support the core team for necessary technical clarifications & resolutions from R&D network	4	4		2
PC8. Support for vehicle integration & series implementation	4	4		2
PC9. Participate quality meetings & receive BMS performance feedback	4	4		2
PC10. Understand field issues regarding BMS related to various architecture, durability or control system issues	3	3		2
PC11. Propose & provide necessary technical resolution for the issues during deployment	2	2		1
NOS Total	**40**	**40**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ASC/N8338
NOS Name	Support manager to execute implementation of BMS system
Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Automotive Product Development
NSQF Level	5.5
Credits	TBD
Version	1.0
Last Reviewed Date	28/02/2023
Next Review Date	28/02/2026
NSQC Clearance Date	28/02/2023

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.

2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.

3. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training centre (as per assessment criteria below).

4. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training centre based on these criteria.

5. In case of successfully passing only certain number of NOSs, the trainee is eligible to take

subsequent assessment on the balance NOS's to pass the Qualification Pack.

6. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack

Minimum Aggregate Passing % at QP Level : 70

(**Please note**: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ASC/N9810: Manage work and resources (Manufacturing)	50	30	0	20	100	15
DGT/VSQ/N0104 - Employability Skills (120 hours)	20	30	-	-	50	10
ASC/N8335: Review the targeted design architecture of EV	40	40	-	20	100	15
ASC/N8336: Develop prominent options of BMS architecture, infrastructure and solutions	40	40	0	20	100	20

ASC/N8337: Conduct simulation for verification & validate of various architectures	40	40	-	20	100	20
ASC/N8338: Support manager to execute implementation of BMS system	40	40	0	20	100	20
Total	**230**	**220**	**-**	**100**	**550**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
AMC	Annual Maintenance Contract
PPE	Personal Protective Equipment
ERP	Enterprise Resource Planning
PM	Predictive Maintenance
QMS	Quality Management System
TOPS	Team Oriented Problem Solving
QMS	Quality Management System
CFT	Complement Fixation Test

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.

Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.