## Job Role: Automotive Design Safety Specialist

### Brief Job Description:

The individual at this job is responsible for end-to-end design and development of systems and services (Electrical/Electronic/Mechanical), deployment of standards and review of systems and engineering activities. He/she leads the product engineering activities and guides team on technical functions through technologies, and engineering applications. He/she also develops management processes for team, PD (Product Development) programs and report and record QIP (Quality Improvement Plan) related activities towards achieving product quality excellence.

### Personal Attributes:

The person should be result oriented with good technical and analytical skills, should have excellent interpersonal skills, communication and presentation skills and be a good team player. He/she should have ability to manage projects, prioritizing of work, collaborating well, motivating team members and mentoring the budding engineers.

### Applicable National Occupational Standards (NOS)

### Compulsory NOS: -

1. Manage work and resources (Research & Development)
2. Employability NOS (120 Hours)
3. Conduct safety analysis of electrical/electronic/mechanical systems
4. Lead Computer Aided Engineering (CAE) simulations to ensure safety and vehicle performance

### Qualification Pack (QP) Parameters

| | |
|---|---|
| Sector | Automotive |
| Sub sector | Engineering |
| Occupation | Automotive Product Designing |
| Country | India |
| NSQF Level | 6 |
| Aligned to NCO/ISCO/ISIC Code | |
| Minimum Educational Qualification & Experience | B.E./B.Tech in the relevant field with 1 Year of relevant experience<br>OR<br>Pursuing 2nd year of M.E./M.Tech in the relevant field and continuous education<br>OR<br>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 | |
| Minimum Job Entry Age | |
| Last Reviewed On | |
| Next Review Date | |
| Deactivation Date | |
| NSQC Approval Date | |

| Version | |
|---|---|

# ASC/N8330: Conduct safety analysis of electrical/electronic/mechanical systems

Description:

This NOS unit is about performing product engineering of Electrical/Electronic/Mechanical systems adhering to safety standards like ISO 26262, AUTOSAR, CMVR and other applicable regulations for excellence in product performance through risk mitigation by identifying hazards and deploying measured steps to combat malfunctioning of automated functionalities.

## Scope

The scope covers the following:

- Define the design targets for the Electrical/Electronic systems
- Develop the systems from concept to production drawing release stage
- Monitor the risk mitigation program
- Validate each system for compliance to standards
- Report and record data on safety analysis and progress of activities

## Elements and Performance Criteria

*Define the design targets for the Electrical/Electronic systems*

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

PC1. Identify the parameters that can cause malfunctioning and enhance performance of vehicle by automation

PC2. Set the goals for engineering teams, hardware and software suppliers and associates providing services for creating suitable designs of the vehicle

PC3. Define the functional targets for design-simulation-prototyping-testing engineers

*Develop the systems from concept to production drawing release stage*

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

PC4. Deploy resources to generate design concepts complying with quality and cost targets

PC5. Design the Electrical/Electronic/Mechanical systems as per Product Quality plan (APQP) fulfilling the time and cost constraints

PC6. Apply appropriate technologies to meet the goals set for design, simulation, rapid-prototyping, validation

PC7. Co-ordinate with design teams to develop systems compatible to each other and complying with the design safety standards

*Monitor the risk mitigation program*

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

PC8. Identify all potential hazards out of system malfunctioning

PC9. Prepare comprehensive list of critical and non-critical risks arising out of hazardous operations

PC10. Monitor the engineering activities with a focus on the risk mitigation activities

*Validate each system for compliance to standards*

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

PC11. Analyse each system function by simulating normal performance and failure under critical conditions

PC12. Integrate systems on vehicle sub-systems to test virtually the design targets for performance and failures
PC13. Validate system performance on vehicle and clearly identify failure modes and corrective actions
PC14. Release final design after vehicle homologation tests on safety critical systems
PC15. Modify designs based on feedback from handlers in the product lifecycle or as part of continuous improvement, re-engineering or value-engineering and perform validation testing for safety compliance

*Report and record data on safety analysis and progress of activities related to design safety*

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

PC16. Perform safety analysis on each system at pre-defined intervals
PC17. Report the progress of safety related activities including failures, omissions and delays
PC18. Record all product engineering steps in the light of design safety for compliance audits or quality conformance

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Product portfolio of organization
KU2. Company manufacturing processes
KU3. Standard Operation Procedures (SOP) recommended by manufacturer for using equipment / machinery in use
KU4. Departments responsible for various organisational activities
KU5. The range of standard templates and tools available and how to use them
KU6. Role of Innovation & Role of technology in safety standards
KU7. Safety standards followed in industry
KU8. Various parameters that can cause malfunctioning and enhance performance of vehicle
KU9. Designing of the Electrical/Electronic systems as per Product Quality plan (APQP)
KU10. Process to integrate systems on vehicle sub-systems
KU11. Risk mitigation process

## 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
GS10. Keen to Observe & analyse

## Assessment Criteria

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| *Define the design targets for the Electrical/Electronic systems* | **7** | **7** | | **3** |
| PC1. Identify the parameters that can cause malfunctioning and enhance performance of vehicle by automation | 2 | 2 | | 1 |
| PC2. Set the goals for engineering teams, hardware and software suppliers and associates providing services for creating suitable designs of the vehicle | 3 | 3 | | 1 |
| PC3. Define the functional targets for design-simulation-prototyping-testing engineers | 2 | 2 | | 1 |
| *Develop the systems from concept to production drawing release stage* | **10** | **10** | | **5** |
| PC4. Deploy resources to generate design concepts complying with quality and cost targets | 2 | 2 | | 1 |
| PC5. Design the Electrical/Electronic/Mechanical systems as per Product Quality plan (APQP) fulfilling the time and cost constraints | 3 | 3 | | 1 |
| PC6. Apply appropriate technologies to meet the goals set for design, simulation, rapid-prototyping, validation | 3 | 3 | | 2 |
| PC7. Co-ordinate with design teams to develop systems compatible to each other and complying with the design safety standards | 2 | 2 | | 1 |
| *Monitor the risk mitigation program* | **5** | **5** | | **3** |
| PC8. Identify all potential hazards out of system malfunctioning | 1 | 1 | | 1 |
| PC9. Prepare comprehensive list of critical and non-critical risks arising out of hazardous operations | 2 | 2 | | 1 |
| PC10. Monitor the engineering activities with a focus on the risk mitigation activities | 2 | 2 | | 1 |
| *Validate each system for compliance to standards* | **11** | **11** | | **5** |
| PC11. Analyse each system function by simulating normal performance and failure under critical conditions | 2 | 2 | | 1 |
| PC12. Integrate systems on vehicle sub-systems to test virtually the design targets for performance and failures | 3 | 3 | | 1 |

| | | | | |
|---|---|---|---|---|
| PC13. Validate system performance on vehicle and clearly identify failure modes and corrective actions | 2 | 2 | | 1 |
| PC14. Release final design after vehicle homologation tests on safety critical systems | 2 | 2 | | 1 |
| PC15. Modify designs based on feedback from handlers in the product lifecycle or as part of continuous improvement, re-engineering or value-engineering and perform validation testing for safety compliance | 2 | 2 | | 1 |
| *Report and record data on safety analysis and progress of activities related to design safety* | **7** | **7** | | **4** |
| PC16. Perform safety analysis on each system at pre-defined intervals | 3 | 3 | | 2 |
| PC17. Report the progress of safety related activities including failures, omissions and delays | 2 | 2 | | 1 |
| PC18. Record all product engineering steps in the light of design safety for compliance audits or quality conformance | 2 | 2 | | 1 |
| **NOS Total** | **40** | **40** | **-** | **20** |

# ASC/N8331: Lead Computer Aided Engineering (CAE) simulations to ensure safety and vehicle performance

## Description:

This NOS unit is about performing CAE simulations on Mechanical/Electrical/Electronic systems to predict performance and define life / warranty period through Finite Element Analysis (FEA) of structural parts and Computational Fluid Dynamics (CFD) of liquid/gas with product part number or the surrounding environment during operation.

## Scope

The scope covers the following:

- Identify the elements for virtual validation
- Develop Virtual Product Development (VPD) plan for CAE simulations
- Develop CAE and FE models for individual analysis methods
- Monitor the design safety verifications
- Perform virtual validation

## Elements and Performance Criteria

*Identify the elements for virtual validation of the design (DV) of parts and of the integration (PV) of systems*

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

PC1. Ensure availability of an array of CAE & CAD software, high performance computers and servers (local/cloud)

PC2. Identify vehicle parts and operating conditions (load cases) to undergo CAE simulations (apt boundary condition)

PC3. Identify electrical/electronic parts of each system and mechanical parts of each assembly for design verification

PC4. Identify each aspect of vehicle integration and operations that calls for CAE simulation

*Develop Virtual Product Development (VPD) plan for CAE simulations in sync with the Vehicle Development Plan (VDP)*

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

PC5. Ensure that the capability matrix and workload / capacity schedule are mutually supportive

PC6. Develop detailed plan for simulations (light and server-intensive) best utilising the available computing resources

PC7. Conduct virtual validation reviews in conjunction with Initial-Interim-Final Design Release and DV-PV-PPV Testing

*Develop CAE models common for FEA, CFD, MDB and discrete F.E models for individual analysis methods*

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

PC8. Plan CAE strategy for pre-processing suiting the simulations (Crash/CFD/NVH) as per the VPD plan

PC9. Lead F.E Meshing team in co-ordination with system design teams to make concurrent changes on F.E models

PC10. Monitor development of compatible F.E mesh common for analysis types (structure/fluid/acoustic)

*Monitor the design safety verifications complying to crash safety standards and part failure conditions*

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

PC11. Conduct virtual validation of electrical/electronic/mechanical parts for design integrity
PC12. Lead CAE simulation under extreme operating conditions for static/dynamic/transient conditions
PC13. Lead analysis of failure modes on safety critical parts and vehicle sub-assemblies
PC14. Monitor the post-processing and result-interpretation records at all stages of CAE

*Perform virtual validation in coherence with designing, re-designing, re-engineering stages in the product lifecycle*

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

PC15. Schedule all CAE simulation activities for accurate & timely results during designing, re-designing, re-engineering
PC16. Archive digital records systematically in a safe environment for easy retrieval during the stipulated time window by following organisational procedures

## Knowledge and Understanding (KU)

**The individual on the job needs to know and understand:**

KU1. Product portfolio of organization
KU2. Company manufacturing processes
KU3. Standard Operation Procedures (SOP) recommended by manufacturer for using equipment / machinery in use
KU4. Departments responsible for various organisational activities
KU5. CAE & CAD software, high performance computers and servers (local/cloud)
KU6. CAE simulation
KU7. Vehicle parts and operating conditions (load cases) to undergo CAE simulations

## 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
GS10. Keen to observe & analyse

## Assessment Criteria

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| *Identify the elements for virtual validation of the design (DV) of parts and of the integration (PV) of systems* | **9** | **9** | | **6** |
| PC1. Ensure availability of an array of CAE & CAD software, high performance computers and servers (local/cloud) | 2 | 2 | | 1 |
| PC2. Identify vehicle parts and operating conditions (load cases) to undergo CAE simulations (apt boundary condition) | 3 | 3 | | 2 |
| PC3. Identify electrical/electronic parts of each system and mechanical parts of each assembly for design verification | 2 | 2 | | 2 |
| PC4. Identify each aspect of vehicle integration and operations that calls for CAE simulation | 2 | 2 | | 1 |
| *Develop Virtual Product Development (VPD) plan for CAE simulations in sync with the Vehicle Development Plan (VDP)* | **8** | **8** | | **4** |
| PC5. Ensure that the capability matrix and workload / capacity schedule are mutually supportive | 2 | 2 | | 1 |
| PC6. Develop detailed plan for simulations (light and server-intensive) best utilising the available computing resources | 3 | 3 | | 2 |
| PC7. Conduct virtual validation reviews in conjunction with Initial-Interim-Final Design Release and DV-PV-PPV Testing | 3 | 3 | | 1 |
| *Develop CAE models common for FEA, CFD, MDB and discrete F.E models for individual analysis methods* | **8** | **8** | | **3** |
| PC8. Plan CAE strategy for pre-processing suiting the simulations (Crash/CFD/NVH) as per the VPD plan | 3 | 3 | | 1 |
| PC9. Lead F.E Meshing team in co-ordination with system design teams to make concurrent changes on F.E models | 3 | 3 | | 1 |
| PC10. Monitor development of compatible F.E mesh common for analysis types (structure/fluid/acoustic) | 2 | 2 | | 1 |
| *Monitor the design safety verifications complying to crash safety standards and part failure conditions* | **11** | **11** | | **5** |
| PC11. Conduct virtual validation of electrical/electronic/mechanical parts for design integrity | 3 | 3 | | 2 |
| PC12. Lead CAE simulation under extreme operating conditions for static/dynamic/transient conditions | 3 | 3 | | 1 |

| | | | | |
|---|---|---|---|---|
| PC13. Lead analysis of failure modes on safety critical parts and vehicle sub-assemblies | 3 | 3 | | 1 |
| PC14. Monitor the post-processing and result-interpretation records at all stages of CAE | 2 | 2 | | 1 |
| *Perform virtual validation in coherence with designing, re-designing, re-engineering stages in the product lifecycle* | **4** | **4** | | **2** |
| PC15. Schedule all CAE simulation activities for accurate & timely results during designing, re-designing, re-engineering | 2 | 2 | | 1 |
| PC16. Archive digital records systematically in a safe environment for easy retrieval during the stipulated time window by following organisational procedures | 2 | 2 | | 1 |
| **NOS Total** | **40** | **40** | **-** | **20** |