

SAEISS Dr G Padmanabham Memorial Electric Two Wheeler Design Competition (ETWDC) 2025

Rule Book

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1. SAEINDIA SOUTHERN SECTION ELECTRIC TWO WHEELER DESIGN COMPETITION (SAEISS ETWDC) RULES AND ORGANIZER AUTHORITY

1.1 Rules Authority

The SAEIIS ETWDC Rules are the responsibility of SAEIIS ETWDC Organizing Committee and are issued under the authority of SAEIIS ETWDC Organizing Committee. Official announcements from SAEIIS ETWDC Organizing Committee shall be considered part of and have the same validity as these rules.

Ambiguities or questions concerning the meaning or intent of these rules will be resolved by SAEIIS ETWDC Organizing Committee during competition onsite.

1.2 Rules Validity

The SAEIIS ETWDC Rules posted in the rulebook. **Rules Compliance**

By entering a SAEIIS ETWDC competition, the team members, faculty advisors and other personnel of the entering Engineering Institutions (Engineering colleges/Universities) agree to comply with, and be bound by, the rules and its interpretations or procedures issued as announced by SAEIIS ETWDC Organizing Committee. All team members, faculty advisors and other Engineering Institutions (Engineering colleges/Universities) representatives are required to cooperate with, and follow all instructions from competition organizers, officials and judges.

1.3 Understanding the Rules

Teams are responsible for reading and understanding the rules in their entirety for the competition in which they are participating. The section and paragraph headings in these rules are provided to facilitate reading: they do not fully explain all the paragraph contents.

1.4 Loopholes

It is virtually impossible for a set of rules to be so comprehensive that it covers all possible questions about the vehicle's design parameters or the conduct of the competition. Please keep in mind that safety remains paramount during SAEIIS ETWDC, so any perceived loopholes should be resolved in the direction of increased safety/ concept of the competition.

1.5 Violations of Intent

The violations of the intent of a rule will be considered a violation of the rule itself. Questions about the intent or meaning of a rule may be addressed to SAEIIS ETWDC Organizing Committee or Technical Inspectors.

1.6 General Authority

SAEIIS ETWDC Organizing Committee reserves the right to revise the schedule of the competition and/or interpret or modify the competition rules at any time and in any manner that is, in their sole judgment, required for the efficient operation of the event.

1.7 Penalties

Organizers have the right to modify the penalties listed in the various dynamic event descriptions to better reflect the design of their event courses, the course lengths or any special conditions unique to the site. The standard dynamic event penalties in these rules are default values that will be applied unless there is a change by the organizer.

2. PARTICIPANT'S REQUIREMENTS

2.1 Eligibility Limits

Eligibility is limited to students to ensure this is an engineering competition. Individual members of teams participating in this competition must satisfy the following requirements.

2.2 Student Status

Team members must be enrolled as degree seeking student in Engineering Institutions (Engineering colleges/Universities). Team members who have already graduated prior to the competition are NOT eligible to participate.

2.3 Society Membership

Team members must be members of SAE INDIA. Proof of membership, such as a valid membership card, is required during the final event. Those interested may join SAEINDIA at: www.saeindia.org.

2.4 Age

Team members must be at least eighteen (18) years of age at the time of the competition.

2.5 Driver requirements

Driver must be one of the Team members, same driver will not be allowed for other teams from same institute or different institute. External person will not be allowed to be the driver for the competition.

2.6 Driver's License

Team members who will drive a competition vehicle at any time during a competition must hold a valid, government issued driver's license. This will be required on site for proof.

2.7 Liability Waiver

All on-site participants and faculty are required to sign a liability waiver upon registering on-site.

2.8 Insurance

Individual medical and accident insurance coverage is required and is the sole responsibility of the participant.

2.9 Team Size

A team can have a maximum of 10 members. It is preferable that the team has good representation of students from 2nd, 3rd, or 4th year and from the different disciplines of Study(Mechanical, Automobile, Production, Electrical/Electronics and so on).

3. FACULTY ADVISOR

3.1 Faculty Adviser

Each team is allowed to have a maximum of 1 faculty adviser and shall be considered as the official representative to co-ordinate and accompany the team.

4. RULES OF CONDUCT

4.1 General

Good conduct and compliance with the rules and the official instructions are requirements to be followed by every team member. An incident of unsportsmanlike conduct, the organizer is authorized to impose an appropriate penalty.

Unsportsmanlike conduct can include arguments with officials, disobedience of official instructions and the use of abusive or threatening language to any official or other participant. Depending on the seriousness of the infraction the penalty for such actions can range from a deduction of up to fifty percent (50%) of the team points, to expulsion of the entire team. Penalties of this type will only be imposed after a complete review of the incident by the organizer.

4.2 Alcohol and Illegal Material

Alcoholic beverages, firearms, weapons of any type and illegal materials are prohibited at SAEISS ETWDC site during the competition. The penalty for violation of this rule is the immediate expulsion of the entire team, not just the individual(s) involved. This rule applies to team members, advisors and any individuals working with the team on-site.

4.3 Smoking – Prohibited

Smoking is prohibited in all competition areas.

4.4 Parties

Disruptive parties either on or off-site must be prevented by the faculty adviser or team captain.

4.5 Site Condition

Please help the organizers keep the site clean. The sites used for SAEISS ETWDC is generally private property and should be treated as such. Competitors are reminded that they are guests of the owners. All trash should be placed in the receptacles provided. Failure to clean the premises will result in an unsportsmanlike conduct penalty. Competitors are encouraged to police their areas after meals.

5. SPECTATOR RULES

5.1 General

The organizers typically do not have a direct line of communication with spectators other than on-the-spot at the competition; thus, the competitors, faculty and volunteers are expected to help inform the spectators of the safety rules and help restrict spectators to the spectator areas.

5.2 Alcoholic Beverages

Spectators may not drink or possess alcoholic beverages at any competition location.

5.3 Access Restrictions

Spectators must keep a specified back distance decided by the organizers, from any area where vehicles are operating under power. Motor vehicle competitions are potentially dangerous and safety rules will be strictly enforced.

5.4 Children

A competition site is not a safe place for children and unsupervised young people. Spectators who fail to strictly control their children will be asked to leave the site.

5.5 Removal of Spectators

The course officials and organizers have the absolute right to restrict spectator access to any parts of the site and to eject anyone who violates safety rules or ignores the instructions of officials.

5.6 Unsafe Practices and Conduct

All participants are required to exercise safe practices and always avoid unsafe activities during the competition. The event organizer has the discretionary authority to impose a just penalty for any conduct deemed unsafe. All team members will be held to this rule.

6. OBJECTIVE

To Design, Engineer, Prototype and demonstrate an Electric Two Wheeler (Scooter) to carry a Single person, with a price tag of Rs 60,000.

The design should be documented by the way of complete manufacturing drawing of all the parts and assemblies, with individual costing along with engineering material, accompanied by a project report which can be used to convince a company to invest on manufacturing an optimized variant of this product after due certification by the homologation authority of the country of manufacture.

Industrial-Design (ID) practices pertaining to the vehicle shape, color, texture, other aesthetics and ergonomics may be followed to the possible extent with the help of pre-declared agencies like NID, IIT-B etc., Parts may be manufactured by standard or non-conventional components may also be considered for this purpose. The external appearance of the vehicle should not overlap on any product in the market which may otherwise have legal implications by way of design-registrations; however, participants would be encouraged to incorporate innovations, which if found patent worthy shall be supported by SAEISS for IP protection.

The design will be competing against many other designs received from other institutions from all over India. The winning design will be rewarded suitably, and the team members will be deriving indirect benefit of being selected for design centres and R & D in automotive companies.

7. DESIGN SPECIFICATIONS

ETWDC intends to strengthen the design competence of participants by encouraging engineers to indulge in core engineering design activities that has potential intellectual property value. A Design log sheet shall be maintained for completion of activities as mentioned in rewards points TABLE.

7.1 General design requirements

7.1.1 Vehicle construction and critical dimensions:

- Electric Propelled, Single Seated Scooter to carry Indian 95th Percentile male*
- Vehicle Max speed of 35 Kmph.
- All parts are to be custom design / built

Wheel base	: 1150 mm to 1350 mm
Ground clearance	: Minimum 150 mm
Handlebar height	: Minimum 900 mm
Seat height	: Minimum 750 mm
Overall length	: Should not exceed 1800 mm
Overall width	: Should not exceed 750 mm
Overall height	: Should not exceed 1200 mm

*Refer the Design Standard for more details

7.1.2 Frame and body:

- Frame – only Tubular pipe
- Frame, electric, electronic and wiring should be covered with body panels
- Body panels must be easily removable to access other components

7.1.3 Suspension and Steering:

- The scooter must be provided with the front and Rear suspension.
- Front wheel steer with handle bar only.
- Steering stop must be provided on either sides not exceeding 45 degrees
- Rake angle : 22 - 30 degrees

7.1.4 Brakes

- Braking system to meet Central Motor Vehicle Rules (CMVR Rule: 96, IS:14664)
- Brake lines/hoses should not touch any moving components / High voltage lines and properly tagged with rigid member

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7.1.5 Power Train

- Battery 48V, 24Ah Lithium Ion Batteries
- BLDC/DC Motor - 750 W to 1000 W (Rated power)
- All the E kit components shall have dust or water entry resistance
- Hub or Mid drive type (if mid drive motor is used, only belt/chain/gear transmission only)
- If belt/chain/gear transmission used it should be properly covered

7.1.6 Wheel & Tyre

- Diameter of rim : 10 to 12 inches
- Tyre width : 2.5 to 3.5 inches

7.1.7 Lighting & Signaling devices

- Head lamp, Indicator lamps (Front and rear), Rear brake lamp and horn are mandatory
- The selection and positioning of above as per AIS 009 / IS:15796

7.1.8 Tell –Tale and Indicators

- Instrument cluster must have speedometer, odometer and battery state of charge indicator as per AIS 126

7.2 Cost:

- E-BOM cost should be equivalent to the target cost-. Attach all forms for costing.
- Serviceability to suit standard tools available in present garages.
- Maintainability in line with current practices of Electric Two Wheelers.
- Design to consider 3R principle (Reduce, Reuse and Recycle)

Special Note: Innovation may be attempted in suspensions / Electric Drive / frame / handlebar / brake system. Innovation may also be demonstrated in choice of materials, manufacturable practices. All parts / Assemblies are design engineered and should be drawn by students and may be fabricated in house, the assembly sequence and disassembled must be demonstrated (Video graphed and submitted) in house.

7.3 Factors to be considered:

7.3.1 Battery pack:

- 7.3.1 Battery pack:**

 - Only rechargeable Lithium Ion battery packs are allowed for use in vehicle.
 - Students can choose any kind of lithium-ion cell chemistry (NMC, LFP etc.), shape (Cylindrical, Prismatic etc.) and size based on their design needs.
 - Lithium Ion Battery Pack must have a BMS by default and the same should be rated for EV (Electric Vehicle) application providing proper cell balancing, Over voltage Protection, Over Current Protection, Short Circuit Protection and thermal protection.
 - DATA Sheets of Lithium Ion cells and BMS used in the battery packs covering all the technical details must be submitted along with design report
 - The battery pack should cover all the cells and BMS in a proper manner without exposing any of the internal components to the dust or water entry.
 - The battery pack must be well covered and insulated with a hard casing made of Plastic, Metal or any other fire retardant material.
 - This layer Should also provide protection to battery pack against shock and vibrations, without disintegration of any internal components of the battery pack Any Wires or Plug Points of the battery pack should be properly mentioned with tags or stickers notifying its purpose/function.
 - Battery pack must be positioned inside the vehicle and properly shielded from dust or water intrusion.
 - Battery pack should be properly fastened to the vehicle with nyloc nuts to avoid any vibrations or shocks during vehicle movement. Use of nylon lock nuts is advised.
 - Teams are requested only to get assembled Packs from Manufacturers and not assemble cells on their own. SAEIIS will not be responsible for any such unwarranted processes leading to Violation of Safety Procedures.
 - Battery pack used must be compliant with AIS 048 safety standards.
 - The DC Output from the Battery should not be connected to the loads directly. A Connector (Anderson Connector) should be used.

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7.3.2 Charging System

- Team can have their own charging system design but charger Input voltage is fixed at 230V 50 Hz AC
- Charging current can be set according to design needs (2A-10A allowed)
- A charging system/Charger used should be rated for the battery pack according to engineering specifications and should be properly covered and insulated
- The vehicle/Charger should indicate user if any charging operation is underway through LED light
- The charger should have Over voltage Protection, Over Current Protection, Short Circuit Protection, Reverse Protection
- Proper Plugs should be used for connecting the Li-ion battery charger to the battery pack, there should not be any loose running wires
- **No onboard charging systems are allowed**
- Chargers should meet SAE/BIS/CE standards

7.3.3 Wiring harness

- Use of copper wires with suitable gauge lengths according to amperage of the circuit is encouraged
- Silk wires are not permitted for high-voltage (48V and above) circuits, such as those connected to the motor, battery, or charging interface. Use copper wires of appropriate gauge (based on amperage) with automotive-grade insulation. Refer to standard current-carrying capacity charts when selecting wire sizes.
- Suitable Male To Female Connectors should be used for wiring interface with other components, under no circumstances insulation tape be used for connecting the high voltage lines to motor/controller
- If use of male to female connector not possible the wires can be soldered and covered with heat shrinkable cable sleeves / Insulation tapes properly
- A single wiring harness from front dashboard controls to the controller is preferred and it must be covered with a flexible PVC pipe
- Housings and/or covers must prevent inadvertent human contact with any part of the tractive/battery system circuitry. This includes people working on or inside the vehicle. Covers must be secure and adequately rigid.

7.3.4 Safety Precautions & Hazard Check Points:

Fuse Box to in-corporated in all wiring harness Design



- Wiring harness should be connected via fuse box. It should not be connected directly from battery to motor.
- While in emergency conditions the fuse should be used to disconnect the Power flowing from the Battery.

8. REWARD POINTS

S No	Category	Points	Review	Remarks
1	Master layout and Design report	75	DR1	Online Evaluation
2	Critical Dimension calculations and Powertrain Simulations	25		Online Evaluation
3	CAE – reports	25		Online Evaluation
4	Part drawings after CAE	20		Online Evaluation
5	E-BOM	20		Online Evaluation
6	Cost estimation as per E BOM	25		Online Evaluation
7	Manufacturing Drawings	45	DR2	Online Evaluation
8	Inspection report – Parts and Design Log	45		Online Evaluation
9	Design to Product Comparison	25	DR3	At Competition
10	Aesthetics (color / shape / texture, etc.,)	45		At Competition
11	Electric Two Wheeler weight	85		At Competition
12	Build quality – inspection -Safety Installation Checks	45		At Competition
13	Innovation	50		At Competition
14	Engineered Components	50		At Competition
15	Assemblage	20	DR4	At Competition
16	Design Log PPT	25		At Competition
17	Presentation	50		At Competition
18	Question and answer	25		At Competition
19	Braking test	40		At Competition
20	Maneuverability Test	75		At Competition
21	Vehicle Range Test	75	DR4	At Competition
22	Acceleration Test	35		At Competition
23	Gradeability Test	30		At Competition
24	Bump Test	45		At Competition
TOTAL		1000		

8.1 Design Review 1 (DR1) : 190 points**Criteria**

- Master layout of the vehicle with schematic of the whole vehicle to scale in NX CAD.
- Location of all aggregate with respect to wheel centers / entire drives line / frame/ fork / seat/ handlebar / fender/ Battery Pack/Motor
- Calculation for tube diameters and any other dimension of aggregates
- Powertrain selection with Simulations and /or Manual Calculations
- Charging Circuit Diagram as per Standard
- Electric Motor Drive Circuit Diagram as per Standard
- CAE reports of parts as appropriate
- Updated part drawings after CAE analysis.
- 1:5 drawing at the parts along with 2D layout
- E- BOM / Costing sheet
- Electronic project report – A4 Size consisting of team ID/ Name & advisors name.
- Commercial sales brochure

8.2 Design Review 2 (DR2) : 90 Points**Criteria**

- Review the Manufacturing drawings
- Review the Inspection report with the Material Specification of the parts
- Review the Interim Design Log

8.3 Design Review 3 DR3: 320 Points Criteria

- Innovation in design and function shall be the main focus of evaluation
- The frame and fork shall have the required strength and stiffness.
- The Electric Two Wheeler should have the required Safety Installation for 48v system.
- Weight of the Electric Two Wheeler shall be as low as possible.
- Qualities of the prototype for fit and finish for welding, workmanship of the completed Electric Two Wheeler.
- Focus on serviceability / assembly / disassembly /Dust and Water Proof.
- The Engineered components/ System in the Vehicle will be evaluated.

8.4 Design Review 4 (DR4): 400 Points**Criteria**

- Design log of all activities from start to end shall be documented.
- Presentation PPT with videos / pictures to highlight vehicle Spec / features / USP / Potential market / business Scope
- Demo: Conformance of EBOM, Fabrication quality (endurance worthy), fit & finish, weight and dimension and all the dynamic events shall be performed at the final event.

8.5 Special Note:

- Team should submit 'Master layout' of the Electric Two Wheeler in 3D or 2D showing complete architecture drawn or modelled to full scale but printed to desired scale.
- All key dimensions to be indicated for evaluation purpose.
- All part drawings to be submitted 1:5 scale.
- It is recommended that all components are fabricated/machined/ procured are strictly as per drawing and to be brought into the campus/ college after proper metrological/material inspection and report.
- Assembly to be carried out in-house with necessary confidentiality.
- All drawings submitted to SAE screening committee shall be strictly maintained confidential.

9. POINTS CRITERIA

Electronic Report – General instructions.

All reports must have a title page that contains team ID, team name, Institute name, team captain and faculty advisor's names with signatures. All reports should be in PDF format with commenting privileges enabled. The Design Report is limited to a maximum of 25 (8 ½" by 11") pages (minimum font = 10 pt and recommend double spaced). All of these documents combined shall not exceed 15 MB.

All submitted materials must include only printable information. No links to external sites, videos, etc. shall be included. A good rule of thumb is that any material that would not function should be excluded.

9.1 Master layout and Design Report – Total 75 points:

- Layout of the whole vehicle drawn to scale.
- Strictly CAD drawings or Equivalent, 3 views (front, side and top) in NX CAD
- Location of all aggregates to be clearly dimensioned in phantom projection
- Pictures of any CAD model will not be considered.

9.2 Critical Dimension calculations and Powertrain Simulations (25 points)

- Chassis frame tube / beam size.
- Fork details.
- Powertrain Calculation for Motor & Battery Selection
- Simulation Report

9.3 CAE Reports (25 points)

- Stress and deflection plots for frame, fork, Suspension Members, Battery and Motor Mounting.

9.4 Parts drawings after CAE (20 points)

- All designed and fabricated parts should have a drawing with a unique part no with college name in title block. Sample drawings format may be made available if required.

9.5 E BOM to be arranged in the following part groups. (20 points) :

S.No	Part groups	Remarks
1.	Fork/Steering Assembly	
2.	Frame	
3.	Brake assembly	
4.	Transmission system	
5.	Front wheel assembly	
6.	Rear wheel assembly	
7.	Stand / Seat / lighting if any	
8.	Electrical system including harness.	
9.	Throttle controller	
10.	Traction Battery with specs	
11.	Traction Motor with specs	

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9.6 o Cost estimation as per E BOM (25 points)

- E BOM cost estimated based on the E BOM structure by adding quantity weight etc., for every part / assembly.
- The intention is to give the team experience in preparing an engineering cost analysis for the proposed design.
- Cost break down should be in to
 - Design and Development cost.
 - E BOM cost.
- The Design and development cost represents the expense necessary to convert an idea to a product that is ready for manufacture. The range is 3% to 6% of the manufacturing variable cost. The E BOM cost not exceeds 60 % of on-road price of the Electric Two Wheeler. However ex-factory price of the Electric Two Wheeler can be taken as 85 % of the on-road price. The format of the worksheets shown in Appendix may be used as reference.
- The Commercial sales brochure (max 4 pages) shall be attached
- The manufactured cost of the Electric Two Wheeler will be composed of the following specifications:
 - All costs are to be given in INR.
 - All purchased spare parts shall be estimated at 40 percent of retail cost (0.40 * retail/Spare price).
 - All raw materials are to be considered wholesale. If only retail prices for raw material are available then the wholesale price of 70 percent of retail may be used (0.70 * retail price).
 - The Cost Reporting Sheet is as per E BOM of the proposed vehicle. Reference sample enclosed.

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9.7 Manufacturing drawings (45 points)

The manufacturing drawings would be evaluated for completeness in all aspects to be submitted for prototype and mass production. More the details of each parts / assembly would be rewarded accordingly.

9.8 Inspection reports parts and Design Log(45 points)

All critical dimension / material spec should be inline with the part drawings as in section 9-division 5. The self-inspection report must be submitted for Design Review.

The interim design log should be submitted for evaluation. For the guideline about Design log, Refer Item 15.

9.9 Design to Product Comparison (25 points)

The vehicle will be evaluated for the deviation in the design submitted by the respective team during the Design Review.

The team with the minimal deviation will receive the highest marks.

9.10 Aesthetics (color / shape / texture, etc.,) (45 points)

The competition is to encourage designing and developing beautiful and most appealing Electric Two Wheeler. The choice of good color shape / texture and any features that add to the aesthetics of the Electric Two Wheeler would have the maximum points.

9.11 Weight of the Electric Two Wheeler (85 points)

The competition is to encourage designing and developing a light weight Electric Two-Wheeler to carry 1 Indian. The lightest Electric Two Wheeler that undergoes all the intended function would have the highest points by using the below formula.

$$\text{Weight test points} = \left(\left(\frac{(M_{\max} - M_{\text{actual}})}{(M_{\max} - M_{\min})} \right) \times 70 \right) + 15$$

Where,

M_{\max} = Mass of the heaviest Electric Two Wheeler in the competition

M_{\min} = Mass of the lightest Electric Two Wheeler in the competition

M_{actual} = Mass of the evaluated Electric Two Wheeler.

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9.12 Inspection – Build Quality (45 points)

Build quality will be inspected during spot inspection and per event.

9.13 Innovation (50 points)

This section carry's the maximum marks. Innovation in frame, handle bar, suspension, Electric circuitry and wheel may have good weightage for the design. Choice of material, manufacturing process, Layout or any other USP may be rewarded accordingly.

9.14 Engineered Components/System (50 Marks)

- This section evaluates the component / system engineered by the team.
- One of the objectives for this competition is to encourage the participants to Engineer and develop the vehicle and not to assemble the Vehicle with the bought components.
- The Team who have built the Vehicle with most Engineered Components/System will receive points the highest points.

9.15 Serviceability / Disassembly (20 points)

- This section evaluates the ease of disassembly. The use of standard tools is mandatory for the demo test.
- Teams will receive points using the following calculation. Scope will include Battery, Motor and accessories

$$\text{Serviceability disassembly points} = \left(\left(\frac{(T_{slow} - T_{actual})}{(T_{slow} - T_{fast})} \right) \times 15 \right) + 5$$

Where,

T_{actual} = Actual time taken by the evaluated team to disassemble the vehicle

T_{slow} = Time taken by the Slowest Team Time (Full time if some teams don't complete course)

T_{fast} = Time taken by the Fastest Team Time

9.16 Design Log (25 points)

Teams must submit a Design Log that documents the design concept formation, development process & team activities during the course of development. All reports should be in PDF format with commenting privileges enabled. The number of pages is limited to 25

(8 ½" by 11") pages and pages must be numbered. The Design Log should be submitted along with the report.

Items to consider including in this log include concept generation notes (whether on graph paper, or other medium), brainstorming notes, calculations, team notes from meetings, emails, etc. Anything and everything used to develop the Electric Two Wheeler can be put into the design log.

9.17 Presentation (50 points)

Presentation can have PPT with videos / pictures to highlights vehicle Specs / features / innovation if any /USP/ Potential market / business Scope. Team Organization / planning – work division with group members

Max 10 slides. Slide should have readable fonts / pictures from a distance.

9.18 Question and Answer (25 points)

The evaluators shall ask the Questions which shall focus on, but not limited to the design log, Presentation, the components used in the vehicle.

9.19 Brake Test (40 points)

The stopping distance for the given speed of the Electric Two Wheeler would be recorded and vehicle with shortest distance would be ranked as best for its brake. There would be at least 2 speeds that the Electric Two Wheeler would be tested. Brake Test ratio is calculated by using the following formulae

$$\text{Brakes Test Ratio} = \left(\frac{V_{\text{entry}}^2}{(D_{\text{stop}})} \right)$$

Where,

V_{entry} = velocity at the entry point

D_{stop} = Stopping distance travelled by the vehicle

Teams will receive points using the following calculation:

$$\text{Brake points} = \left(\left(\frac{B_{\text{low}} - B_{\text{actual}}}{B_{\text{low}} - B_{\text{high}}} \right) \times 25 \right) + 15$$

Where,

B_{actual} = Actual Brake Test Ratio achieved by the Team.

B_{low} = Lowest Brake Test Ratio (Full time if some teams don't complete course)

B_{high} = Highest Brake Test Ratio

Note: It is expected to have the wheels lock when the brake is applied. It is mandatory to complete the Brake Test to be eligible to participate in the Dynamic tests.

9.20 Maneuverability Test (75 points)

It is expected to design the Vehicle with stable Weight Balancing. There will be a Maneuverability curved Track. The Maneuverability track will be decided by the organizer. Rider is supposed to clear the Track for the fixed number of rounds (3 rounds, Subject to change) without going out of the track. The time taken for covering the above-mentioned rounds will be noted by the technical evaluator.

The Maneuverability points will be calculated as below:

$$\text{Maneuverability points} = \left(\frac{M_{slow} - M_{actual}}{M_{slow} - M_{fast}} \right) \times 60 + 15$$

Where,

M_{actual} = Actual Time taken for completing the Maneuverability Test.

M_{slow} = Maximum time taken by the team to complete the Maneuverability test

M_{fast} = Minimum time taken by the team to complete the Maneuverability test

9.21 Range Test (75 points)

The objective is to develop the vehicle with high efficiency to save energy. The Rider is supposed to cover the distance as indicated by the organizer. Driver can be changed in-between at the designated locations. Range will be estimated based on the energy consumption. The teams with lowest energy consumption will receive the highest mark using the following calculation:

$$\text{Range points} = \left(\frac{R_{highest} - R_{actual}}{R_{highest} - R_{lowest}} \right) \times 60 + 15$$

Where,

R_{actual} = Energy consumed by the vehicle under evaluation for the designated distance

$R_{highest}$ = Highest Energy consumed for covering the designated distance

R_{lowest} = Lowest Energy consumed for covering the designated distance

9.22 Acceleration Test (35 points)

A Straight Track of 500m will be designated by the organizer for this test. Time taken to cover the distance and the maximum velocity will be noted to calculate the acceleration. Teams will receive points using the following calculation:

$$\text{Acceleration points} = \left(\left(\frac{A_{\text{actual}} - A_{\text{slow}}}{A_{\text{slow}} - A_{\text{fast}}} \right) \times 20 \right) + 15$$

Where,

A_{actual} = Acceleration clocked by the Team.

A_{slow} = Lowest Team Acceleration (Full time if some teams don't complete course)

A_{fast} = Highest Team Acceleration

9.23 Gradeability Test (30 points)

There rider is supposed to climb a Grade in the test. The time taken to complete the grade track will be noted.

Teams will receive points using the following calculation=

$$\text{Gradeability test points} = \left(\left(\frac{G_{\text{slow}} - G_{\text{actual}}}{G_{\text{slow}} - G_{\text{fast}}} \right) \times 15 \right) + 15$$

Where,

G_{actual} = Actual time taken to complete the Grade test

G_{slow} = Longest time taken to complete the Grade test

G_{fast} = Least time taken to complete the Grade test

9.24 Bump Test (45 points)

In this test the riding comfort, the suspensions will be evaluated. It consists of two parallel tracks. The track consists of specified number of bumps (~24 Bumps) placed at in-between distances of 1 meter in 1st track & 1.4 meters in 2nd track. The rider must ride through both the tracks on the bumps. During this test if any component/parts drop from the vehicle or if the driver goes out of the track, the same will be noted and penalty will be included to the Bump Test point calculation.

The time taken to cover the bump test will be noted and the teams will receive points

$$\text{Bump test points} = \left(\left(\frac{BT_{\text{slow}} - BT_{\text{actual}}}{BT_{\text{slow}} - BT_{\text{fast}}} \right) \times 30 \right) + 15$$

Where,

BT_{actual} = Actual time taken to complete the Bump test

BT_{slow} = Longest time taken to complete the Bump test

BT_{fast} = Least time taken to complete the Bump test

10 ANNEXURE

Mandatory Kit

Vehicle safety

Note: Driver

At the Final
and Institutions

A Overall height	Should not exceed 1200 mm
B Handle bar height	Minimum 900 mm
C Seat height	Minimum 55 mm
D Wheel base	1150 mm to 1350 mm
E Overall length	Should not exceed 1800 mm
F Overall width	Should not exceed 750 mm
G Ground clearance	Minimum 150 mm

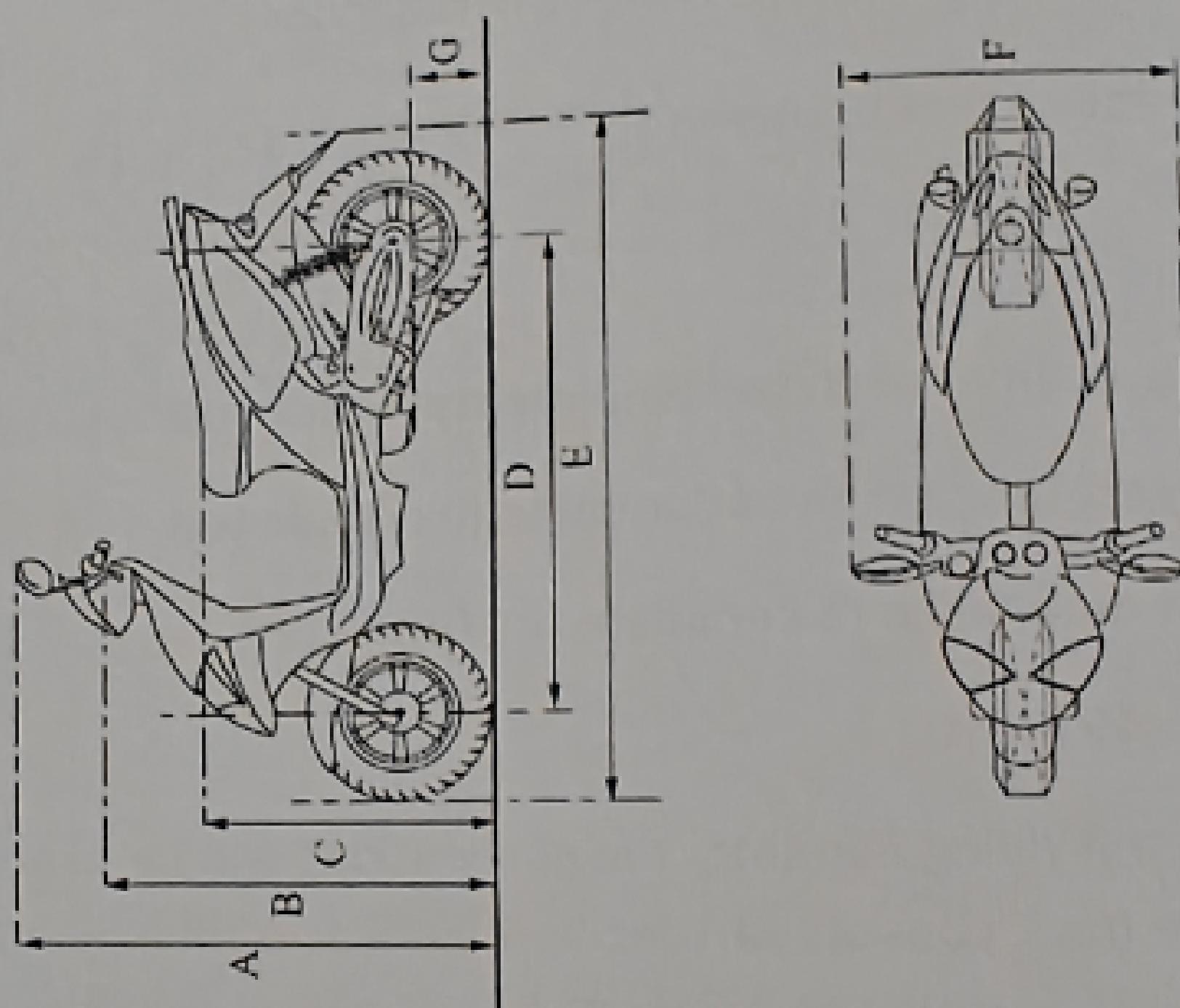


Fig.1 Sample Layout

Dwg No	Part No	Part Description	Quantity	Cost	Remark

Table 1: Representative costing work sheet

Mandatory Kit for Driver safety:

- Helmets (ISI Rated), Gloves, Knee Guard, Elbow Guard, Shoes and Socks (Fire Resistant material Preferred)
- Protective Clothing - Drivers shall wear shirts and long pants made of natural materials such as cotton, denim, etc. Drivers may also wear fire resistant shirts and pants having an SFI, FIA, NFPA 2112, or other fire-resistant rating

Vehicle safety:

- All team should have 1 kg fire extinguisher (ABC type)

Note: Driver safety kit and fire extinguisher are mandatory at the Final event.

At the Final Event, it should be ensured to have the Vehicle number, Team name and Institution name be visible in the vehicle.

Details of Revisions in the Rule Book

Revision	Date	Description
1	02-02-2023	<ul style="list-style-type: none"> Battery Capacity has been defined as 24Ah. DR3 & DR4 will be conducted at the final event. Update to Inspection report submission The description for the Maneuverability Test, Range Test, Acceleration Test, Bump Test was updated. Formulae for the Dynamic events were updated.
2	29-10-2023	<ul style="list-style-type: none"> Tyre Width is updated (Section 7.1.6) The Battery Output should be connected to the load through a Connector (Section 7.3.1) The Reward Points is updated with new category. The Design to Product Comparison, Engineered Components/System is introduced (Section 8)
3	05-08-2025	<ul style="list-style-type: none"> Added reference to CMVR Rule: 96, IS:14664 to align braking system requirements with regulatory standards Added clarification prohibiting use of silk wires in high-voltage circuits and recommended copper wires with automotive-grade insulation

Note: The revision history table is for reference only. The participants should review the complete rulebook to be aware of all the rules and guidelines for this competition.

Any update to this document shall be made available during the course of the competition. Teams may have to get in touch with SAEISS for any clarification / any incomplete information / interpretation of the contents of the document.

For any clarification about the rules or for any support please reach out to us at:
etwdc@saeiss.org