



PRELIMINARY ROUND GUIDELINES PART - 2

aBAJA

Phase 1 - Preliminary Round

Event	Description	Points
Phase I : Preliminary Round	Presentation Round	40
	Online Quiz	10
Total Points		50

- Teams must prepare for the following sub-events:
1. **Presentation Round:** A maximum of 40 mins will be allotted per team to present their models which includes,
 - Presentation by the team to showcase the Autonomous/ADAS software stack design: **20 mins**
 - Questions put up by the panel to be answered by the team: **20 mins**
 2. **Quiz Round:** The Quiz will consist of questions from General Engineering/ Automotive Engineering and Autonomous Vehicle Technology

1. Presentation Round Guidelines:

- Kindly go through the [Slide Sequence](#) mentioned below for detailed information on evaluation parameters/topics, respective slide sequences, and score weightage. The team's presentation should be in line with the topics mentioned and not exceed the maximum number of slides indicated.
- Slide Nos. must be mentioned as per the order defined in the Slide Sequence
- No slide transitions/animations are allowed.
- The score obtained by the respective team will be scaled down to 40 points.
- Teams must use Font Style 'Calibri' and Font Size '14 or above'
- For problem statement, assumptions and individual dynamic scenarios refer to Part 1 of preliminary round guidelines released on [BAJA SAEINDIA Forum](#)

1.1 Slide Sequence

Slide No.	Title	Points
1	Team ID and College Name	NIL
2	Vehicle Hardware Architecture	5
3 & 4	Autonomous Vehicle Software Architecture / Stack	15
5 & 6	Autonomous Emergency Braking – Software	10
7 & 8	Adaptive Cruise Control - Software	10
9 & 10	Lane Keep Assist - Software	10
11 & 12	Path Following - Software	10
13 & 14	Traffic Light/Sign detection - Software	10
15	Failure analysis and mitigation	10
16 & 17	Software Development Plan	15
18	Team composition with work allocation and facilities	5
Max Slides = 18	Overall Marks	100

The following points have been sketched out to assist teams in their preparation for the Preliminary Round presentation. Teams are encouraged, but not limited to, include the below mentioned points under each title/slide:

Slide 1: Team ID and College Name

- Team ID, Team name, College name
- Returning Team or New Team of aBAJA SAEINDIA 2025

Slide 2: Vehicle Hardware Architecture

- Interaction between Central control unit with Drive-by-wire systems, sensors and any other components utilized by the team
- System Block diagram showcasing components used and their interface, e.g., central control unit, sensors, DBW, etc.
- Communication protocols and choice of communication frequency between various hardware in the architecture and justification

Slide 3 & 4: Autonomous Vehicle Software Architecture / Stack

- Full Software Architecture block diagram showcasing the various software components (Sensor data processing, Perception, Sensor fusion, Localization, Planning, Longitudinal Control, Lateral Control, etc.) considering a single software is used for all the dynamic events and flashed in the Central control unit
- Detail the interface between the individual software components/blocks within the architecture

Slide 5 & 6: Autonomous Emergency Braking – Software

- Feature requirements and performance targets
- Explanation of feature specific control and how the proposed software architecture is adapted for feature specific use case
- Different dynamic test scenarios considered and justification on how the proposed software will work for all the different dynamic test scenarios

Slide 7 & 8: Adaptive Cruise Control – Software

- Feature requirements and performance targets
- Explanation of feature specific control and how the proposed software architecture is adapted for feature specific use case
- Different dynamic test scenarios considered and justification on how the proposed software will work for all the different dynamic test scenarios

Slide 9 & 10: Lane Keep Assist – Software

- Feature requirements and performance targets
- Explanation of feature specific control and how the proposed software architecture is adapted for feature specific use case
- Different dynamic test scenarios considered and justification on how the proposed software will work for all the different dynamic test scenarios

Slide 11 & 12: Path Following – Software

- Feature requirements and performance targets

- Is the software a combination of what is done in Adaptive cruise control and Lane keep assist?
 - If yes, then explain the strategy used to make Adaptive cruise control and Lane keep assist work together for solving path following.
 - If not, justify on why the proposed alternative software for path following is better than using adaptive cruise control and lane keep assist combined.
- Explanation of feature specific control and how the proposed software architecture is adapted for feature specific use case
- Different dynamic test scenarios considered and justification on how the proposed software will work for all the different dynamic test scenarios

Slide 13 & 14: Traffic Light/Sign Detection – Software

- Feature requirements and performance targets
- Explanation of feature specific control and how the proposed software architecture is adapted for feature specific use case
- Different dynamic test scenarios considered and justification on how the proposed software will work for all the different dynamic test scenarios

Slide 15: Failure analysis and mitigation

- Communication safety checks
- Fail safe mechanisms when individual blocks fail within the software architecture
- Prevention of unintended steering, acceleration and deceleration
- Restricting vehicle speed to certain limits
- Bringing the vehicle to stand still in case of any risk anticipated by autonomous operator
- Self-killing of the powertrain in certain situations –
Examples:
 - In case of vehicle roll-over/vehicle leaving track limits
 - Any malfunction in the central computing unit
 - Failure of any crucial sensing module
 - If geo-fence is breached (Optional)
- Failure troubleshooting and debugging strategy

Slide 16 & 17: Software Development Plan

- Complete project plan from vehicle modification, hardware integration, software development, validations, etc.
- Software development strategies, e.g., usages of third-party library like Yolo, development tools/software, design tools, etc.
- Verification & Validation strategy, including test cases, test execution preparation, which part of V-cycle would be utilized. Also showcasing understanding of V – Cycle and how it is adapted for aBAJA use case
- Target milestones
- Standard template for V-cycle can be found here - <https://bit.ly/ReferenceV-CycleTemplate>. The template provided are for reference purpose. Teams can modify it as necessary

Slide 18: Team composition with work allocation and facilities

- Team hierarchy (detailed structure with captain, vice-captain, safety - drivers, other members, and Faculty Advisors)
- Team split up based on different engineering departments (Mechanical, CSE, IT, EEE, ECE, etc), also mention at which stage of project, which department would have critical role (thus needing more members)
- Involvement of college facilities / mentors at various stages of project like software development, testing and validation for individual features
- Work allocation among team members considering the various activities involved in the software development, verification and validation process
- Software/s planned to be used for development, testing and validation

1.2 SOP – Virtual Presentation Round

Step-by-Step Guide for presentation process:

Step 1: Check your registered Email ID for the meeting invite link. Participants are required to join the meeting through **laptop/pc mandatorily**.

Step 2: Before clicking on to the meeting link, team members need to change their name format as follows:

- Name Format: **Last Four Digit of Team ID_First Name** (ex. 41001_XYZ)

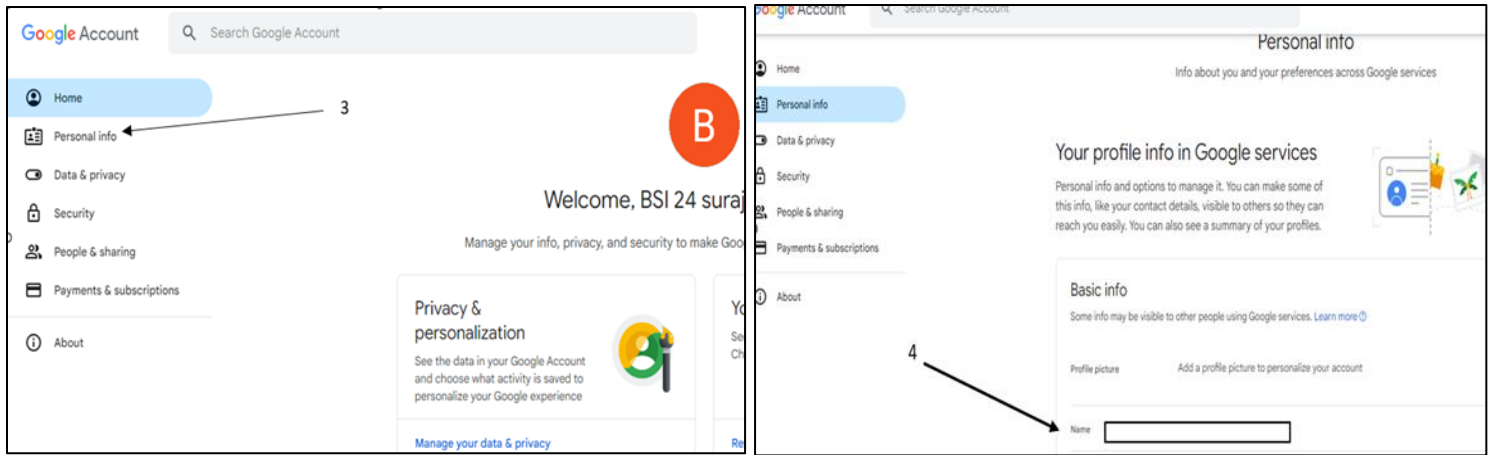
Note: If one does not follow the above prescribed format, the member will not be admitted into the meeting.

Step 3: To change name format, follow given steps below,

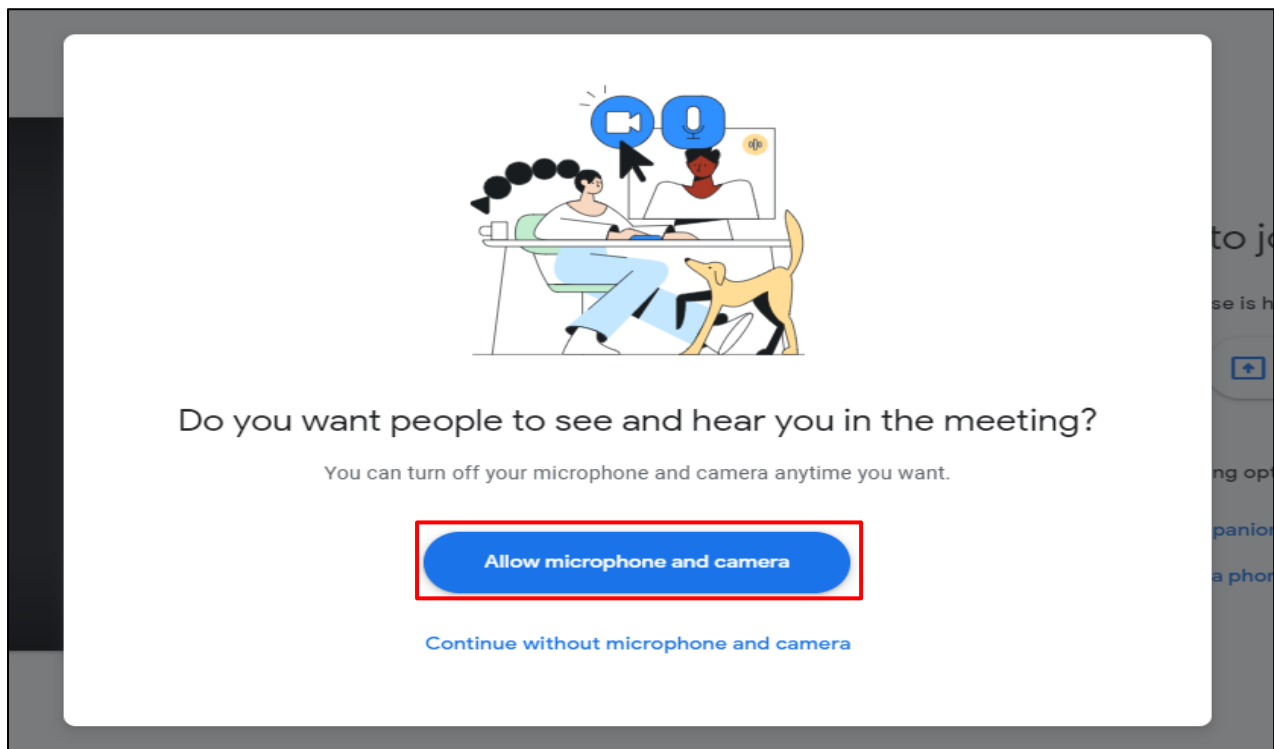
- On browser home page, select to the top left **“Profile” (1)**. Then click to the **“Manage your Google Account” (2)**.



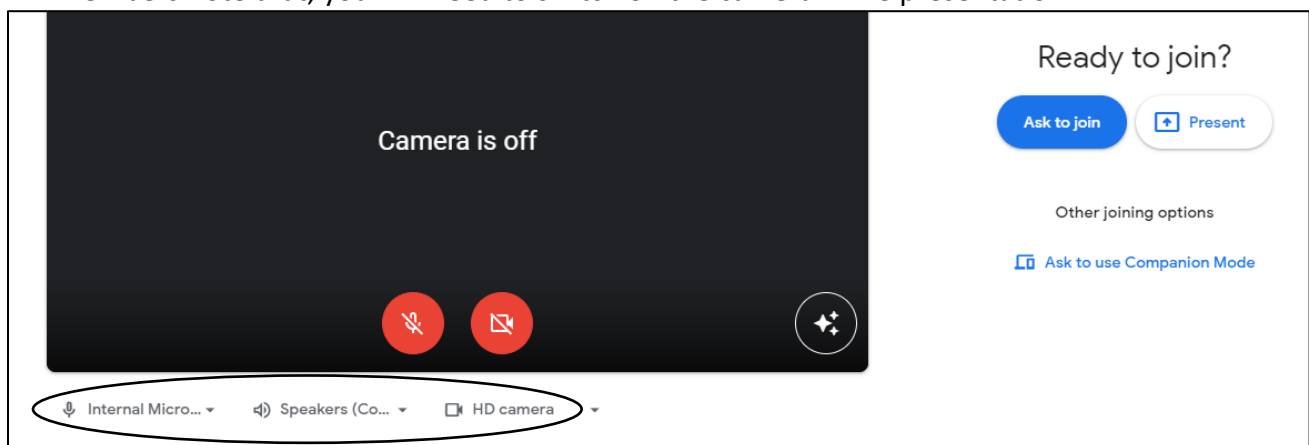
- On new window, click on **“Personal Info” (3)**. In Basic Info Section, one can change the name format **(4)**.



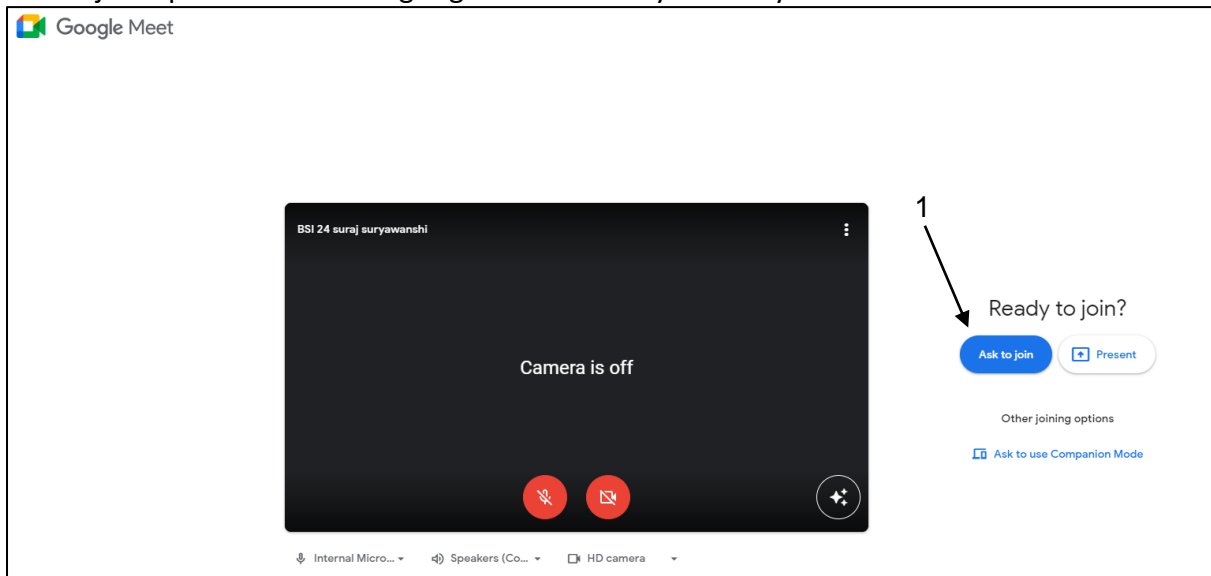
Step 4: After changing name format (Name Format: **Last Four Digit of Team ID_First Name**) members can now click on to Google Meeting Link. This will re-direct members to the **permission of camera and microphone** webpage. You'll need to allow camera and microphone access to google meet.



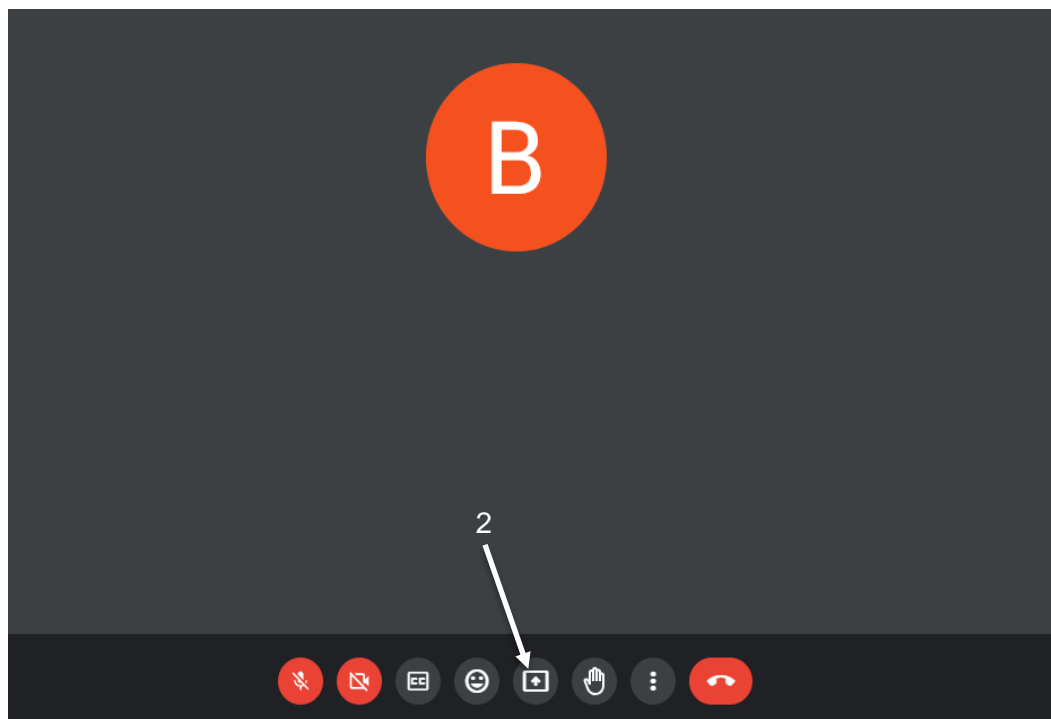
Step 5: Select Appropriate Microphone, Speaker and Camera devices from drop down. Members note that, you will need to switch on the camera while presentation.



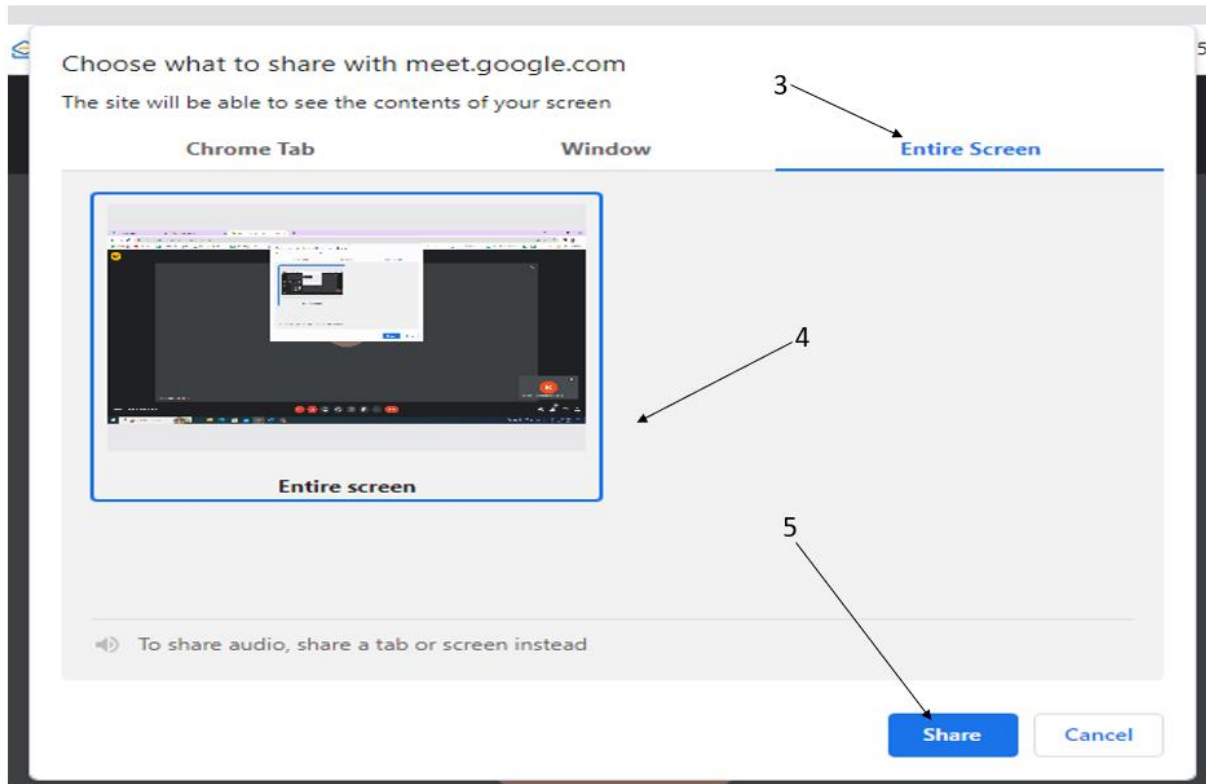
Step 6: After approving permissions, you will see “Ready to Join” (1) page. Please click on Ask to join option. The meeting organizers will let you in at your schedule time



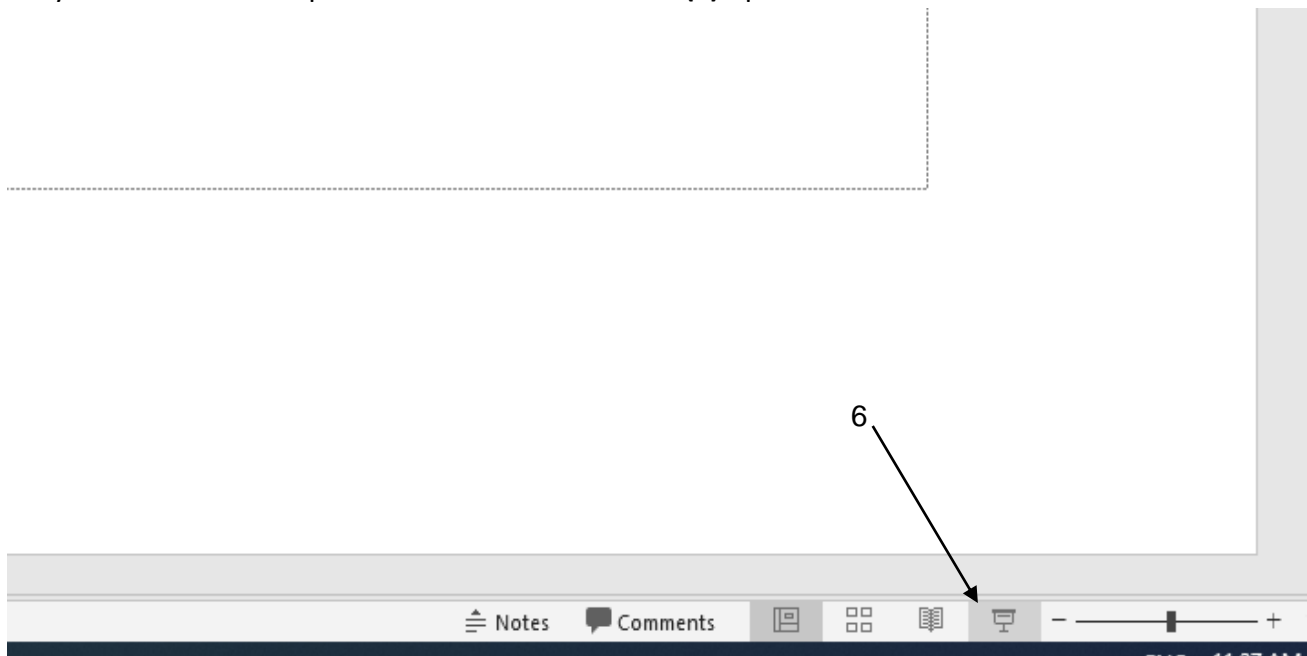
Step 7: While in a meeting, to share your presentation, click to the **Present Now (2)** option.



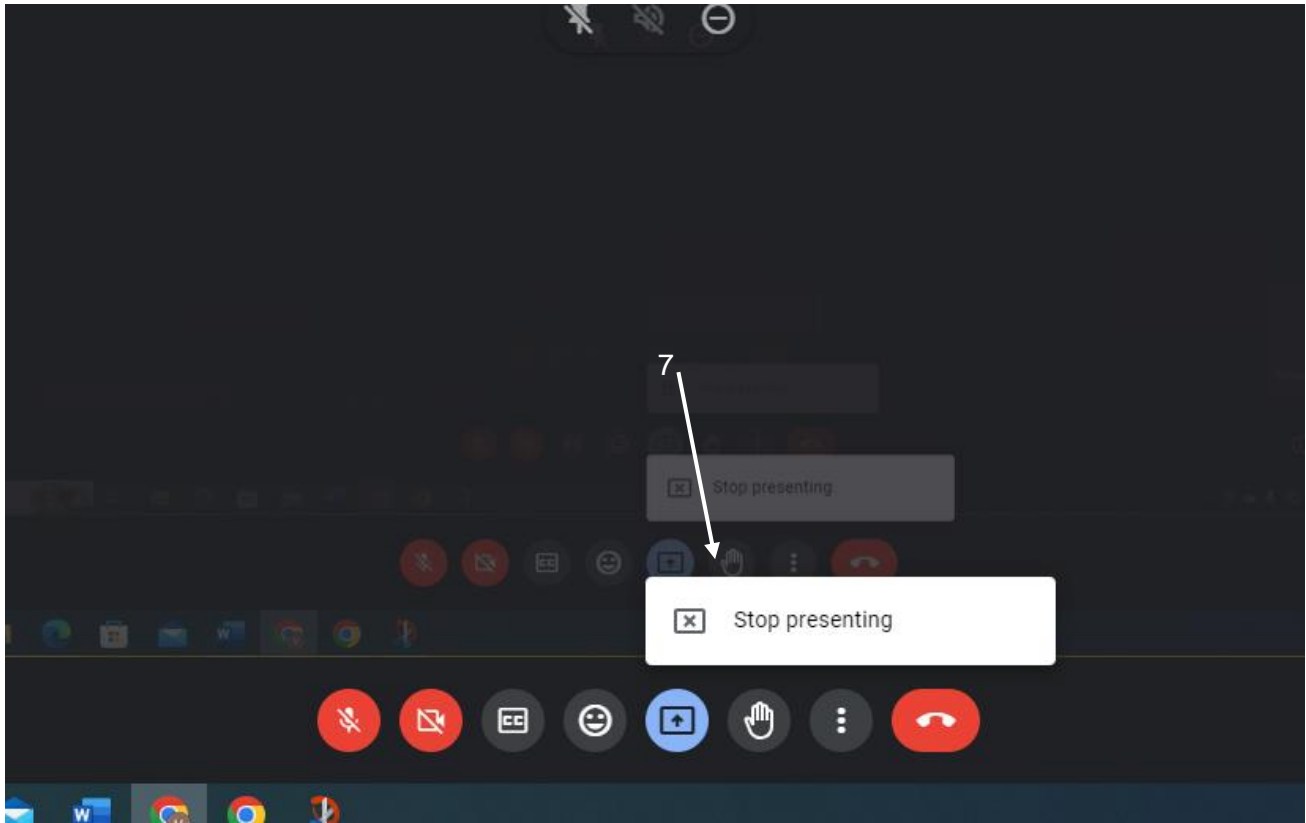
Step 7: You can see pop-up, go to **Entire Screen (3)** and then click on the screen showing (4) in the pop-up. And lastly click on **Share (5)**



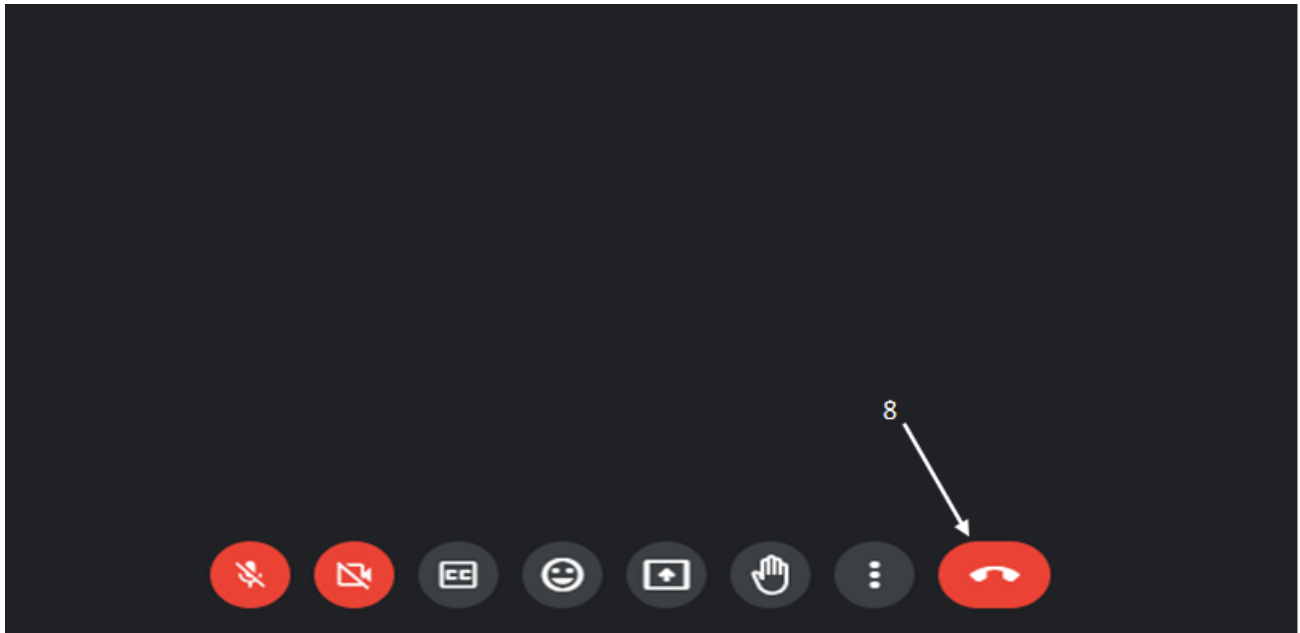
Step 8: Once screen started to present, you can go to the MS PowerPoint Window having your Presentation open. Click on the **Slide Show (6)** option



Step 9: After presentation, to stop sharing the screen come back to the google meet browser window. Click on **Stop Presenting (7)**



Step 10: After your allotted meeting time is finished, all the team members will have to leave the meeting by clicking the **Leave (8)** Option.



*** Note - no special considerations shall be given to any teams for time extension and team members should strictly adhere to the time constraints.**

2. Online Quiz Guidelines:

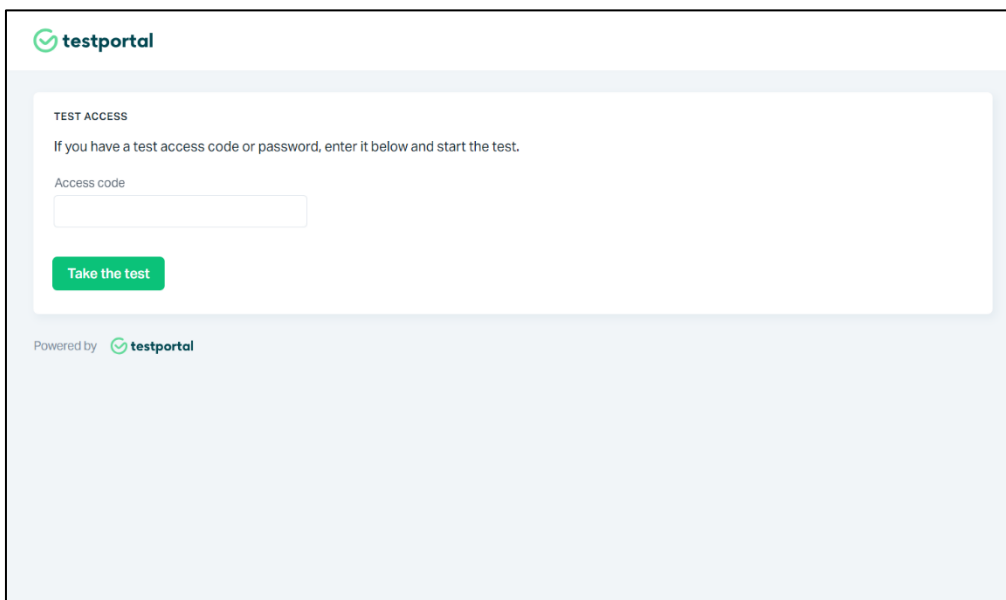
- In addition to the presentation, a General Engineering / Automotive Engineering / ADAS & Autonomous Vehicles basic knowledge test will be conducted during the Preliminary Round of the aBAJA SAEINDIA 2025 event for all the teams.
- The test will be conducted online on **25th January 2025, 7:30 PM IST**. A maximum of 30 minutes will be allotted per team for the test.
- The test will contain questions on General Engineering / Automotive Engineering / ADAS & Autonomous Vehicles with no negative marks for wrong answers.
- Scores obtained by the respective team will be scaled down to 10 marks.

2.1 SOP – Online Quiz

Quiz Event Format:

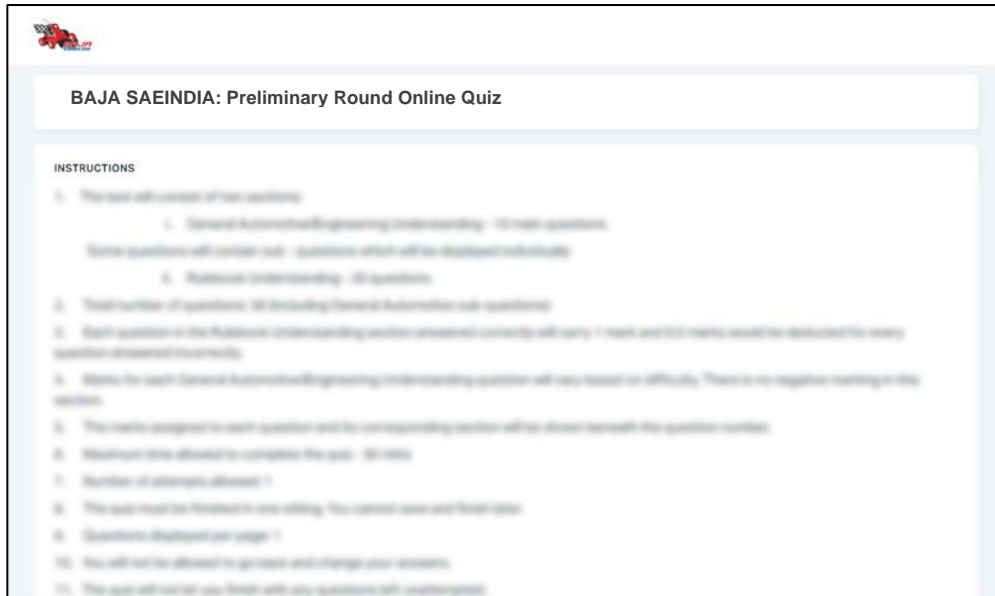
- The **time slot** and **quiz link** will be shared with the teams via mail along with the **access code**. Once the link is clicked, the below page will appear. Enter your access code to proceed.

***Note:** A reliable and uninterrupted internet connection is essential to successfully attempt all sections and complete the quiz.



The screenshot shows the 'testportal' interface. At the top, there is a green checkmark icon and the text 'testportal'. Below this, a white box contains the text 'TEST ACCESS' and 'If you have a test access code or password, enter it below and start the test.' There is an input field labeled 'Access code' and a green button labeled 'Take the test'. At the bottom of the white box, it says 'Powered by testportal' with a green checkmark icon.

- Teams are advised to thoroughly read the instructions.



BAJA SAEINDIA: Preliminary Round Online Quiz

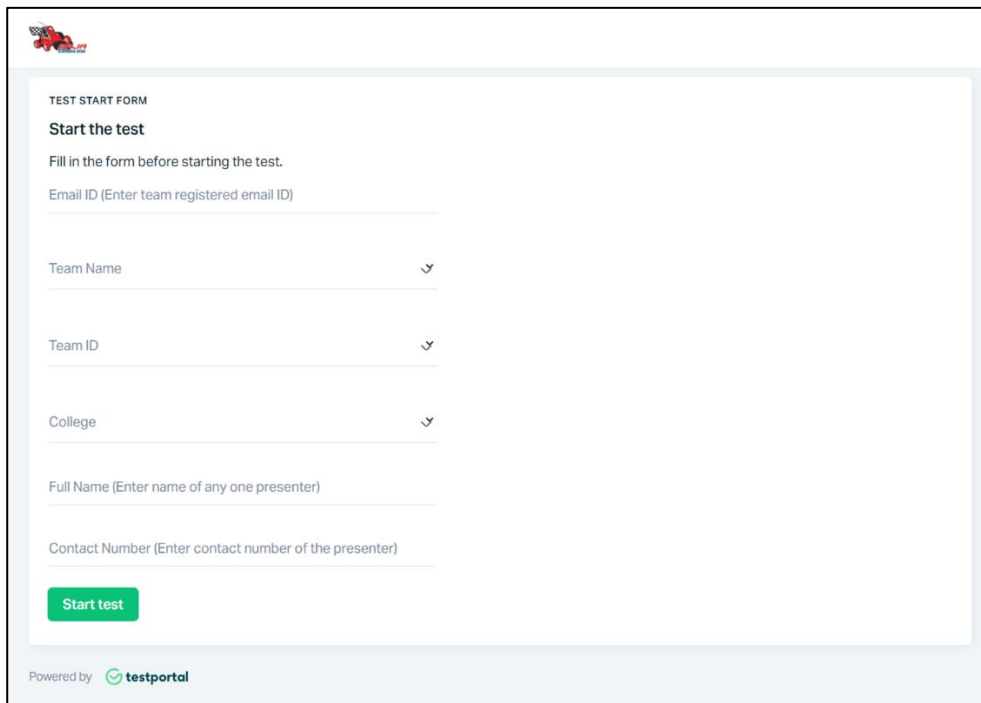
INSTRUCTIONS

- The test will consist of two sections:
 - General Automotive/Engineering Understanding - 10 mark questions
 - Robotics Understanding - 20 questionsSome questions will contain sub-questions which will be displayed individually.
- Total number of questions: 30 including General Automotive sub-questions
- Each question in the Robotics Understanding section answered correctly will carry 1 mark and 0.5 marks would be deducted for every question answered incorrectly.
- Marks for each General Automotive/Engineering Understanding question will vary based on difficulty. There is no negative marking in this section.
- The marks assigned to each question and its corresponding section will be shown beneath the question number.
- Maximum time allowed to complete the quiz - 30 mins.
- Number of attempts allowed: 1
- The quiz must be finished in one sitting. You cannot save and finish later.
- Questions displayed per page: 1
- You will not be allowed to go back and change your answers.
- The quiz will mark you finish with any questions left unanswered.

- Upon proceeding, teams are required to enter their details.

***Note:** Only one entry per team is allowed and it should be amongst the 5 registered members for the presentation.

- The timer will start once the 'Start test' button is clicked.



TEST START FORM

Start the test

Fill in the form before starting the test.

Email ID (Enter team registered email ID)

Team Name


Team ID

College

Full Name (Enter name of any one presenter)

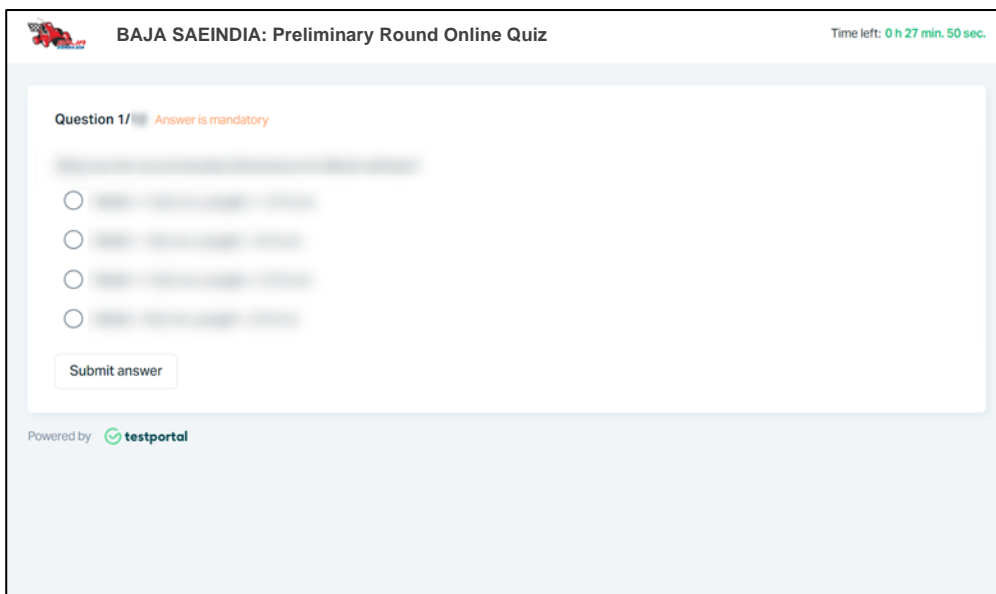
Contact Number (Enter contact number of the presenter)

Start test

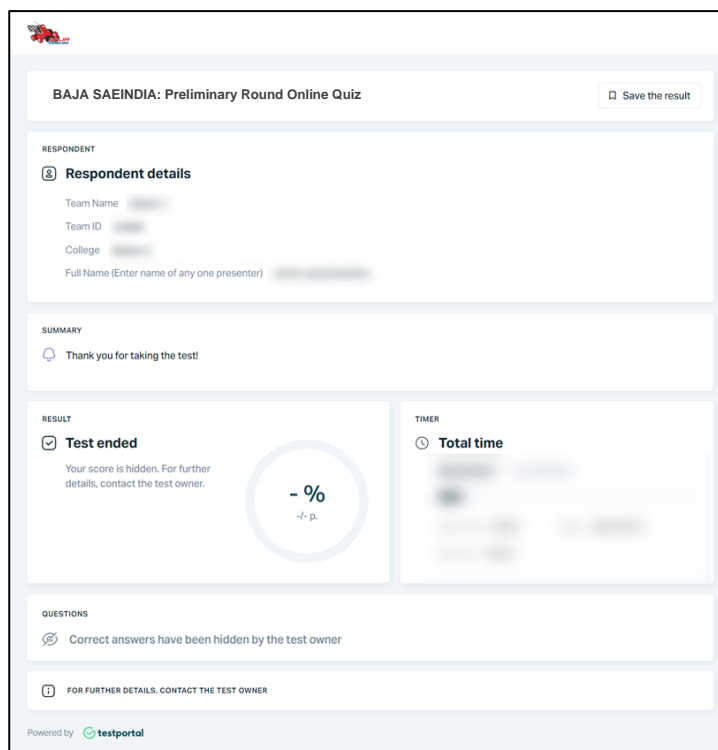
Powered by  testportal

- Teams can answer questions one at a time, once answered click on the 'Submit answer' button to proceed to the next question. The time left for the total quiz will be displayed on the top.

***Note:** Teams can't go back to the previous questions once answered.



- Upon submission of the final answer, the summary of the quiz session will be displayed after successful completion.



Points to remember:

- The quiz link will be accessible only in the allotted time range.
- In the event of connection failure during the quiz, students should use the same browser from the same device to reload and continue.
***Note:** The timer will automatically pause and will resume once the link is reloaded.
- Only one submission per team will be accepted.
- Read the instructions thoroughly before attempting the quiz.

3. Reference Training Videos

Sr.No.	Topic	Description	Video Link
A			
ADAS Autonomous Vehicle			
1	Overview of ADAS and Autonomous Driving and SAE levels of AD.	History and background of ADAS, evolution of Automated Driving and their linkage	https://bit.ly/Overview_of_ADAS_Functionalities
2	SAE level for AD	Explanation of various SAE levels and expected autonomy	https://bit.ly/SAE_Levels_of_AD (From 00:00:00 - 00:15:34)
3	Overview of ADAS Functionalities	Overview of ADAS functionalities (EBA, ACC, LCF, etc.) and sensors involved in realizing those functions	https://bit.ly/ADAS_Function_Overview
B			
Sensing & Perception			
1	Introduction to different sensing systems	Overview of different sensors and their use cases, concept of multiple sensor integration depending upon application needs	https://bit.ly/Intro_to_diff_sensing_systems (From 00:15:35 - 00:55:31)
2	RADAR	Basic concepts of Radar like FMCW, dopplers, azimuth estimations, range, radar cube, etc. Overview of long range and short-range radar, applications, pros and cons	https://bit.ly/Radar_sensor
3	Camera	Principles of Camera functioning, FOVs, types of cameras like mono, stereo, etc., applications, pros and cons	https://bit.ly/Camera_sensor
4	IMU & GPS	Concepts of IMU, various axis data sensed, working principle and basic concepts	https://bit.ly/IMU_and_GPS
5	Concepts of fusion - 2 parts	Understand the need of fusion, types of fusion methodologies, how fusion is done (e.g., low-level, high-level fusion, Kalman Filter variants, etc.)	https://bit.ly/Concepts_of_Fusion_Part_1
			https://bit.ly/Concepts_of_Fusion_Part_2
6	Overview of AI/ML	Introduction to Machine Learning, various concepts like Neural Networks, application to ADAS.	https://bit.ly/Overview_of_AI_ML
C			
Vehicle Dynamics Control			
1	VDC controls - 3 parts	Architecture, Kalman Filter Fundamentals	https://bit.ly/VDC_Part_1
			https://bit.ly/VDC_Part_2
			https://bit.ly/VDC_Part_3

2	ESP	ABS - Fundamentals TCS- Fundamentals YSC - Fundamentals - Over Steer, Under Steer, Yaw rate determination, Cornering Physics, characteristic speed, critical speed, side slip angle, estimation of curve radius, understeer gradient determination	https://bit.ly/Vehicle_Dynamics_Controller_ESP
D	Communication Protocols		
1	Communication Protocols	Overview of CAN, LIN, Flexray and basics of ethernet in Automotive	https://bit.ly/Communication_Protocols
E	Scenario Creation		
1	Introduction to scenario creation	Basics of understanding a critical driving scenario in real world conditions, parameters to be considered for scenario re-creation	https://bit.ly/Intro_to_Scenario_creation
2	Overview of regulations and consumer group protocols	Overview of NCAPs across the globe. Overview or other major regulations, e.g., UNE C152, etc.	https://bit.ly/Overview_of_regulations_and_consumer_group_protocols
3	Overview of parameters to be monitored for scenarios	Introduction to various performance parameters like TTCs, position accuracies, sensitivity checks and data analytics, False Positive, True Negatives, etc.	https://bit.ly/Overview_of_parameters_to_be_monitored_by_scenarios
4	Introduction to data acquisition	Introduction to various data recorders, tools and equipment's and analysis tools	https://bit.ly/Intro_to_Data_Acquisition
F	Functional Safety		
1	SAEINDIA – Webinar Series	Functional safety principles and practices along with verification and validation	http://bit.ly/Fuctional_Safety_Reference_videos



4. Annexure

List of Recommended Books

- 'Konrad Reif', Automotive Mechatronics
- 'Plato Pathrose' ADAS and Automated Driving: A Practical Approach to Verification and Validation
- 'Karl Johan' & 'Richard M. Murray', Feedback Systems
- 'Azim Eskandarian', Handbook of Intelligent Vehicles
- 'H B Mitchell', Data Fusion: Concepts and Ideas
- 'Umar Zakir' & 'Abdul Hamid', Autonomous, Connected, Electric and Shared Vehicles
- 'Rajesh Rajamani', Vehicle Dynamics and Control

List of Recommended Online References

- [Computer Vision Onramp](#)
- [Machine Learning Onramp](#)
- [Image Processing Onramp](#)
- [Control Design Onramp](#)
- [Signal Processing Onramp](#)
- [Reinforcement Learning Onramp](#)
- [Deep Learning Onramp](#)
- [System Composer Onramp](#)
- [Intro to self-driving cars](#)
- [ROS 2 Documentation](#)
- [Getting Started with MATLAB and ROS](#)
- [CAN Bus - The Ultimate Guide](#)

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