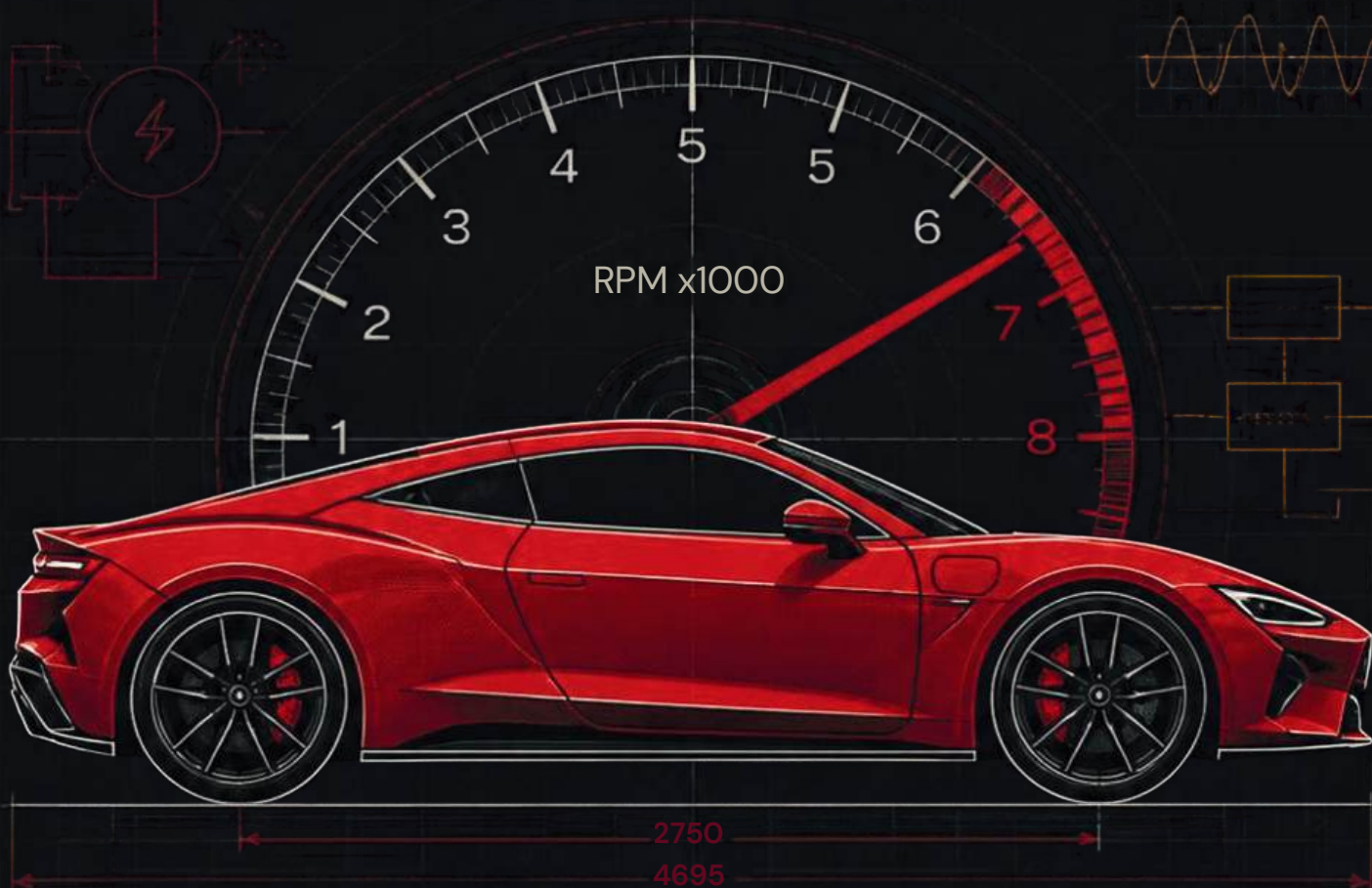


TORQUE

Where Force Meets Motion

AY 2022 - 2023

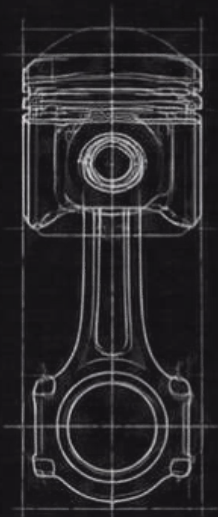


Technical Articles | Stories | Travelogues | Poems



CONTENTS

TORQUE



01	Cover	1
02	Contents	3
03	Department	3-6
04	Under the Hood	7-16
05	Tales from the Garage	17-23
06	Road Notes	24-29
07	Rev Up Your Brain	30-31
08	Glossary & Acknowledgements	32
09	Back Cover	33

Department of Automobile Engineering | Academic Year 2022-2023



ABOUT THE DEPARTMENT

Established in 2004, our Department of Automobile Engineering is not just about traditional learning. We immerse our students in the latest trends through seminars, workshops, and interactions with industry experts. With a robust UG program welcoming aspiring engineers each year, we ensure you're not just academically sound but industry-ready. Our value-added courses each semester bridge the academic-industry gap, empowering you to undertake core domain projects. Dive into hands-on experiences in our expansive 5000 sq. ft Automobile Lab, equipped for all your innovative endeavours. And it's not just about studies; our associations 'SAEIndia Collegiate club of SCMS' & 'TORQUE' offer platforms for you to organize and participate in riveting technical events. Join us, and find yourself in esteemed companies like Mahindra, JK Tyres, TVS, and Bosch after graduation.

VISION & MISSION

VISION

To be a centre of excellence in disseminating knowledge in the automobile engineering domain.

MISSION

Provide automobile related education of exceptional quality to students by inculcating a thirst for knowledge through adequate practical exposure and classroom sessions.



Message from the Head of the Department



Dr. Jenson Joseph E
Professor & HOD

Automobile engineering sits at the heart of how the world moves. It brings together curiosity, creativity, and responsibility to design systems that are faster, safer, cleaner, and more accessible for everyone.

Our department is built on the belief that strong fundamentals, disciplined practice, and open-minded inquiry create engineers who can shape this future with confidence and compassion.

I am proud of the energy and empathy our students bring to the workshop, the laboratory, and every project they undertake. Their ideas remind us that innovation is not only about technology, but also about people and purpose.

Hands-on learning is central to our approach. From the first spark in the engine laboratory to the final test on the track, we learn by doing, reflecting, and improving—together.

We also carry forward a commitment to sustainability and safety. The vehicles and mobility solutions of tomorrow must respect our planet and uplift our communities.

TORQUE, our annual magazine, captures this spirit. It is a space to share experiments and insights, celebrate achievements, and inspire new questions. My best wishes to the editorial team and all contributors.

Keep building, keep questioning, and keep striving for excellence with integrity. The road ahead is wide open.

“**The best engineers remain curious about how things move, and why.**”

Dr. Jenson Joseph E

Professor & HOD

From the Editor's Desk

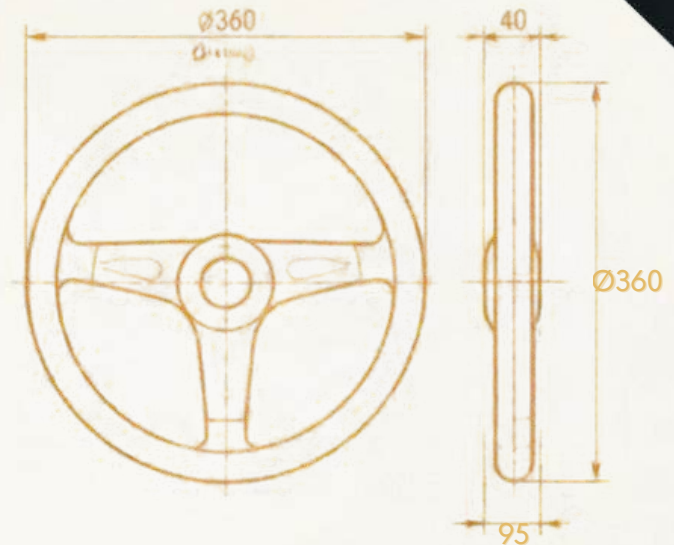
ENGINEERING BEGINS WITH QUESTIONS AND FINDS PURPOSE IN SOLUTIONS. THIS EDITION OF TORQUE CELEBRATES THAT JOURNEY—WHERE ANALYSIS MEETS IMAGINATION, AND CURIOSITY KEEPS THE ENGINE RUNNING.

Welcome to the Academic Year 2022-2023 edition of TORQUE. As another year of ideas, effort and discovery comes to a close, this magazine is our way of looking back—at the miles we've covered and the road that still stretches ahead.

Inside, you'll find a blend of technical articles that break down systems we study and solve, stories that capture moments beyond the classroom, travelogues that take you along new roads, poems that speak from quieter gears, and a quiz that challenges your engineering instincts.

Automobiles are more than machines; they are made of many parts working in harmony, just like the way our department thrives. From design labs to workshop floors, from formula tracks to classroom debates, every contribution—big or small—keeps the engine of learning alive.

We hope this issue informs, inspires and entertains you. Whether you're here for the technology, the tales, or the thrill of a good quiz, there's something in these pages for every curious mind and every passionate heart.



At its core, engineering is both analysis and imagination. We analyze to understand, and we imagine to improve. One keeps us rigorous; the other keeps us human.

To our contributors, reviewers, designers and readers—thank you. This magazine belongs to all of you.

Turn the pages, stay curious, and keep building the future.

“Every machine carries a story about the people who learn to understand it.”

Happy reading and here's to the road ahead.

The Editorial Team





THE TEAM

Faculty

Dr. Jenson Joseph E
Professor & HOD

Mr. Amal P Dev
Assistant Professor

Student Editorial Team

Mr. Shafeeq Shajahan
2019-23 Batch

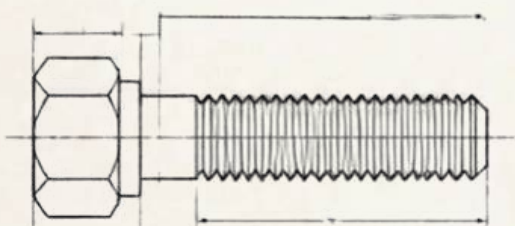
Mr. Aswin Saud
2021-25 Batch

Mr. Chris Morais
2019-23 Batch

Mr. Abhiram M S
2019-23 Batch

Mr. Melvin C Joshy
2020-24 Batch

Ms. Minnu Ajith
2019-23 Batch



2022 AT A GLANCE

3 Jan

Mercedes-Benz Vision EQXX revealed: 100 kWh research car aiming at 1,000 km range through efficiency.

11 May

Tata Nexon EV Max launched: 40.5 kWh, 437 km ARAI range.

2022

Formula 1 resets its rules: ground-effect aerodynamics, 18-inch wheels, E10 fuel.

2022

Toyota GR Corolla debuts: 300 hp turbo three-cylinder, GR-Four AWD, six-speed manual.

2022

Lucid Air reaches 520 miles EPA range.

2022

Hyundai Ioniq 6 unveiled: 800 V, Cd 0.21, up to 614 km WLTP.

2022

strong hybrids reach India: Toyota Urban Cruiser Hyryder, Maruti Suzuki Grand Vitara.

28 Sep

Tata Tiago EV launched at introductory Rs 8.49 lakh.



TECHNICAL ARTICLE 01

1,000 Kilometres on One Charge

How the Mercedes-Benz Vision EQXX showed that the smartest way to build along-range electric car is to make it need less energy, not to carry more of it.

TORQUE EDITORIAL DESK | ACADEMIC YEAR 2022–23



Ask most people how to make an electric car go farther and the answer arrives instantly: fit a bigger battery. In January 2022, Mercedes-Benz unveiled a research car that answered differently. The Vision EQXX, shown at CES, carried a battery with almost the same energy content as the one in the EQS luxury sedan, about 100 kWh, yet it was built around a radical idea: spend every engineering hour reducing how much energy the car needs to move.

Smaller, lighter, denser

The battery pack is the headline. Mercedes says it stores close to 100 kWh with 50 percent less volume and 30 percent less weight than the pack in the EQS. Engineers from the company's Formula One powertrain division helped squeeze the cells into this compact format. The pack reaches an energy density of almost 400 Wh per litre and operates at more than 900 volts, which, as another article in this issue explains, lets a car move large amounts of power through thinner, lighter wiring.

The complete car weighs about 1,750 kg (roughly 3,858 lb) and is as unreachably low as a Formula 1 car, with a centre of gravity just 35 cm above the ground. The car's design also meets the European regulations, so Formula 1 inspired subframe and tiny side-view mirrors each shave a little mass or drag.

1,000 km

8.7 kWh

consumption

~100 kWh

battery capacity

Efficiency is the new horsepower.

Fighting the air

At motorway speed, most of an electric car's energy goes into pushing air out of the way. The drag force is $F = \frac{1}{2} \times \rho \times A \times v^2$, where ρ is the air density, C_d the drag coefficient, A the frontal area and v the speed. Because the power needed to beat drag is force multiplied by speed, it grows with the cube of speed: drive 20 percent faster and the aerodynamic power demand rises by roughly 73 percent.

The EQXX answers with a long tapering tail, a smooth covered underbody and a drag coefficient of about 0.17, among the lowest ever claimed for a car of its kind.

TRY THIS AT HOME

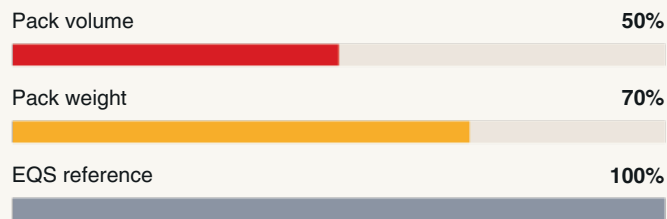
Take a car with frontal area $A = 2.0 \text{ m}^2$ at 100 km/h (27.8 m/s) in air of density 1.2 kg/m^3 .

With $C_d = 0.17$, drag power is about 4.4 kW. With $C_d = 0.30$ it is about 7.7 kW.

That 3.3 kW gap, held for a 10-hour, 1,000 km journey, is

roughly 33 kWh: a third of the whole battery. (Illustrative figures.)

EQXX BATTERY PACK VS EQS PACK (EQS = 100%)



Chips, software and the last few percent

Efficiency was hunted in the electronics too. Mercedes claims the drive system delivers around 95 percent of the battery's energy to the wheels, helped by silicon-carbide power electronics. Cabin heating, cooling and infotainment were treated as part of the energy budget rather than afterthoughts, and a roof-mounted solar panel adds a small trickle of range. The car was also developed with heavy use of digital design tools, compressing the development time.

The road test

Claims on a spec sheet are one thing; the road is another. During 2022 the EQXX was driven on public roads from Germany to the south of France. It arrived with about 15 percent charge left, roughly 140 km of remaining range, after averaging a record-low 8.7 kWh per 100 km. That works out to about 87 kWh drawn over the 1,000 km journey. Later in the year a second drive, from Germany to Silverstone in Britain, stretched the distance to 747 miles (about 1,202 km).

What it means for engineers like us

The EQXX will never be sold, but Mercedes says its lessons are meant for production cars. The deeper message for automobile engineering students is that the discipline is returning to first principles: aerodynamics, mass, rolling resistance and thermodynamics. Battery chemistry will keep improving, yet every kilowatt-hour that clever design never has to carry is cheaper, lighter and greener than one that must be mined, manufactured and hauled around for the life of the car.

Sources: Mercedes-Benz announcements and 2022 press coverage by Popular Science, Autoblog and Electric & Hybrid Vehicle Technology International.

Bharath V. Kumar
2019-23 Batch AU

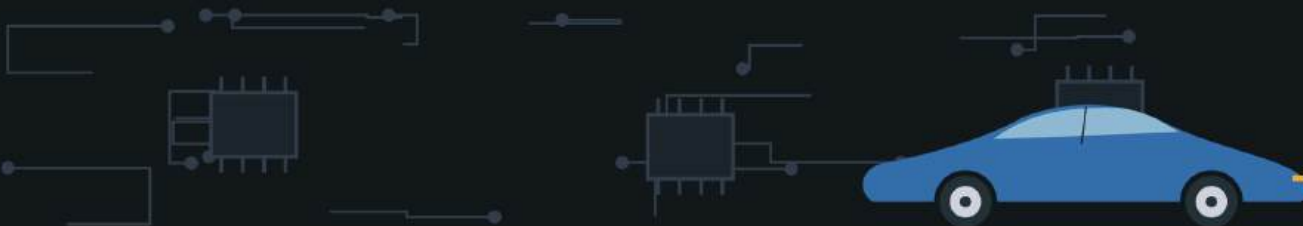


TECHNICAL ARTICLE 02

The Car as a Computer

Android Automotive OS and the Rise of the Software-Defined Vehicle: Why the Most Important Component in a 2022 Car May Be One You Cannot Touch

TORQUE EDITORIAL DESK | ACADEMIC YEAR 2022–23



Open the bonnet of a car from the 1990s and you could trace almost every function to a part you could hold. Open the specification of a car launched in 2022 and the most talked-about feature may be an operating system. Cars are becoming computers on wheels, and 2022 was the year that idea went mainstream.

Not just a phone on the dashboard

Many drivers know Android Auto, which projects apps from a phone onto the car's screen. Android Automotive OS is a different animal. It is Google's first operating system developed specifically and only for cars, and it runs natively on the vehicle's own computer. Navigation, media, voice assistant and apps work without a phone connected, and the car maker can design the look and feel of the interface itself. By 2022 several manufacturers had adopted it, including Polestar and Volvo, Renault with its new electric Megane E-Tech, and General Motors in models such as the Cadillac Lyriq. The pitch to the maker is clear: instead of building a navigation and app ecosystem from scratch, use a proven one and spend the effort on brand experience.

THE SOFTWARE STACK OF A MODERN INFOTAINMENT SYSTEM

Car-maker apps and interface

maps, media, voice, brand design

Android Automotive OS

Google's car-specific operating system

Vehicle services and drivers

speed, climate, battery, camera data

Computer and vehicle networks

SoC, CAN bus, automotive Ethernet

The software-defined vehicle

The shift runs deeper than screens. Traditionally a car held dozens of small electronic control units (ECUs), each a separate box with its own software supplied by a different vendor. Engineers are now consolidating these into a few powerful domain or zonal computers, so that functions are defined by software and can be improved after the car has left the factory.

The hardware is the stage. The software is the performance.

That makes over-the-air (OTA) updates possible. A single download can refine battery management, adjust the suspension tune or add a feature, much as a phone gains new abilities overnight. Modern cars are often described as running tens of millions to well over a hundred million lines of code, far more than most aircraft of a generation ago.

THE CAN BUS IN 30 SECONDS

Controller Area Network, developed by Bosch in the 1980s, lets ECUs share data over just two wires.

Engine speed, wheel speed, brake status and battery data all travel as short messages that any node can read.

It is still the backbone of most vehicles, now joined by automotive Ethernet for high-bandwidth data.

New risks, new rules

A car that can be updated remotely can also, in principle, be attacked remotely. Regulators have responded. UN Regulations R155 on cybersecurity management and R156 on software updates, which apply to vehicle type approvals in many markets including the European Union, require manufacturers to show that they manage cyber risks over the whole life of a vehicle. Secure boot, encrypted communication and intrusion detection are becoming as standard as airbags.

A new skill set

For a mechanical or automobile engineer this is not a threat but an opportunity. Someone must still understand how a suspension, a thermal system or a braking system behaves before software can control it well. The most valuable engineers of the next decade will be bilingual: fluent in the physics of machines and conversant in the logic of code. If your curriculum has a programming lab or a controls course, take it seriously. It is where the next generation of the automobile is being written.

Sources: Popular Science 2022 automotive innovations list; manufacturer announcements; UNECE WP.29 regulations R155 and R156.

Bharath V. Kumar

2019-23 Batch AU



POEM 01

What Turns the World

*Before the speed, there is the turning:
a hand upon a spanner, a bolt that will not budge,
the patient arithmetic of force and arm,
a lever's long promise — lean, and the world will move.*

*Pistons rehearse their small explosions,
a crankshaft translates fire into rotation,
and somewhere under the bonnet's hush
an ancient idea, a circle, keeps the faith.*

*They talk of horsepower, of the number on the plate,
of what a car can do at the end of a straight.
But ask the hill. Ask the loaded road.
Ask the stalled lorry on the ghat at dawn.
It is torque that climbs.*

*So here's to the unglamorous strength,
the grunt before the glory,
to the ones who work at the turning point
and the students learning where to put their weight.
Give us a lever and a place to stand;
we have the wrench. We'll find the rest.*

Sandeep Lal
2021-25 Batch AU

Trade-offs

Nothing is free. Silicon-carbide wafers are harder and costlier to produce than silicon ones, which is why the material first appeared in premium cars. High-voltage systems demand better insulation, careful creepage and clearance distances in connectors, and a charging network that can actually deliver 350 kW. Many 800-volt cars therefore include a DC-DC converter so they can still charge from older 400-volt chargers.

Why it matters in India

Indian roads and chargers differ from those of Europe or the United States, with high ambient temperatures and a mostly lower-power charging network. Efficient power electronics matter even more here, because every watt lost as heat in an inverter is a watt the air conditioning must remove on a hot afternoon. As Indian makers and suppliers scale up electric platforms, silicon-carbide devices and higher-voltage architectures are likely to move steadily from luxury models toward the mass market.

Sources: Popular Science 2022 automotive innovations list; Lucid Motors and Hyundai press releases; Motor Authority; standard power-electronics references.

Melvin C. Joshy
2020-24 Batch AU



TECHNICAL ARTICLE 04

India's Electric Turning Point

With the Nexon EV Max and the Tiago EV, 2022 became the year electric cars stopped being a curiosity on Indian roads and started looking like a sensible purchase.

TORQUE EDITORIAL DESK | ACADEMIC YEAR 2022–23



For years the Indian electric car story was a promise made in future tense. In 2022 it moved into the present. Two launches from Tata Motors, one aimed at the long-range buyer and one at the budget buyer, showed that a mass-market electric car could be both practical and priced within reach.

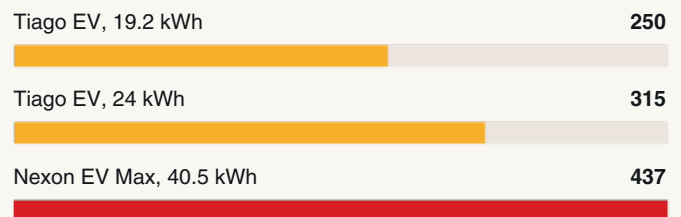
Nexon EV Max: more range, same body

Launched in May 2022, the Nexon EV Max carried a larger 40.5 kWh battery in the familiar compact SUV body and claimed an ARAI-certified range of 437 km, with prices starting at Rs 17.74 lakh. The larger pack addressed the first question every prospective buyer asks: will it get me where I need to go? A faster-charging option and added features followed the same pattern, showing how quickly electric models were evolving.

Tiago EV: the price breakthrough

The bigger headline came on 28 September 2022, when Tata launched the Tiago EV at an introductory price of Rs 8.49 lakh, positioned as the most affordable electric car in the country. It came with two battery options: 19.2 kWh with a claimed range of 250 km, and 24 kWh with a claimed 315 km. Tata highlighted a liquid-cooled battery and motor with a protection rating of IP67 against dust and water, reassuring buyers in a country of monsoon downpours.

CLAIMED ARAI RANGE (KM)



A car is only revolutionary when ordinary families can afford to buy one.

Reading the range numbers

ARAI range figures come from a test cycle and real-world driving, with air conditioning, hills and traffic, usually delivers less. Still, the numbers reveal interesting engineering. Dividing battery size by claimed range gives roughly 77 Wh per kilometre for both Tiago EV variants and about 93 Wh per kilometre for the heavier Nexon EV Max. Larger, heavier vehicles simply need more energy to move.

MODEL	BATTERY	ARAI RANGE	Wh PER CLAIMED KM
Tiago EV (19.2)	19.2 kWh	250 km	7
Tiago EV (24)	24 kWh	315 km	7
Nexon EV Max	40.5 kWh	437 km	7

Table: battery size, claimed range and energy per claimed kilometre (computed).

9
3

Not everything was electric

India's 2022 also saw strong hybrids arrive in the mainstream. The Toyota Urban Cruiser Hyryder and its sibling, the Maruti Suzuki Grand Vitara, offered petrol-electric systems that recover braking energy and let the car run on electric power at low speeds, a pragmatic step for buyers not yet ready to depend on public charging.

Challenges ahead

Charging remains the biggest obstacle. Most owners charge at home overnight, but apartment dwellers and highway travellers need dependable public charging, and a car that must wait 90 minutes at a slow charger loses some of its appeal. Government support helps: the FAME-II incentive scheme for electric vehicles and the production-linked incentive (PLI) schemes for automobiles and advanced chemistry cells are intended to build domestic manufacturing as well as demand. Battery recycling, grid capacity and cell supply chains are the long-term questions.

The student's takeaway

Every one of these challenges is an engineering problem waiting for a solver: thermal management for hot climates, efficient motors, affordable cells, charging protocols and recycling. The field that our department studies has rarely offered so many open problems or so many opportunities to solve them in India, for India.

Sources: Tata Motors launch coverage (Onmanorama, Business Today, EVO India, Mobility Outlook, Outlook Business), May and September 2022.

Jonathan C. Jacob
2020-24 Batch AU



SECTION 02

Tales from the Garage

Three stories where engines, people and memories meet.

PAGE 18 **The Last Carburettor**

PAGE 20 **Cold Start**

PAGE 22 **Range Anxiety**

STORY 01

The Last Carburettor

Some engines are not repaired by tools. They are repaired by listening.

TORQUE EDITORIAL DESK | ACADEMIC YEAR 2022–23



Gopalan Nair had not started the car in eleven years, and the car had not forgiven him. It sat under a faded tarpaulin at the back of his workshop in Ottapalam: a cream Premier Padmini with a dent in the rear door and a fine coat of red dust over everything. The workshop itself had shrunk with the neighbourhood. Where a dozen mechanics once shouted over each other, there was now one retired man, a radio and a cat.

“It will not start,” he told his granddaughter, as if announcing a death in the family.

Anjali was in the third year of her automobile engineering course and had arrived for the holidays with a laptop, a diagnostic scanner she was proud of and a quiet certainty that she knew more than her grandfather. She plugged the scanner in, then realised, with embarrassment, that the car had nothing to plug into. There was no engine control unit. There were no sensors. There was a battery, a coil, a distributor and a carburettor.

“Where is the port?” she asked.

Her grandfather laughed until he coughed. “The port is here.” He tapped his ear.

They began the next morning. He taught her to pull a spark plug and read it like a doctor reads a tongue: dry and sooty meant too rich, white and blistered meant too lean, a pale biscuit colour meant happiness. He taught her to hold a screwdriver against the engine block and press the handle to her ear to hear a failing bearing. She had studied the theory of all this in class. She had never smelled it.

“Fuel is coming,” he said, cranking the engine, “and spark is there. So the trouble is in the mixing.” The carburettor came off in four bolts and ten minutes of grumbling. They laid it on a sheet of newspaper, and Anjali, who could derive the Bernoulli equation in her sleep, saw for the first time what it meant. Air rushing through a narrow throat, pressure dropping, fuel pulled up through a jet no wider than a hair. All of fluid mechanics, in a brass body the size of her fist.

The idle jet was blocked with a pinch of varnish, the memory of petrol that had stood too long.

“Use the compressed air from the college lab,” she said, reaching for her bag.

“Use a bristle from a broom,” he said. “Never a wire. Brass is softer than your pride, and a scratched jet is a ruined jet.”

She used the bristle. It took forty minutes, a magnifying glass and the discovery that her hands, which could type a hundred words a minute, were clumsy at this.

They bolted it back at dusk. Gopalan took the driver's seat, pumped the pedal twice and turned the key. The engine coughed, wheezed, hunted and died.

“Again,” said Anjali.

It coughed. Hunted. Caught for three seconds, five, ten, and then settled into a lumpy, uncertain idle that rose and fell like the breathing of someone asleep. A puff of blue smoke rolled out of the exhaust and was gone.

“The mixture screw,” her grandfather shouted over the noise. “Turn it slowly and listen. You want the highest, smoothest sound. Then give it a quarter turn leaner.”

She crouched at the side of the engine with a screwdriver, closed her eyes and listened. The note climbed. It wobbled, steadied, climbed again, and then, at one particular angle of the screw, the engine hummed like a tuned string. She turned it back a quarter. The idle was perfect.

For a long time neither of them spoke. The cat, who had fled at the first bang, returned to the doorway and sat down to supervise.

“I bought her in 1991,” Gopalan said at last, wiping his hands on a rag that had seen worse days. “Your mother was born in the back seat of this car, on the way to Palakkad. The hospital was far and the monsoon was heavy. She never once stopped.”

Anjali looked at the engine, ticking and warm, and then at her scanner, still lying useless on the workbench. She thought about the electric cars she hoped to design one day, motors that turned in perfect silence, sealed batteries, software that would diagnose itself.

“Appooppa,” she said, “I want to build electric cars.”

“Good,” he said, without hesitation. “Build the best ones in the world. But learn to listen first. A silent motor still has something to say.”

That evening she recorded forty seconds of the idle on her phone. Years later, in a laboratory far from Ottapalam, when a prototype made a faint wrong sound that no sensor had flagged, she would put her ear against the casing without thinking, and she would hear her grandfather say: mixing, child. The trouble is always in the mixing.

Jyothiss C
2020-24 Batch AU



STORY 02

Cold Start

Eight students, one off-road car and ninety seconds to fix the thing that nobody could find.

TORQUE EDITORIAL DESK | ACADEMIC YEAR 2022–23

02



Nobody tells you how quiet a paddock becomes when your car will not start.

Around us, sixty teams from across the country were bolting, welding and shouting in half a dozen languages. Our car, a lopsided orange off-road buggy we had spent eleven months building and named Gajraj, sat in the pit lane with the stillness of a patient.

It was the final hour of the endurance race. We had been running fourth. Then, during a routine pit stop to change a driver, Gajraj had stalled, and now it would not fire again.

“Check the fuel,” said Rohan, our captain, kneeling by the rear wheel with his hands shaking just a little.

“Half a tank,” said Fathima, from the cockpit. She was our driver for the second half, helmet already on, waiting.

“Check the spark.”

“Strong spark,” said Jibin, who had pulled a plug and held it against the block as the starter turned. Blue and fat. The ignition was fine.

“Then it is fuel delivery,” said Rohan. “Pump, filter or line.”

We had trained for this. Back at the college workshop, our faculty advisor had made us practise “thirty-second fault finding” until we could do it blindfolded: you start from what you know is working and move step by step until you find what is not. Fuel in the tank. Spark at the plug. Air through the filter. So the break was somewhere between the tank and the engine.

The clock on the pit board read 01:41:12 of a two-hour race. The track marshal was already glancing our way.

“Everyone stop talking,” said a small voice. It belonged to Sneha, a second-year student who had joined the team in August and spent most of the season sweeping the floor and fetching tools. She had barely said ten sentences in front of the seniors.

“Turn the key on,” she said. “Don't crank. Just switch it on and everyone listen.”

Fathima turned the ignition on. We stood there like fools in a church, listening to an off-road car in a field. “It's supposed to buzz,” Sneha said slowly. “The pump. For two seconds, when you switch on. It's silent.” Nobody had noticed. We had all been looking at things; she had been listening for one.

Jibin was already tracing the pump's wiring with his fingers. The harness ran under the seat, along the frame and, we discovered with a sinking feeling, past the spot where the driver's heel hit during the pit stop. There, half hidden under a zip tie, a small connector had worked loose. The two halves hung apart by barely two millimetres, enough to break the circuit.

“Seventy-eight seconds,” Rohan said, reading the board. “We can still do it.”

Jibin pressed the connector home until it clicked. Sneha, without being asked, wrapped it with a layer of tape and clipped it to the frame. Fathima switched on the ignition and, from somewhere beneath the seat, came the beautiful, ridiculous, two-second buzz of a pump that was alive.

She turned the key. Gajraj coughed once, caught and roared, spraying red dust across the pit lane. Fathima gave a thumbs-up and was gone in a cloud.

We did not finish fourth. Lost time put us eleventh out of sixty, which, for a team in its first year, was more than we had dared to hope. When the results were announced, the loudest cheer from our section was for the member who had joined in August.

Later, as we loaded Gajraj onto the truck in the golden evening light, Rohan stood next to Sneha and said, “You know, we had the best equipment and the best simulations and the best plan. And it was a connector the size of a thumb.”

“Everything is a connector the size of a thumb,” said Sneha, and went to fetch the tape.

Prasidh P.
2021-25 Batch AU



STORY 03

Range Anxiety

A father who trusts only petrol, a son who borrowed an electric car, and a tea shop that changed the arithmetic of the journey.

TORQUE EDITORIAL DESK | ACADEMICYEAR2022–23



Raghavan Nambiar was a man who measured the world in kilometres per litre. He owned a diesel sedan, fourteen years old, carried a spare can of fuel in the boot, and regarded electric cars the way he regarded vegetarian biryani: with polite suspicion.

“It is a wedding in Kozhikode,” he said to his son Nikhil, “not an expedition to Mars. Why would we take that thing?”

“Because,” said Nikhil, patting the roof of his friend's borrowed electric hatchback, “it's silent, it's smooth and it costs a fraction to run. You will love it, Achan. Trust me.”

Raghavan climbed in as if it might bite. The dashboard glowed. The car made no sound whatsoever when Nikhil pressed the button, and Raghavan looked around in alarm, convinced it had not started.

“It's on,” said Nikhil.

“It's dead.”

“It is on, Achan. Look at the screen. Battery ninety-four percent. Range two hundred and thirty kilometres. Kozhikode is a hundred and thirty away. We could go there, come back and visit your sister in Thrissur on the way home.”

“Hmm,” said Raghavan, in the tone of a man who has noted your confidence and decided to hold it against you.

For the first twenty kilometres he said nothing. For the next twenty he stared at the battery percentage like a stock broker watching a falling index. By the time they crossed Kuttippuram he had developed a theory that the car's computer was exaggerating, and by Valanchery he had started a running commentary. “Ninety-four, ninety-two, ninety. We have driven forty kilometres and used four percent. That means a hundred kilometres is ten percent. So we will arrive with eighty-seven percent. No wait. Why has it dropped three percent in that last stretch?”

“We went uphill, Achan.”

“There is no hill in Kerala which is worth three percent.”

“Then it's the air conditioner.”

“Switch off the air conditioner.”

“It is thirty-four degrees outside.”

“Then we will perish gracefully,” said Raghavan, and wound down his window.

Nikhil, who had read a dozen articles about regenerative braking and gleefully explained all of them, noticed that his father was silent for a long time after that. When the old man spoke again, it was not about the battery.

“When your mother was alive,” he said, looking at the paddy fields drifting by, “we used to drive this road every year for her cousin's festival. We never had a screen telling us how much road was left. We just went. And now every day I wake up and I check my own numbers: the blood pressure, the sugar, the pension. I am carrying a dashboard around inside me.”

Nikhil did not know what to say, so he said nothing, and reached out to switch the air conditioner back on. At the town of Kottakkal they stopped, not because they needed to, but because a roadside tea shop had a hand-painted sign that said **EV CHARGING, TEA, BANANA FRY** in three different colours of paint. The charger was a modest wall unit behind the stove. The owner, a lean man named Abdu, plugged it in as casually as someone refilling a kettle.

“Slow charger,” he said apologetically. “Thirty minutes will give you only a little. But the tea is fast.” They sat on a wooden bench with glasses of sweet, scalding tea and a plate of banana fry. A bus thundered past. A schoolgirl on a bicycle waved at no one in particular. The charger hummed softly behind them, patient and unhurried.

Raghavan, for the first time that morning, was not looking at the screen.

“You know what, Nikhil,” he said, brushing crumbs from his shirt, “in a petrol car I would never have stopped here.”

“That's the secret,” Nikhil said. “Nobody ever got range anxiety from a good cup of tea.”

They arrived in Kozhikode with thirty-one percent of the battery left, ten minutes ahead of the muhurtham and in time for the feast. Raghavan declared the car “acceptable.” On the return journey he insisted on driving, and was heard to say that the silence was “rather like meditation, only faster.”

“But next time,” he added, as the evening lights of Thrissur came into view, “we will go by the old sedan.” “And where would we stop for tea?” asked Nikhil.

His father thought about it for a long moment, tapped the steering wheel and sighed. “Fine. Kottakkal. But I am bringing my own can of diesel.”

Lajith Sajeewan
2021-25 Batch AU



SECTION 03

Road Notes

Two journeys by road, from the tea hills of the Ghats to the southern tip of India.

PAGE 25

Hairpins and Tea

PAGE 27

Three Seas, One Road

TRAVELOGUE 01

Hairpins and Tea: Driving upto Munnar

Forty hairpin bends, one stubborn clutch and a mountain that rewards patience with the greenest view in Kerala.

TORQUE EDITORIAL DESK | ACADEMIC YEAR 2022–23



ROUTE NOTES

Route: Kochi – Kothamangalam–Adimali–Munnar

Distance: roughly 130 km

Altitude gain: sea level to about 1,500m

Best months: September to March

Car tip: use low gears on the descent; do not ride the brakes

Munnar begins long before you reach it. It begins at the first drop in temperature, when the air coming through the car window turns from damp heat into something cool and thin, and you realise you have stopped sweating.

We left Kochi before sunrise in a hatchback packed with four friends, one flask of coffee and an unreasonable amount of banana chips. The plan was simple: reach the tea country by lunch, spend two days walking and photographing, and return with our sanity restored. Our car-obsessed friend Arjun, who had insisted on driving, had a plan of his own: to demonstrate, with an enthusiasm bordering on the religious, the art of the mountain road.

The climb begins

The road from Kothamangalam through Neriamangalam and Adimali is a long, steady lesson in gradients. For the first hour the plantations of rubber and cardamom crowd the road; then they thin out and the world tilts upward. The engine note changes, the revs rise, and one by one the hairpin bends begin.

“Third gear,” Arjun announced to nobody in particular, as the road folded sharply back on itself. “Always go down a

gear before the bend, not in it. The engine does the work, the brakes only support.”

It is a fine thing to hear someone explain torque while the speedometer needle sits at twenty-five. A car climbing a steep grade needs far more twisting force at the wheels than one cruising on flat road, and a low gear multiplies the engine's torque to deliver it. Higher up, the thinner air steals a little power, which a naturally aspirated engine can only grumble about.

Waterfalls and warnings

At Cheeyappara the road runs beside a stepped waterfall, a staircase of white water falling in tiers through the forest. We stopped, stretched, bought roasted corn from a woman who had arranged her cobs on a bicycle wheel and watched a troop of monkeys inspect an abandoned bag. A little further on, at Valara, the cascade is taller and the spray reaches the road itself.

It is also where the signs begin: **Engine in low gear. Sound horn at bends. Landslide-prone zone.** The Western Ghats are generous with their beauty and strict with their rules. In the monsoon the road can be closed after heavy rain, and we were glad to travel in the dry season.

A sea of green

And then, round the last corner, Munnar opened up beneath us. The tea gardens spread across the hills in perfect contour lines, as though a giant had combed the mountains. Mist drifted between the ridges. Pickers in bright shawls moved along the terraces with baskets on their backs, tiny and unhurried. Somebody in the back seat said, softly, “Oh.” Nobody said anything else for a minute.

The next morning we visited Eravikulam National Park, home of the endangered Nilgiri tahr, a sure-footed mountain goat that seems to regard the vertical as a form of flat ground. Above the park rises Anamudi, at 2,695 metres the highest peak in South India. We did not climb it, but we stood in its shadow with the wind pushing at our jackets, feeling comfortably small.

The locals told us that the hills turn a ghostly blue every twelve years when the neelakurinji flowers bloom, most recently in 2018. We could only imagine it. That is how a good journey leaves you: wanting to come back for something you have not yet seen.

The way down

Descending is harder than climbing. Gravity wants the car, and brakes that are used too heavily overheat and fade. Arjun, to our relief, stayed in second gear almost all the way down, letting the engine's own resistance hold the speed while the brakes were used in short, firm squeezes. The coffee flask ran dry somewhere above Adimali. The banana chips lasted until Kothamangalam.

By the time the lights of Kochi came into view, the hairpins already seemed like a dream. We had not gone far in kilometres. But we had gone, as the best roads take you, a long way up and a little way in.

A. Aravind

2019-23 Batch AU



TRAVELOGUE 02

Three Seas, One Road: Kochi to Kanyakumari

A journey down the southwest coast of India to the point where the Arabian Sea, the Bay of Bengal and the Indian Ocean meet.

TORQUE EDITORIAL DESK | ACADEMIC YEAR 2022–23



ROUTE NOTES

Route: Kochi – Alappuzha–Kollam–Thiruvananthapuram – Kanyakumari

Distance: roughly 280 km one way

Highlights: backwaters, Kovalam, Muppandal wind farm, Vivekananda Rock Memorial

Best months: October to February

Every country has a place where the map runs out, and for mainland India that place is Kanyakumari. We set out to see it by road, because the road, we decided, is the only honest way to measure distance. Planes make geography disappear. Cars give it back.

Down the coast

We left Kochi at dawn, joining the national highway that runs south along the coast. At that hour the road belongs to milk vans, fish trucks and the occasional dream cyclist. Coconut palms leaned over the carriageway like old men sharing secrets, and behind them, flashing between gaps in the trees, the backwaters caught the first light.

South of Alappuzha the road slides past canals where houseboats were still asleep, and into Kollam, the old cashew town. Here we stopped for breakfast: appam and egg curry on a banana leaf, served by a man who refilled our plates before they were empty and refused, firmly, to be paid for the refills.

Highway driving in Kerala is an exercise in patience and anticipation. The road is busy, the villages almost never end,

and the unexpected is the rule: a bus pulling out without warning, a goat deciding that now is the moment to cross. Our driver, Sreejith, held a steady speed, scanned two vehicles ahead and used the horn like a polite cough, never a shout.

Past the capital

Thiruvananthapuram arrived in a blur of traffic, temple towers and college campuses, and was gone as quickly. At Kovalam we left the highway for a stretch of coast road, parked above a crescent of sand and watched surfers wobble out to sea. The water was warm. The lighthouse stood above the beach like a sentry. We could have stayed all day, but the south was calling.

Beyond the state border the landscape changed. The palms thinned, the land flattened, and the horizon filled with enormous white wind turbines turning slowly in the sea breeze. This is Muppandal, one of the largest wind farms in India, and a reminder that the energy transition is not only a story about batteries. Hundreds of turbines stood in the dry fields, their blades sweeping the sky with a calm, mechanical grace. The car engineer in our group, who had spent the whole drive talking about torque, was silent for once. A turbine is a machine that turns the wind's torque into electricity, and he took a long time to photograph each one.

Where the land ends

WereachedKanyakumariin the late afternoon. The town is small and crowded, smelling of salt, frying oil and jasmine. Beyond the harbour, two rocks rise from the sea: one carries the Vivekananda Rock Memorial and, beside it, the 133-foot statue of the Tamil poet Thiruvalluvar, said to stand for the 133 chapters of his Thirukkural. A short ferry crossing took us to the memorial, where the wind was strong enough to take our caps.

The reason pilgrims and travellers come here is the meeting of the waters: the Arabian Sea, the Bay of Bengal and the Indian Ocean touch at this point, and the sea shows slightly different colours where they join. We had come for the sunset, and the sunset did not disappoint. The sky turned the colour of ripe mango, then of copper, then of ash. The crowd along the shore fell silent, and a whole town stopped to watch the sun slip into the water.

On the drive back the next morning, with the engine ticking contentedly and a packet of local banana chips on the dashboard, I thought about distance. Two hundred and eighty kilometres is not far. A car covers it in a morning. But the road had taken us from backwater to beach, from cashew town to wind farm, from one sea to three. A good journey, I decided, is not measured by what you cover but by what covers you.

R. Neeraj
2019-23 Batch AU



POEM 02

The Road Remembers

*The highway hums its one long note
and the dashboard glows like a small, kind moon.
Milestones drift by like thoughts we meant to finish.
Rain scribbles on the windscreen; the wipers answer,
a left, a right, a patient metronome.*

*Somewhere ahead, a town asleep in tea-shop light;
somewhere behind, the city folding up its noise.
We carry nothing but a flask and a name
for the place we're heading, which isn't, quite, a place.*

*An engine is a kind of faith —
that if you feed the dark it will return you light,
that distance is only a conversation with time,
and the road has never once refused to listen.*

*So take the bend and trust the camber.
Let the headlights draw the future in short, bright strokes.
We are not going anywhere.
We are going.*

Shafeeque Shajahan
2019-23 Batch AU

Rev Up Your Brain

Twelve questions for the garage and the classroom

- 01** Which company's Vision EQXX concept drove around 1,000 km on a single charge in 2022?
- 02** What does ABS stand for?
- 03** What is the SI unit of torque?
- 04** The component that converts battery DC into AC for the motor is called the...?
- 05** What does the symbol C_d represent in aerodynamics?
- 06** Which stroke follows the compression stroke in a four-stroke petrol engine?
- 07** What does ECU stand for?
- 08** Octane rating measures a fuel's resistance to what?
- 09** What does CVT stand for in a transmission?
- 10** Regenerative braking converts which energy into electrical energy?
- 11** The Wankel engine uses which kind of moving part instead of reciprocating pistons?
- 12** What was the introductory price of the Tata Tiago EV in 2022?

Answers are on the next page. No peeking until you have tried them all!

Answer Key

- 01 *Mercedes-Benz*
- 02 *Anti-lock Braking System*
- 03 *Newton-metre (N m)*
- 04 *Inverter*
- 05 *Drag coefficient*
- 06 *The power (expansion) stroke*
- 07 *Engine (or Electronic) Control Unit*
- 08 *Knocking (pre-ignition)*
- 09 *Continuously Variable Transmission*
- 10 *Kinetic energy*
- 11 *A triangular rotor (rotary engine)*
- 12 *Rs 8.49 lakh*

How did you do? 10 or more: you could run the workshop. 6 to 9: a solid engine, still running in. Under 6: time to visit the library and the garage.

Glossary

Terms used in this issue

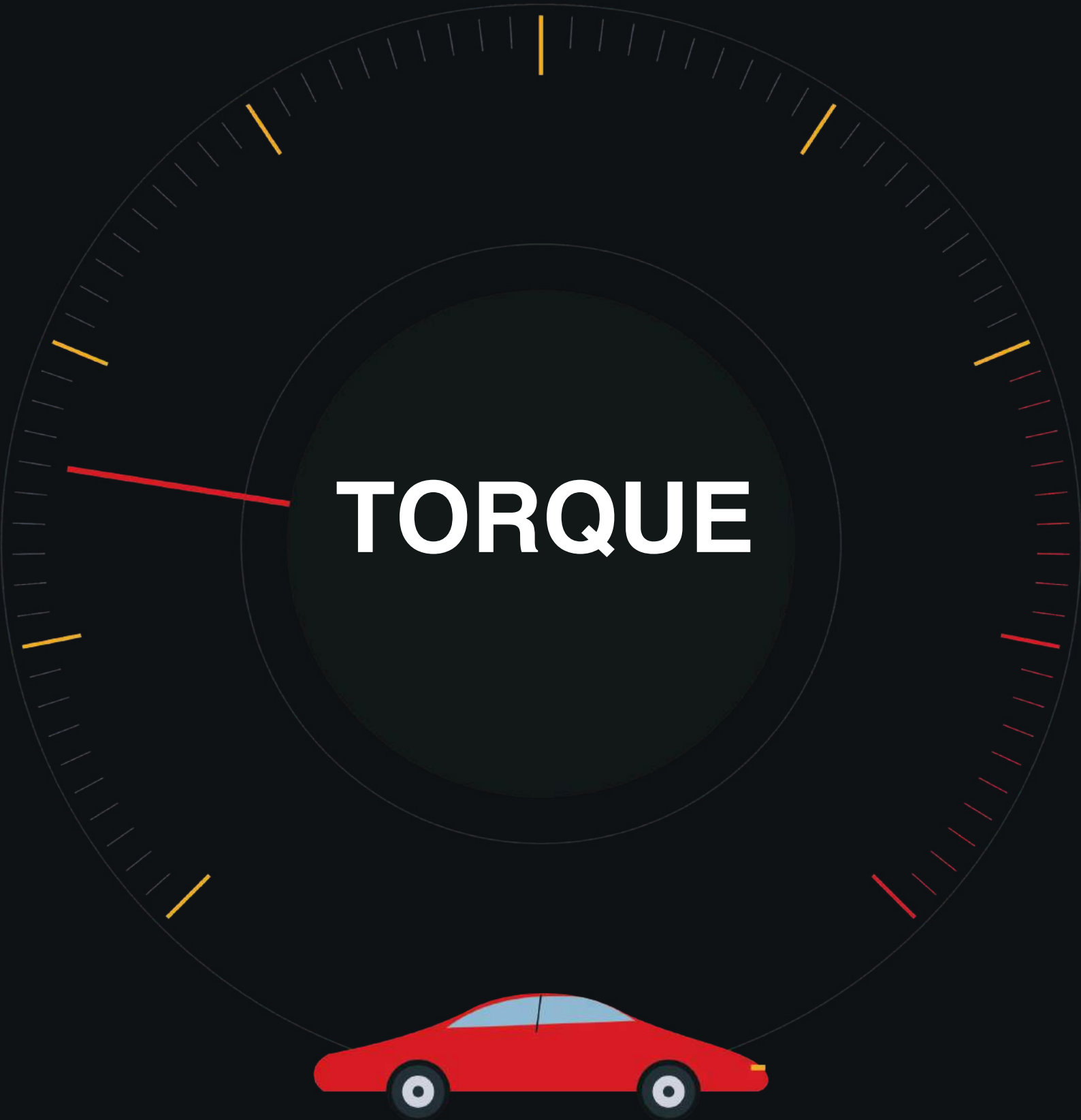
Torque	The twisting force produced by an engine or motor, measured in newton-metres.
Horsepower	A measure of power, the rate at which work is done. One mechanical horsepower is about 746 watts.
Drag coefficient (Cd)	A number describing how easily a shape slips through air; lower is better.
Regenerative braking	Recovering a vehicle's kinetic energy as electricity while slowing down.
Inverter	Power electronics that convert DC from the battery to AC for the motor.
Silicon carbide (SiC)	A semiconductor allowing higher voltages, temperatures and switching speeds than silicon.
CAN bus	A two-wire network that lets a car's electronic control units share data.
OTA update	Over-the-air software update delivered to a vehicle without a workshop visit.
State of charge (SoC)	The remaining energy in a battery, expressed as a percentage of its capacity.
ARAI range	Range figure certified by the Automotive Research Association of India on a test cycle.
WLTP	Worldwide Harmonised Light Vehicle Test Procedure, a standardised test cycle for range and fuel use.
Compression ratio	The ratio of cylinder volume at the start and at the end of compression.
Turbocharger	An exhaust-driven compressor that forces more air into the engine to make more power.
Wheelbase	The distance between the front and rear axles.

Acknowledgements

TORQUE2022–23 was produced by the students and faculty of the Department of Automobile Engineering. We thank the Head of the Department, the faculty coordinator, all student contributors and the readers who make a magazine worth writing. Technical figures in the articles are drawn from manufacturer announcements and press coverage published in 2022; stories, travelogues and poems are original works of fiction and imagination written for this issue.

TORQUE

DEPARTMENT OF AUTOMOBILE ENGINEERING
ACADEMIC YEAR 2022 – 2023



DEPARTMENT OF AUTOMOBILE ENGINEERING
ACADEMIC YEAR 2022 – 2023