S.P.B. PATEL
ENGINEERING COLLEGE
SAFFRONY INSTITUTE OF TECHNOLOGY CAMPUS

Near Shanku's Water Park,
Ahmedabad – Mehsana Highway,
Linch, Mehsana – 384435
Email: info@saffrony.ac.in
Web: www.saffrony.ac.in
Phone : (02762) 285721

CYCLE 1
NAAC Accreditation 2023

ACADEMIC YEAR
2020-21

Submitted to

NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL

S.P.B. PATEL ENGINEERING COLLEGE

SUPPORTING DOCUMENTS

1.2.2 Percentage of students enrolled in Certificate/ Value added courses and also completed online courses of MOOCs, SWAYAM, NPTEL etc. as against the total number of students during the last five years

Name of Certificate/ Value added course	Course Code (if any)	Year of offering/study	Period (from date - to date)	Duration of course	Number of students enrolled in the year	Number of Students completing the course in the year
2020-21						
Plastic Waste Management	noc21-ce04	2020-2021	Jan - March 2021	8 Weeks	2	2
Programming, Data Structures And Algorithms Using Python	noc20-cs70	2020-2021	Jan - April 2020	12 Weeks	1	1
Course on Solidworks	NA	2020-21	20th Oct 2020	1 Month 6 Day	1	1
ONLINE DESIGN BOOTCAMP 2021	NA	2020-21	24th May 2021	5 Day	6	6
Professional Life Skill Development	NA	2020-2021	July 20 - December20	56 Hours	218	218
Electric Hybrid Vehicle Course	NA	2020-2021	Nov-20	32 Hours	62	62

S.P.B. Patel Engineering College

Date: 1st January 2021

NOTICE

All Degree Engineering students and faculty members are hereby informed that the Institute has established a local chapter in association with NPTEL.

We encourage everyone to take advantage of this opportunity by enrolling in courses of their interest.

For any queries regarding NPTEL Programs, please contact Prof. Nirav Joshi, the designated resource person for NPTEL.

Principal

S.P.B. Patel Engineering College Linch

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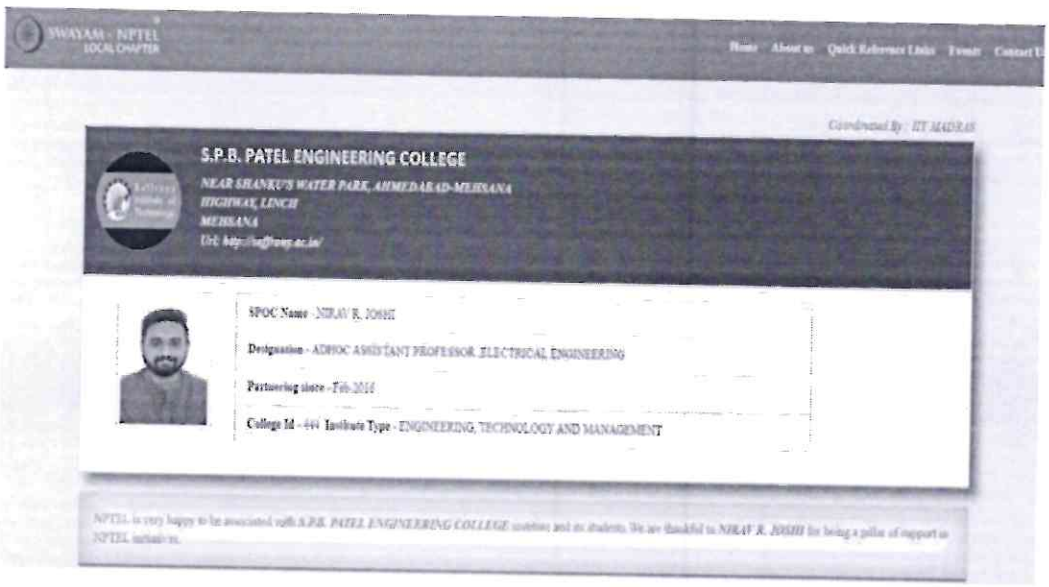

Elite

NPTEL Online Certification

(Funded by the Ministry of HRD, Govt. of India)

This certificate is awarded to

SHARMISHTHA MAKWANA

for successfully completing the course

Plastic Waste Management

with a consolidated score of **73** %

Online Assignments	22.46/25	Proctored Exam	50.75/75

Total number of candidates certified in this course: **1651**

Prof. G P Raja Sekhar
Dean, Continuing Education
IIT Kharagpur

Jan-Mar 2021
(8 week course)

Prof. Debjani Chakraborty
Coordinator, NPTEL
IIT Kharagpur

Indian Institute of Technology Kharagpur

FREE ONLINE EDUCATION swayam शिक्षित भारत, उन्नत भारत

Roll No:NPTEL21CE04S21040081

To validate and check scores: https://nptel.ac.in/noc

This certificate is computer generated and can be verified by scanning the QR code given below. This will display the certificate from the NPTEL repository, https://nptel.ac.in/noc/

Roll No: NPTEL20CS70S41040162

To
SHREYASHKUMAR MAHENDRABHAI PATEL
3/ DEVARSHI BANGLOWS ,PART -1
DHAROI COLONY ROAD
VISNAGAR
GUJARAT - 384315
PH. NO :9328298424

Score	Type of Certificate
>=90	Elite+Gold
75-89	Elite+Silver
>=60	Elite
40-59	Successfully Completed
<40	No Certificate

No. of credits recommended by NPTEL:2
An additional 1 credit may be awarded if the University deems it fit, based on the actual student effort involved.

Elite

NPTEL Online Certification

(Funded by the Ministry of HRD, Govt. of India)

This certificate is awarded to

SHREYASHKUMAR MAHENDRABHAI PATEL

for successfully completing the course

Programming, Data Structures and Algorithms using Python

with a consolidated score of **69** %

Online Assignments	24/25	Programming Exam	22/25	Proctored Exam	22.5/50

Total number of candidates certified in this course: **1579**

Devendra Jalihal

Prof. Devendra Jalihal
Chairman
Centre for Continuing Education, IITM

Sep-Nov 2020
(8 week course)

Prof. Andrew Thangaraj
NPTEL Coordinator
IIT Madras

Indian Institute of Technology Madras

FREE ONLINE EDUCATION swayam

200240204

INSTITUTE FOR DESIGN OF ELECTRICAL MEASURING INSTRUMENTS
(Ministry of Micro, Small and Medium Enterprises, Govt. of India)
MSME – TECHNOLOGY CENTRE
Swatantryaveer Tatya Tope Marg, Chunabhatti, Sion, Mumbai – 400 022

IDEMI
A Government of India Society
(Ministry of MSME - Government of India)

Certificate

This is to certify that

MR. PRATHAM KIRTI JAIN

has successfully completed Govt. Certificate course in

"SOLID WORKS" **with A+ Grade**

from 20/10/2020 to 26/11/2020 through online platform

Date: 30th December, 2020

(SUNIL SANAP)
PROGRAM CO-ORDINATOR

(PRADEEP GUJARATHI)
PRINCIPAL DIRECTOR (I/C)

TRG:FF:20

Gujarat Technological University

Community Innovation & Co- Creation Centre

Design Innovation Centre

ESTD - 2007

DESIGN INNOVATION CENTRE

CiC3

E - Certificate of Participation

This is to certify that

Patel Vinit Rakeshkumar

has attended Five Days **"Online Design Bootcamp 2021"**
Conducted by **C**ommunity **I**nnovation & **C**o-**C**reation **C**entre
(CiC3) in association with **D**esign **I**nnovation **C**entre **(DIC)**,
Ahmedabad held during 24th May - 28th May 2021

संजय चौहान

GTU/GIC/DIC/BOOTCAMP/2021/042

Date: 28th May 2021

DR. SANJAY CHAUHAN
DIRECTOR, GIC - GTU

Gujarat Technological University

Community Innovation & Co- Creation Centre

Design Innovation Centre

DESIGN INNOVATION CENTRE

CiC3

E - Certificate of Participation

This is to certify that

Patel Akshkumar Bharatkumar

has attended Five Days **"Online Design Bootcamp 2021"** Conducted by **C**ommunity **I**nnovation & **C**o-**C**reation **C**entre **(CiC3)** in association with **D**esign **I**nnovation **C**entre **(DIC)**, Ahmedabad held during 24th May - 28th May 2021

संजय चौहान

DR. SANJAY CHAUHAN
DIRECTOR, GIC - GTU

GTU/GIC/DIC/BOOTCAMP/2021/168

Date: 28th May 2021

Regarding Certificate : Online Design Bootcamp 2021

1 message

<dic4@gtuinstitutes.ac.in>
Reply-to: dic4@gtuinstitutes.ac.in
To: harshghediya16@gmail.com

Thu, Jun 3, 2021 at 12:49 PM

Gujarat Technological University

Community Innovation & Co- Creation Centre

Design Innovation Centre

DESIGN INNOVATION CENTRE

CiC3

E - Certificate of Participation

This is to certify that

Bhatti Nitin Pravinbhai

has attended Five Days **"Online Design Bootcamp 2021"**
Conducted by **C**ommunity **I**nnovation & **C**o-**C**reation **C**entre
(**CiC3**) in association with **D**esign **I**nnovation **C**entre (**DIC**),
Ahmedabad held during 24th May - 28th May 2021

संजय चौहान

GTU/GIC/DIC/BOOTCAMP/2021/167

Date: 28th May 2021

DR. SANJAY CHAUHAN
DIRECTOR, GIC - GTU

Gujarat Technological University

Community Innovation & Co- Creation Centre

Design Innovation Centre

DESIGN INNOVATION CENTRE

CiC3

E - Certificate of Participation

This is to certify that

ARNAV MODANWAL

has attended Five Days **"Online Design Bootcamp 2021"**
Conducted by **C**ommunity **I**nnovation & **C**o-**C**reation **C**entre
(CiC3) in association with **D**esign **I**nnovation **C**entre **(DIC)**,
Ahmedabad held during 24th May - 28th May 2021

संजय चौहान

GTU/GIC/DIC/BOOTCAMP/2021/091

Date: 28th May 2021

DR. SANJAY CHAUHAN
DIRECTOR, GIC - GTU

Gujarat Technological University

Community Innovation & Co- Creation Centre

Design Innovation Centre

ESTD - 2007

DESIGN INNOVATION CENTRE

CiC3

E - Certificate of Participation

This is to certify that

Het Patel

has attended Five Days **"Online Design Bootcamp 2021"** Conducted by **C**ommunity **I**nnovation & **C**o-**C**reation **C**entre **(CiC3)** in association with **D**esign **I**nnovation **C**entre **(DIC)**, Ahmedabad held during 24th May - 28th May 2021

संजय चौहान

DR. SANJAY CHAUHAN
DIRECTOR, GIC - GTU

GTU/GIC/DIC/BOOTCAMP/2021/037

Date: 28th May 2021

S.P.B. Patel Engineering College

NOTICE

All the students of Degree Engineering and faculty members are hereby informed that the Institute has started a local chapter in association with NPTEL.

All are requested to take benefit of this course and enroll in the course of your interest

If you have any queries related to NPTEL Programs, Please contact Prf. Nirav Joshi, resource person NPTEL

Principal

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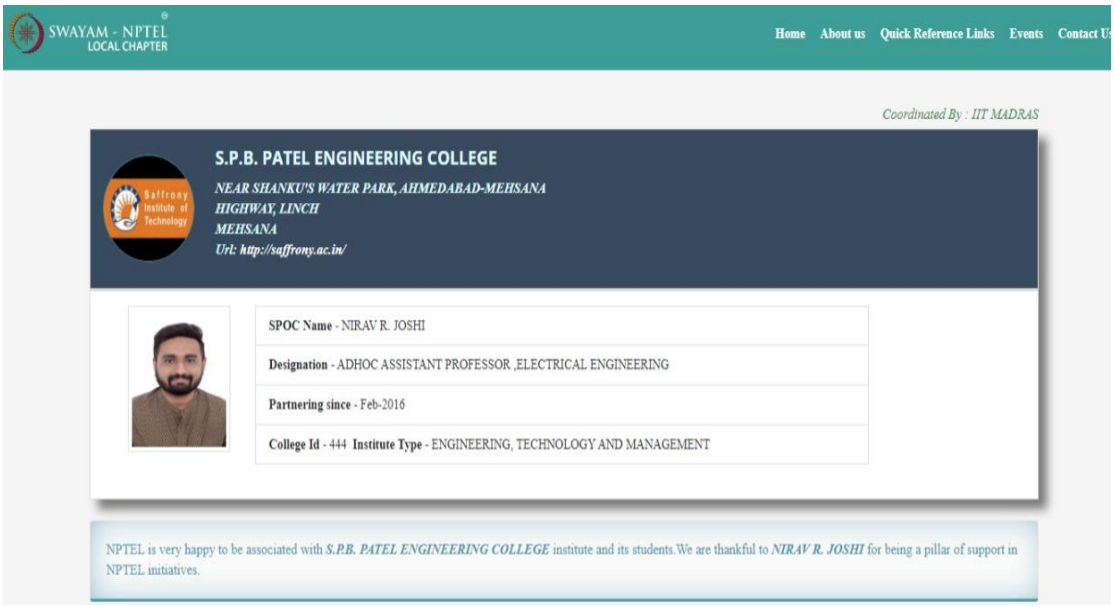

S.P.B. Patel Engineering College

NOTICE

Date: 26th June 2020

All students of the Degree Engineering 2017 Batch are hereby informed that, to minimize the gap between academia and industry, the Institute is going to organize a Professional & Life Skill Development Course between July 2020 and December 2020.

Principal

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S.P.B. Patel Engineering College
Linch

S.P.B. PATEL ENGINEERING COLLEGE
SAFFRONY INSTITUTE OF TECHNOLOGY CAMPUS

Professional and Life Skills Development (PLSD) Program

Year: 2020-2021

Period: July 2020 - December 2020

Duration: 56 Hours

Number of Students Enrolled: 181

Introduction:

Saffrony introduced the Professional and Life Skills Development (PLSD) program, exclusive to its students, aimed at equipping them with essential skills for success in the corporate world. The program emphasizes practical application over theoretical knowledge, focusing on experiential learning and real-life problem-solving.

Program Highlights:

1. Soft and Life Skills Development: The program prioritizes the deeper understanding and implementation of soft and life skills essential for professional success.

2. Financial Literacy and Personal Finance Planning: Sessions on financial literacy and personal finance planning empower students to manage their finances effectively, preparing them for financial independence.

3. Business Finance Fundamentals and Entrepreneurship Basics: Participants gain insights into business finance fundamentals and entrepreneurship basics, equipping them with the tools to navigate the business world confidently.

4. Employability Enhancement: The final phase of the program offers dedicated support in CV preparation, interview skills development, and personalized 1-1 CV counseling to enhance students' employability and career prospects.

Methodology:

Experiential teaching methods, interactive sessions, real-life problem-solving assignments, psychometric testing, and 1:1 counseling facilitate the grooming of students into well-rounded, resilient, and adaptable individuals. Simulated interview scenarios and personalized feedback refine students' communication, presentation, and interpersonal skills to excel in job interviews and professional interactions.

Achievements:

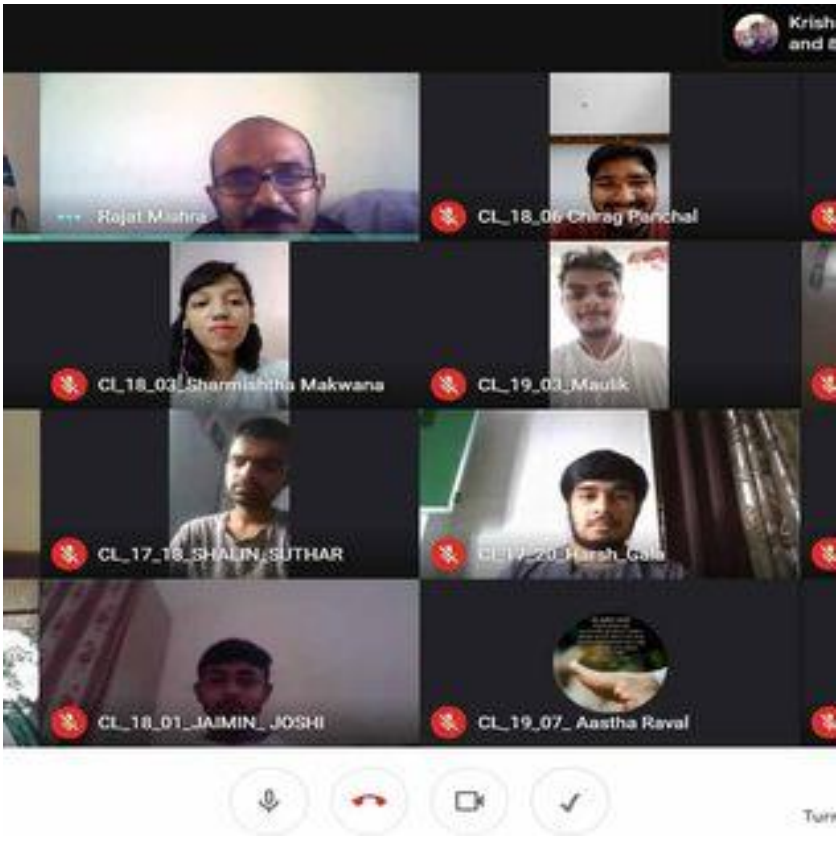
With 181 students enrolled, the PLSD program witnessed high participation and engagement. Feedback from participants highlighted the tangible benefits gained, including enhanced soft skills, improved financial literacy, and increased confidence in employability skills.

Conclusion:

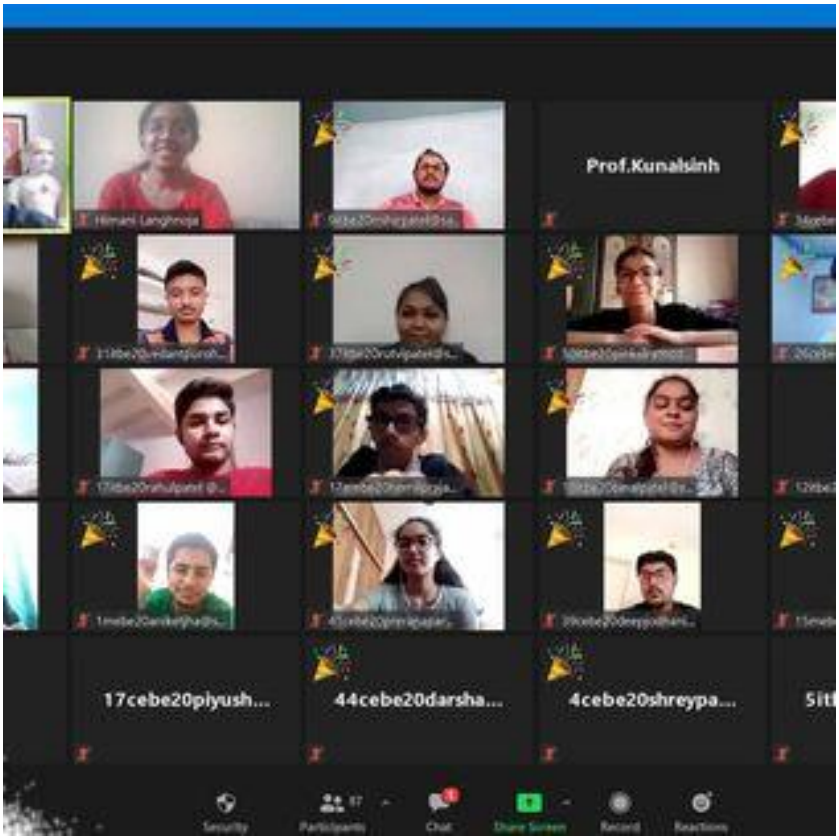
The PLSD program at Saffrony in the academic year 2020-2021 was a success, providing students with the necessary skills and knowledge to thrive in the corporate world. The practical approach and personalized support contributed to the holistic development of participants, empowering them for future endeavors.

This report reflects the commitment of Saffrony to preparing students for meaningful careers by equipping them with both technical and soft skills essential for success in today's competitive job market.

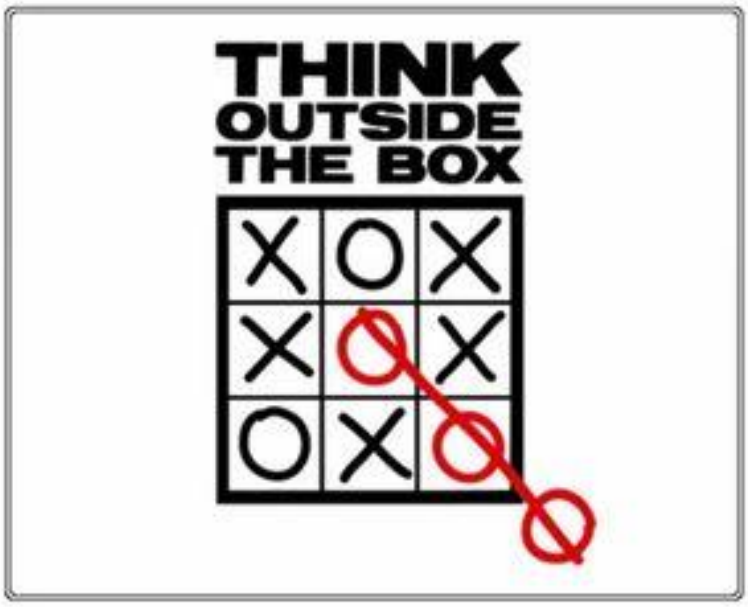
Photographs:


Rajat Mishra
CL_18_06 Chirag Panchal
CL_18_03_Sharmishtha Makwana
CL_19_03_Maulik
CL_17_18_SHALIN_SUTHAR
CL_18_01_JAIMIN_JOSHI
CL_19_07_ Aastha Raval


Dr. Vishnu Awasthi is talking...


Prof.Kunalsinh
17cebe20piyush...
44cebe20darsha...
4cebe20shreypa...

How??



S.P.B. Patel Engineering College

NOTICE

Date: 1st January 2021

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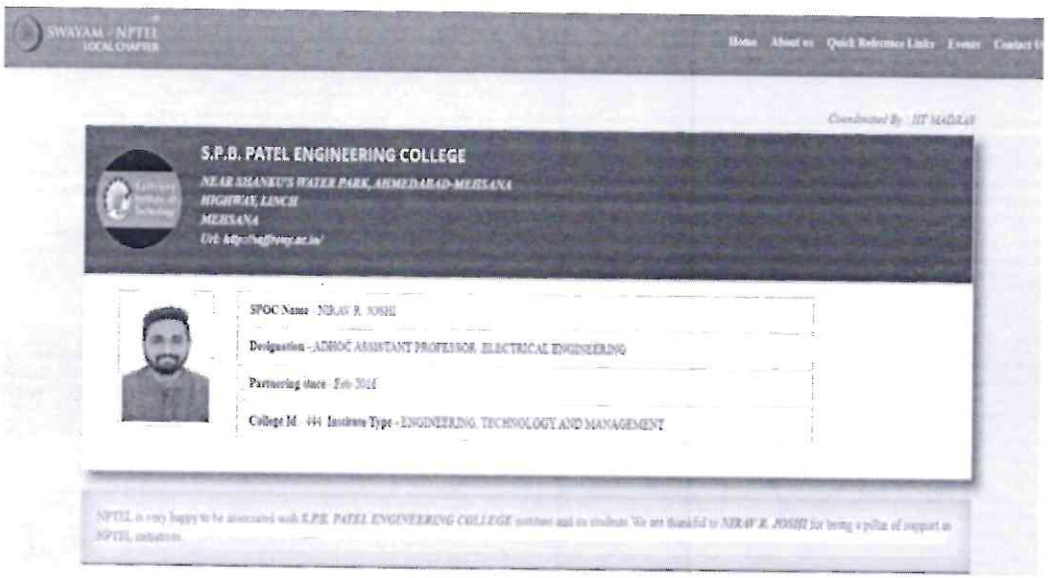

S.P.B. PATEL ENGINEERING COLLEGE
SAFFRONY INSTITUTE OF TECHNOLOGY CAMPUS

Report on
Electric Hybrid Vehicle Course
S.P.B. Patel Engineering College

Date: November 2020

Duration: 32 hours

Participants: 62

Organizer: S.P.B. Patel Engineering College

Conducted by: Prof. Nirav Joshi

Overview:

The Electric Hybrid Vehicle Course held in November 2020 was a comprehensive program aimed at educating participants about the intricacies of electric and hybrid vehicle technology. Over the course of 32 hours, 2 lectures a week, attendees delved into various aspects of these vehicles, including their design, mechanics, environmental impact, and future prospects. The workshop provided both theoretical knowledge and practical insights to equip participants with a solid understanding of this rapidly evolving field.

Key Objectives:

1. Understanding Electric and Hybrid Vehicle Technology: Participants gained insights into the principles behind electric and hybrid vehicle propulsion systems, including battery technologies, electric motors, regenerative braking, and control systems.

2. Environmental Impact and Sustainability: The workshop emphasized the environmental benefits of electric and hybrid vehicles, including reduced emissions and dependence on fossil fuels, contributing to a greener and more sustainable transportation sector.

3. Challenges and Opportunities: Participants explored the challenges facing the widespread adoption of electric and hybrid vehicles, such as infrastructure limitations, cost considerations, and battery technology constraints. They also discussed the potential opportunities for innovation and growth within the industry.

4. Hands-on Learning: Practical sessions allowed participants to apply their theoretical knowledge, with demonstrations on electric vehicle components, maintenance procedures, and safety considerations. Hands-on activities enhanced comprehension and provided valuable experience for future endeavors in the field.

Workshop Highlights:

- Expert Instruction: Renowned experts in electric vehicle technology led the workshop sessions, providing invaluable insights and guidance based on their extensive experience in the industry.
- Interactive Discussions: Participants engaged in lively discussions, sharing perspectives and exchanging ideas on topics ranging from vehicle design to policy implications for the future of transportation.
- Networking Opportunities: The workshop facilitated networking among participants, fostering connections and collaborations that extend beyond the duration of the course.
- Practical Demonstrations: Live demonstrations and simulations offered a firsthand look at electric and hybrid vehicle components and systems, enhancing understanding and retention of key concepts.

As a result of the workshop, participants gained valuable knowledge and skills that are applicable to a wide range of industries, including automotive engineering, renewable energy, and environmental sustainability. Many expressed intentions to apply their learning to their professional roles or pursue further education in electric vehicle technology.

Conclusion:

The Electric Hybrid Vehicle Course held in November 2020 was a resounding success, providing participants with a comprehensive understanding of electric and hybrid vehicle technology. Through expert instruction, interactive discussions, and hands-on learning opportunities, attendees gained valuable insights and skills that have the potential to shape the future of transportation. As the demand for sustainable mobility solutions continues to grow, workshops like these play a crucial role in preparing professionals to meet the challenges and opportunities of an increasingly electrified automotive industry.

Photographs:

S.P.B. PATEL ENGINEERING COLLEGE
SAFFRONY INSTITUTE OF TECHNOLOGY CAMPUS

ATTENDENCE SHEET OF STUDENTS

List of Participants:

Sr.no	BR_NAME	Enrolment_number	Name
1	MECHANICAL ENGINEERING	170390119040	PRAWINKUMAR SHARMA
2	AUTOMOBILE ENGINEERING	170390102001	CHAUHAN CHIRAG VISHNUBHAI
3	AUTOMOBILE ENGINEERING	170390102003	KUSHWAHA ANGEL BHARATKUMAR
4	AUTOMOBILE ENGINEERING	170390102007	PATEL NIKULKUMAR KANUBHAI
5	AUTOMOBILE ENGINEERING	170390102008	SIROYA DHARMIK MANISHBHAI
6	AUTOMOBILE ENGINEERING	170390102009	VACHHETA SHALIN MANOJKUMAR
7	ELECTRONICS & COMMUNICATION ENGINEERING	170390111001	DARJI MUDRA HARSHADBHAI
8	ELECTRONICS & COMMUNICATION ENGINEERING	170390111003	KORAT ABHISHEK RAMESHBHAI
9	ELECTRONICS & COMMUNICATION ENGINEERING	170390111006	MALAVIYA AKASH KARASHANBHAI
10	ELECTRONICS & COMMUNICATION ENGINEERING	170390111007	PATEL RUTVIK JASHVANTKUMAR
11	ELECTRONICS & COMMUNICATION ENGINEERING	170390111009	PATEL SMIT JITUBHAI
12	ELECTRONICS & COMMUNICATION ENGINEERING	170390111010	PRAJAPATI MITKUMAR NARANBHAI
13	ELECTRONICS & COMMUNICATION ENGINEERING	170390111011	SONI FORAM JAGDISHKUMAR
14	ELECTRONICS & COMMUNICATION ENGINEERING	170390111012	BHUT HARSH DINESHBHAI
15	ELECTRONICS & COMMUNICATION ENGINEERING	170390111013	MAYANK MEWARA
16	ELECTRONICS & COMMUNICATION ENGINEERING	170390111014	PANCHAL RIDDHI RAKESHBHAI
17	ELECTRONICS & COMMUNICATION ENGINEERING	170390111016	QURESHI MUZAMMIL MUSTAK
18	ELECTRONICS & COMMUNICATION ENGINEERING	170390111017	RAWAT DIVYANSHU NARESHBHAI
19	MECHANICAL ENGINEERING	170390119002	CHAUDHARI VISHVAS JETHABHAI
20	MECHANICAL ENGINEERING	170390119003	CHAUDHARY HASMUKHBHAI LALJIBHAI
21	MECHANICAL ENGINEERING	170390119006	GAJERA RAHUL VALLABHBHAI
22	MECHANICAL ENGINEERING	170390119007	GARVA MAHEK PRANLAL
23	MECHANICAL ENGINEERING	170390119008	GODHANI RITIK HARESHBHAI
24	MECHANICAL ENGINEERING	170390119009	GOSWAMI RAJGIRI VISHNUGIRI
25	MECHANICAL ENGINEERING	170390119010	GUPTA ANIL SHARMA PRASAD

S.P.B. PATEL ENGINEERING COLLEGE
SAFFRONY INSTITUTE OF TECHNOLOGY CAMPUS

Sr.no	BR_NAME	Enrolment_number	Name
26	MECHANICAL ENGINEERING	170390119011	GUPTA DURGESH SANJAY
27	MECHANICAL ENGINEERING	170390119012	HAJRA SUDIPTA RABINDRANATH
28	MECHANICAL ENGINEERING	170390119013	JANI RUTVIJ HARESHBHAI
29	MECHANICAL ENGINEERING	170390119019	MODI MIT KRUSHNVADAN
30	MECHANICAL ENGINEERING	170390119020	MUKHERJEE ABHIJEET SANATAN
31	MECHANICAL ENGINEERING	170390119021	PANCHAL KISHAN MUKESHBHAI
32	MECHANICAL ENGINEERING	170390119022	PATEL DEEP ROHITBHAI
33	MECHANICAL ENGINEERING	170390119023	PATEL DIVYESHKUMAR KIRITBHAI
34	MECHANICAL ENGINEERING	170390119025	PATEL MITESH NILESHKUMAR
35	MECHANICAL ENGINEERING	170390119026	PATEL NISHARG RAMESHBHAI
36	MECHANICAL ENGINEERING	170390119027	PATEL PRAJESH NARESHBHAI
37	MECHANICAL ENGINEERING	170390119028	PATEL RAJ JASHAVANTBHAI
38	MECHANICAL ENGINEERING	170390119030	PATEL SAHIL KINJALBHAI
39	MECHANICAL ENGINEERING	170390119031	PRAJAPATI MAHESH RADHESHYAMBHAI
40	MECHANICAL ENGINEERING	170390119032	RAMI SIDDHARTH BIPINBHAI
41	MECHANICAL ENGINEERING	170390119033	SUTHAR SAHILKUMAR PANKAJBHAI
42	MECHANICAL ENGINEERING	170390119034	VYAS DHRUV GHANSYAMBHAI
43	MECHANICAL ENGINEERING	170390119035	VYAS DHRUVIL DIPAKKUMAR
44	MECHANICAL ENGINEERING	170390119036	YADAV ROSHANSINGH B
45	MECHANICAL ENGINEERING	140390119116	SHARMA YASH NARESHKUMAR
46	AUTOMOBILE ENGINEERING	150390102003	DARJI JAY HASMUKHKUMAR
47	AUTOMOBILE ENGINEERING	160390102004	PATEL KALPKUMAR VISHNUBHAI
48	MECHANICAL ENGINEERING	170393119009	PRAJAPATI CHIRAGKUMAR POPATLAL
49	MECHANICAL ENGINEERING	170394119001	SODHA VANRAJSINH KHUMAJI
50	MECHANICAL ENGINEERING	170394119002	DABHI NIKULKUMAR KAMLESHKUMAR
51	AUTOMOBILE ENGINEERING	180393102001	GUPTA ATUL RAMSHANKARBHAI
52	ELECTRONICS & COMMUNICATION ENGINEERING	180393111001	PATEL KAUSHAL ROHITKUMAR
53	MECHANICAL ENGINEERING	180393119001	ATTRI RAHULSINGH KRISHANKUMAR
54	MECHANICAL ENGINEERING	180393119002	KHATRI RITIKKUMAR ANILBHAI
55	MECHANICAL ENGINEERING	180393119003	MALEK AFTAB AKBARKHAN
56	MECHANICAL ENGINEERING	180393119004	MEHTA ANIKET GHANSHYAMBHAI
57	MECHANICAL ENGINEERING	180393119005	PALIWAL YASH NIMESHKUMAR
58	MECHANICAL ENGINEERING	180393119006	PRAJAPATI AJAY BHIKHABHAI
59	MECHANICAL ENGINEERING	180393119007	PRAJAPATI PRAGNESHKUMAR NATAVARBHAI
60	MECHANICAL ENGINEERING	180393119008	SATHVARA ANKIT BHARATBHAI
61	MECHANICAL ENGINEERING	180393119009	SATHVARA NIRAVKUMAR BAKABHAI
62	MECHANICAL ENGINEERING	180393119011	THAKKAR PARTHKUMAR ASHOKKUMAR

Course Curriculum:

Introduction to Electric Hybrid Vehicles

1. Overview of Electric Hybrid Vehicles

- Introduction to Electric Hybrid Vehicles: Define electric hybrid vehicles (EHVs) and discuss their significance in the automotive industry. Explain the concept of hybridization and the different types of EHVs, including parallel hybrids, series hybrids, and plug-in hybrids.
- Advantages of EHVs: Highlight the environmental and economic benefits of EHVs, such as reduced emissions, improved fuel efficiency, and lower operating costs. Discuss how EHVs contribute to sustainability and energy independence.
- Challenges and Opportunities: Identify challenges facing the widespread adoption of EHVs, such as battery technology limitations, infrastructure development, and consumer acceptance. Explore opportunities for innovation and growth in the EHV market.

2. Hybrid Vehicle Architecture and Components

- Hybrid Powertrain Components: Explain the architecture of a hybrid powertrain, including the internal combustion engine (ICE), electric motor/generator, transmission, battery pack, and power electronics. Discuss the roles and interactions of each component in hybrid vehicle operation.
- Operating Modes: Introduce the different operating modes of hybrid vehicles, such as electric-only mode, hybrid mode, and regenerative braking. Discuss how hybrid control systems manage power distribution and optimize efficiency during driving.
- Hybrid Vehicle Configurations: Compare and contrast different hybrid vehicle configurations, such as series-parallel hybrids, mild hybrids, and full hybrids. Discuss the advantages and limitations of each configuration in terms of fuel economy and performance.

3. Battery Technology for EHVs

- Introduction to Battery Technology: Provide an overview of battery technologies used in EHVs, including lithium-ion (Li-ion), nickel-metal hydride (NiMH), and lead-acid batteries. Discuss the characteristics, performance, and cost considerations of each battery type.
- Battery Management Systems (BMS): Explain the role of BMS in monitoring and managing battery performance, including state of charge (SOC), state of health (SOH), and temperature. Discuss how BMS optimize battery usage and prolong battery life.
- Advances in Battery Technology: Discuss recent advancements in battery technology, such as solid-state batteries, fast-charging technologies, and battery recycling. Explore the potential impact of these advancements on the future of EHVs.

4. Charging Infrastructure and Standards

- Charging Infrastructure Overview: Provide an overview of charging infrastructure for EHVs, including public charging stations, home charging solutions, and fast-charging networks. Discuss the importance of charging infrastructure in supporting the adoption of electric vehicles.
- Charging Standards and Protocols: Introduce charging standards and protocols used in the electric vehicle industry, such as CHAdeMO, CCS (Combined Charging System), and Tesla Supercharger. Discuss the compatibility and interoperability of different charging standards.
- Charging Considerations: Discuss factors to consider when planning and implementing charging infrastructure, including location selection, power capacity, and accessibility. Explore best practices for maximizing the convenience and efficiency of charging stations.

Hybrid Vehicle Control Systems and Optimization

1. **Hybrid Vehicle Control Strategies**
   - Control System Architecture: Explain the architecture of hybrid vehicle control systems, including powertrain control unit (PCU), motor controllers, and supervisory control algorithms. Discuss how these components work together to optimize vehicle performance and efficiency.
   - Energy Management Strategies: Introduce energy management strategies used in hybrid vehicles, such as rule-based control, predictive control, and adaptive control. Discuss how these strategies prioritize power sources and optimize energy flow based on driving conditions.
   - Regenerative Braking Systems: Explain the operation of regenerative braking systems in hybrid vehicles, which capture and store kinetic energy during braking for later use. Discuss the benefits of regenerative braking in improving fuel efficiency and extending battery life.

2. **Hybrid Vehicle Simulation and Modelling**
   - Simulation Tools and Techniques: Introduce simulation tools and techniques used for modeling and simulating hybrid vehicle systems, such as MATLAB/Simulink, AVL CRUISE, and Ricardo IGNITE. Discuss the advantages of simulation in predicting vehicle performance, energy consumption, and emissions.
   - Vehicle Dynamics Modeling: Discuss the modeling of vehicle dynamics, including longitudinal dynamics (acceleration, braking) and lateral dynamics (steering, cornering). Explain how vehicle dynamics affect hybrid control strategies and system optimization.
   - Case Studies and Applications: Present case studies and real-world applications of hybrid vehicle simulation and modeling. Discuss how simulation tools are used in vehicle design, development, and validation to improve performance and efficiency.

3. **Optimization Techniques for Hybrid Vehicles**
   - Optimization Methods Overview: Provide an overview of optimization methods used in hybrid vehicle design and control, including genetic algorithms, particle swarm optimization, and model predictive control. Discuss the principles and applications of each optimization technique.
   - Multi-Objective Optimization: Discuss the challenges of multi-objective optimization in hybrid vehicle design, such as balancing conflicting objectives (e.g., fuel economy vs. emissions, performance vs. cost). Introduce methods for solving multi-objective optimization problems.
   - Optimization Case Studies: Present case studies and examples of optimization applied to hybrid vehicle systems. Discuss how optimization techniques are used to improve vehicle efficiency, performance, and reliability in real-world applications.

4. **Hands-on Activity: Hybrid Vehicle Control Simulation**
   - Simulation Exercise: Provide participants with hands-on experience in simulating hybrid vehicle control systems using simulation software. Guide participants through the process of setting up simulation models, defining control strategies, and analyzing simulation results.
   - Data Analysis and Interpretation: Assist participants in analyzing simulation data and interpreting results to evaluate the performance of hybrid vehicle control systems. Encourage participants to identify opportunities for optimization and improvement based on simulation findings.

Design and Development of Hybrid Vehicle Systems

1. **Hybrid Vehicle Design Considerations**
   - Design Requirements and Constraints: Discuss the design requirements and constraints of hybrid vehicle systems, including performance targets, regulatory standards, and cost considerations. Emphasize the importance of balancing competing priorities in hybrid vehicle design.
   - System Integration Challenges: Explore the challenges of integrating hybrid vehicle components and subsystems, such as powertrain, energy storage, and control systems. Discuss strategies for optimizing system integration and minimizing design complexity.
   - Design for Manufacturing and Assembly (DFMA): Introduce DFMA principles and techniques for optimizing the manufacturability and assembly of hybrid vehicle systems. Discuss how DFMA principles influence design decisions and reduce production costs.

2. **Electric Propulsion Systems**
   - Electric Motor Technologies: Introduce electric motor technologies used in hybrid vehicle propulsion systems, including induction motors, permanent magnet motors, and

synchronous reluctance motors. Discuss the characteristics, performance, and applications of each motor type.

- Motor Control Strategies: Discuss motor control strategies for hybrid vehicle propulsion, such as field-oriented control (FOC), direct torque control (DTC), and sensorless control. Explain how these control strategies optimize motor efficiency and performance.
- Power Electronics and Inverters: Explain the role of power electronics and inverters in converting DC power from the battery into AC power for the electric motor. Discuss the design considerations and specifications of power electronics components in hybrid vehicle systems.

3. Energy Storage Systems for EHVs

- Battery Pack Design Considerations: Discuss design considerations for battery packs used in EHVs, including energy density, power density, safety, and thermal management. Explain how battery pack design impacts vehicle performance, range, and durability.
- Battery Pack Integration: Explore different approaches to integrating battery packs into hybrid vehicle systems, such as module-level integration vs. pack-level integration, and centralized vs. distributed architectures. Discuss the trade-offs and implications of each integration approach.
- Battery Testing and Validation: Discuss testing and validation procedures for battery packs, including electrical testing, mechanical testing, and environmental testing. Highlight the importance of rigorous testing in ensuring battery safety, reliability, and performance.

4. Hybrid Vehicle System Optimization

- System-Level Optimization: Discuss system-level optimization techniques for hybrid vehicle design, including component sizing, powertrain calibration, and control strategy optimization. Explain how system-level optimization maximizes overall vehicle efficiency and performance.
- Vehicle Simulation and Modeling: Introduce vehicle simulation and modeling tools used in system-level optimization, such as AVL CRUISE, GT-SUITE, and MATLAB/Simulink. Discuss how simulation and modeling support iterative design and optimization throughout the development process.
- Optimization Case Studies: Present case studies and examples of system-level optimization applied to hybrid vehicle design. Discuss how optimization techniques are used to achieve performance targets, meet regulatory requirements, and minimize lifecycle costs.

Testing and Validation of Hybrid Vehicle Systems

1. Testing and Validation Overview

- Importance of Testing and Validation: Discuss the importance of testing and validation in verifying the performance, safety, and reliability of hybrid vehicle systems. Explain how testing and validation support product development and regulatory compliance.
- Testing Methods and Techniques: Introduce different testing methods and techniques used in hybrid vehicle development, including bench testing, component testing, and vehicle testing. Discuss the advantages and limitations of each testing approach.
- Test Planning and Execution: Discuss the process of test planning and execution, including test plan development, test procedure development, and test execution. Highlight the importance of comprehensive test coverage and data analysis in validating system performance.

2. Vehicle Dynamics Testing

- Handling and Stability Testing: Discuss vehicle dynamics testing procedures for evaluating handling, stability, and ride comfort characteristics of hybrid vehicles. Introduce testing maneuvers, such as slalom, lane change, and braking tests, used to assess vehicle dynamics performance.
- Suspension and Chassis Testing: Explore suspension and chassis testing procedures for evaluating ride quality, durability, and performance under various road conditions. Discuss how suspension and chassis design impact vehicle dynamics and overall driving experience.
- Data Acquisition and Analysis: Explain data acquisition and analysis techniques used in vehicle dynamics testing, such as vehicle instrumentation, sensor data collection, and data processing. Discuss how test data is analyzed to assess vehicle performance and identify areas for improvement.

3. Powertrain Testing and Calibration

- Powertrain Testing Procedures: Introduce powertrain testing procedures for evaluating the performance, efficiency, and emissions of hybrid vehicle powertrains. Discuss testing protocols for different operating conditions, such as steady-state, transient, and cold-start conditions.
- Engine and Motor Testing: Discuss engine and motor testing procedures, including dynamometer testing, performance mapping, and durability testing. Explain how engine and motor testing verifies powertrain performance and validates design specifications.
- Calibration and Optimization: Explain the process of powertrain calibration and optimization, including engine mapping, motor control tuning, and hybrid control strategy optimization. Discuss how calibration and optimization enhance powertrain efficiency and drivability.

4. Battery Testing and Validation

- Battery Performance Testing: Discuss battery performance testing procedures for evaluating capacity, power output, and cycle life under different operating conditions.

Introduce standardized test protocols, such as charge-discharge cycling tests and thermal cycling tests.

- Battery Safety Testing: Explore battery safety testing procedures for assessing the risk of thermal runaway, short circuit, and other safety hazards. Discuss how safety testing ensures compliance with industry standards and regulatory requirements.
- Environmental Testing: Discuss environmental testing procedures for evaluating battery performance and reliability in extreme temperature, humidity, and vibration conditions. Explain how environmental testing simulates real-world operating conditions and verifies battery durability.

Future Trends and Innovations in Electric Hybrid Vehicles

1. **Emerging Technologies in Hybrid Vehicles**
   - Overview of Emerging Technologies: Discuss emerging technologies and trends shaping the future of hybrid vehicles, such as electrification, connectivity, and autonomy. Explore how these technologies are transforming vehicle design, operation, and user experience.
   - Electrification Trends: Discuss the trend towards electrification in the automotive industry, including the adoption of electric powertrains, hybridization, and fuel cell technology. Explore how electrification is driving innovation and sustainability in vehicle design.
   - Connectivity and Autonomy: Explore the role of connectivity and autonomy in hybrid vehicle development, including vehicle-to-vehicle (V2V) communication, vehicle-to-infrastructure (V2I) communication, and autonomous driving features. Discuss how connectivity and autonomy enhance safety, efficiency, and convenience in hybrid vehicles.

2. **Future Directions in Hybrid Vehicle Development**
   - Sustainability and Environmental Impact: Discuss the importance of sustainability and environmental stewardship in hybrid vehicle development. Explore strategies for reducing greenhouse gas emissions, minimizing resource consumption, and promoting circular economy principles.
   - Technological Advancements: Explore future technological advancements and innovations in hybrid vehicle design, including advanced powertrain technologies, lightweight materials, and energy storage solutions. Discuss how these advancements will improve vehicle performance, efficiency, and affordability.
   - Market Trends and Consumer Preferences: Discuss market trends and consumer preferences driving the adoption of hybrid vehicles, including regulatory incentives, fuel price volatility, and changing consumer attitudes towards sustainability. Explore how market dynamics will influence the future of hybrid vehicle development and adoption.

3. **Industry Panel Discussion: Future of Hybrid Vehicles**

- Panelists: Invite industry experts, researchers, and thought leaders to participate in a panel discussion on the future of hybrid vehicles. Panelists may represent automotive manufacturers, technology suppliers, research institutions, and regulatory agencies.
- Discussion Topics: Facilitate a discussion on key topics and questions related to the future of hybrid vehicles, such as technology trends, market dynamics, regulatory challenges, and consumer adoption. Encourage panelists to share insights, perspectives, and predictions for the future of hybrid vehicle development.
- Audience Q&A: Allow workshop participants to ask questions and engage in dialogue with the panelists. Encourage participants to share their perspectives and contribute to the discussion on the future of hybrid vehicles.

4. Workshop Conclusion and Next Steps

- Workshop Recap: Summarize key insights, learnings, and takeaways from the workshop sessions. Highlight notable discussions, activities, and achievements throughout the five-day workshop.
- Next Steps: Provide guidance on next steps for participants to continue their learning and exploration in the field of hybrid vehicles. Recommend resources, courses, and professional development opportunities for further education and skill development.
- Closing Remarks: Conclude the workshop with closing remarks, thanking participants, presenters, and organizers for their contributions and participation. Express gratitude for the opportunity to collaborate and learn together in advancing the future of hybrid vehicles.