



# **P.S.R ENGINEERING COLLEGE**

(An Autonomous Institution, Affiliated to Anna University, Chennai)  
Accredited by NAAC A+ Grade, NBA and listed Under,12(B) of the UGC Act,1956  
Sivakasi - 626140, Virudhunagar (dt), Tamilnadu



## **NEWS LETTER**

*May 2022*  
*Volume 12, Issue 2*

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**Institute Vision and Mission**

**Vision**

To contribute to the society through excellence in technical education with societal values and thus a valuable resource for industry and the humanity.

**Mission**

- ❖ To create an ambience for quality learning experience by providing sustained care and facilities.
- ❖ To offer higher level training encompassing both theory and practices with human and social values.
- ❖ To provide knowledge based services and professional skills to adapt tomorrow's technology and embedded global changes.

**Department Vision and Mission**

**Vision**

To be a technical hub of creating Electrical and Electronics Engineers with superior quality, human values and ethical views

**Mission**

- To provide an excellent, innovative and comprehensive education in electrical and electronics engineering.
- To create a conducive learning environment and train the students in the latest technological development domain to enhance carrier opportunities
- To produce competent and disciplined engineers suitable for making a successful career in industry/research.

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**FACULTY ACTIVITIES**

<b>NAME OF THE FACULTY</b>	<b>NAME OF THE WORKSHOP/FDP</b>	<b>FDP/STTP</b>	<b>NAME OF THE INSTITUTE/INDUSTRY</b>	<b>DATE AND DURATION (FROM – TO)</b>
Dr.K.PUNITHA	One Week online Faculty Development Program on Integration of Renewable Energy and Smart Grids for Smart Cities	FDP	Bansal Institute Of Engineering And Technology, Lucknow (U.P.) India	07.03.2022 to 12.03.2022
	Electric Vehicle Part-1	NPTEL Course	IIT Delhi	March 2022
	National Intellectual Property Rights	One Day Awareness Program	Intellectual Property Office, India	09.03.2022
	Future Automation of Power System Protection in Indian Power Sector ( FAPSP'21) - Phase II	FDP	University College of Engineering, BIT Campus, Anna University, Tiruchirappalli	11.12.2021 to 24.12.2021
	Deep Learning Networks for Image Processing	workshop	IEEE India Council	22.12.2021 to 23.12.2021
Dr.R.MADAVAN	Research issues in Electric Vehicles	FDP (ATAL)	Alagappa Chettiar Government College of Engineering and Technology	06/12/2021 to 10/12/2021
Dr.R.MUNIRAJ	Control and Automation	FDP	Indian Institute of Space Science and Technology	14.12.2021 to 17.12.2021
Dr R.ARUNA	Electric Vehicle Part-1	NPTEL Course	IIT Delhi	March 2022
Dr R.ARUNA	One Week online Faculty Development Program on Integration of Renewable Energy and Smart Grids for Smart Cities	FDP	Bansal Institute Of Engineering And Technology, Lucknow (U.P.) India	07.03.2022 to 12.03.2022
	Modern Technologies for Teaching	AICTE Orientation Programme	P.S.R. Engineering College	31.01.2022 to 05.02.2022

	Future Automation of Power System Protection in Indian Power Sector ( FAPSP'21) - Phase II	FDP	University College of Engineering, BIT Campus, Anna University, Tiruchirappalli	11.12.2021 to 24.12.2021
Ms S KRISHNAVENI	Research Aspects in power Electronic Converters for microgrid system	Workshop	Mepc Schlenk Engineering College	26.05.2022 to 27.05.2022
	Electric Vehicle Part-1	NPTEL Course	IIT Delhi	March 2022
	National Intellectual Property Rights	One Day Awareness Program	Intellectual Property Office, India	09.03.2022
	One Week online Faculty Development Program on Integration of Renewable Energy and Smart Grids for Smart Cities	FDP	Bansal Institute Of Engineering And Technology, Lucknow (U.P.) India	07.03.2022 to 12.03.2022
	Future Automation of Power System Protection in Indian Power Sector ( FAPSP'21) - Phase II	FDP	University College of Engineering, BIT Campus, Anna University, Tiruchirappalli	11.12.2021 to 24.12.2021
Mrs.M.YAMUNA	Intelligent computing with IOT in Health care	FTP	Mepco Schlenk Engineering College	09.05.2022 to 11.05.2022
Mrs.M.YAMUNA	IOT over Edge and Cloud Computing	FDP	Anand International College of Engineering	19.04.2022 to 23.04.2022
	One Week online Faculty Development Program on Integration of Renewable Energy and Smart Grids for Smart Cities	FDP	Bansal Institute Of Engineering And Technology, Lucknow (U.P.) India	07.03.2022 to 12.03.2022
Mr P SARATH CHANDRAN	One Week online Faculty Development Program on Integration of Renewable Energy and Smart Grids for Smart Cities	FDP	Bansal Institute Of Engineering And Technology, Lucknow (U.P.) India	07.03.2022 to 12.03.2022
	Future Automation of Power System Protection in Indian Power Sector ( FAPSP'21) - Phase II	FDP	University College of Engineering, BIT Campus, Anna University, Tiruchirappalli	11.12.2021 to 24.12.2021

Mrs N G DHARANYA	One Week online Faculty Development Program on Integration of Renewable Energy and Smart Grids for Smart Cities	FDP	Bansal Institute Of Engineering And Technology, Lucknow (U.P.) India	07.03.2022 to 12.03.2022
Ms M KANIMOZHI	One Week online Faculty Development Program on Integration of Renewable Energy and Smart Grids for Smart Cities	FDP	Bansal Institute Of Engineering And Technology, Lucknow (U.P.) India	07.03.2022 to 12.03.2022
	Electric Vehicle Part-1	NPTEL Course	IIT Delhi	March 2022
	National Intellectual Property Rights	One Day Awareness Program	Intellectual Property Office, India	09.03.2022
Ms M KANIMOZHI	Solar Business Development and Energy Efficiency	3-day virtual Training of Trainers (TOT) Program	e Institute of Sustainable Communities (ISC), Mangla Smart Energy Solutions Pvt. Ltd, Tirupur (MSES), and Ram Kalam Centre for Energy Consultancy and Training	27.01.2022 to 29.01.2022

**DEPARTMENT ACTIVITIES**

Sl. No	Name of the Event	Date
1.	<p>National Conference on Power and Energy Systems (NCPES2K22)</p>  	27.05. 2022

2.

Startup on Energy Audit and Energy Saving opportunities in Domestic and Industrial Equipment- seminar

04.05.2022

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

**IEEE** Invitation

WE CORDIALLY INVITE YOU FOR THE  
PSREC-IEEE STUDENT BRANCH (62441) INAUGURATION  
&  
ONE DAY SEMINAR  
**Startups on Energy Audit and Energy Saving Opportunities  
in the Domestic and Industrial Equipments.**

On 4<sup>th</sup> May 2022 at 9.30 A.M.  
Venue: EEE seminar Hall

**Er. S.SIVAKUMAR**  
External Faculty - Petroleum Conservation Research Association  
has kindly consented to be the chief guest and delivers keynote address

**Thiru. R. SOLAISAMY**  
Managing Trustee and Correspondent, P.S.R. Engineering College  
will Preside over the Function

**Er. S. VIGNESWARI ARUNKUMAR**  
Trustee and Director, P.S.R. Engineering College  
will Felicitate the Function

**Dr. B.G.VISHNURAM**  
Principal, P.S.R Engineering College  
will deliver the Inaugural Address

**Dr. P.MARICHAMY**  
Dean, P.S.R Engineering College  
will deliver the Felicitation Address

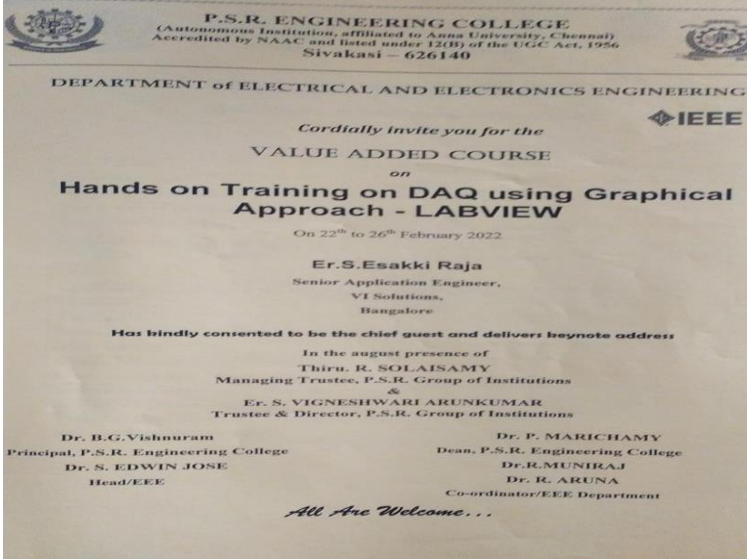

<b>Dr. M. Ulaganathan, ASP/EEE</b> Mr. Rengaraj T, AP/EEE Mr. Prabhu A, AP/EEE <b>Co- Ordinators</b>	<b>Dr. R. MADAVAN</b> ASP/EEE P.S.R. Engineering College <b>PSREC-IEEE SB COUNSELOR</b>	<b>Dr. R. MUNIRAJ</b> HoD/EEE P.S.R. Engineering College <b>Convener</b>
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**ALL ARE WELCOME**





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3.	<p>Value Added COURSE on Hands on Training on DAQ using Graphical Approach – LABVIEW</p> 	22.02.2022 to 26.02.2022
4.	<p>National Level Technical Symposium – SPANGLES 2K21</p> 	03.12.2021

**STUDENT ACTIVITIES**

**WORKSHOPS ATTENDED:**

<b>Name of the student</b>	<b>Date of the event</b>	<b>Title of the event</b>	<b>Institute</b>
N.Jeya Krishana	24.12.2021 to 30.12.2021	Automatic Car Parking system Using Arduino IDE with Ultrasonic Sensor and LCD	Code Bind Technologies, T.Nagar,Chennai-17
S.Raja	24.12.2021 to 30.12.2021	Automatic Car Parking system Using Arduino IDE with Ultrasonic Sensor and LCD	Code Bind Technologies, T.Nagar,Chennai-17
Krithickroshan S	24.12.2021to 30.12.2021	Automatic Car Parking system Using Arduino IDE with Ultrasonic Sensor and LCD	CodeBind Technologies, T.Nagar,Chennai-17
Mahesh Boopathi P	24.12.2021 to 30.12.2021	Automatic Car Parking system Using Arduino IDE with Ultrasonic Sensor and LCD	Code Bind Technologies, T.Nagar,Chennai-17
Manoranjith P	24.12.2021 to 30.12.2021	Automatic Car Parking system Using Arduino IDE with Ultrasonic Sensor and LCD	Code Bind Technologies, T.Nagar,Chennai-17
Palanivel S	24.12.2021 to 30.12.2021	Automatic Car Parking system Using Arduino IDE with Ultrasonic Sensor and LCD	Code Bind Technologies, T.Nagar,Chennai-17
S.Raja	25.12.2021	Android	CodeBind Technologies, T.Nagar,Chennai-17
G.Murugaraj G.Guruvel Sarveshwar	29.12.2021	Automatic Plant Watering System	P.S.R Engineering College,
SIKKANTHAR MYDEEN. R	31.12.2021	Microsoft &Google Certifications with Free “ Ethical Hacking Training”	Microsoft
V.Rishikesh	23.01.2022	Electric Vehicle Battery Management System	SKILL LYNC
S.Anguraj	02.03.2022	National Intellectual Property Awareness Mission	PSR Engineering College
G.Vengadesh	02.03.2022	Awareness Training Program (National Intellectual Property Awareness Mission)	Intellectual Property Office and MoE's Innovation Cell, India
S.HARINATH	02.03.2022	Awareness Training Program (National Intellectual Property Awareness Mission)	Intellectual Property Office and MoE's Innovation Cell, India

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S.Abdul Azeez	02.03.2022	Awareness Training Program (National Intellectual Property Awareness Mission)	Intellectual Property Office and MoE's Innovation Cell, India
G.Guruvel Sarveshwar	02.03.2022	Awareness Training Program (National Intellectual Property Awareness Mission)	Intellectual Property Office and MoE's Innovation Cell, India
P.Yogeshwaran	02.03.2022	Awareness Training Program (National Intellectual Property Awareness Mission)	Intellectual Property Office and MoE's Innovation Cell, India
S.Anguraj	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
P.Krishna Moorthy	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
P. Mahesh Boopathi	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
S.Rukkumani	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
S.Ramesh	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
S.Gobi Krishna	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
R.Arumugakani	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
P.Mahesh Boopathy	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
R.Shanmuga Kumar	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High	National Engineering College, Kovilpatti.

		Voltage Power Apparatus using Soft Computing	
P.Gangatharan	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
T.Surendhar	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
J.Gopikannan	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
V. Jeyasimman	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
M.Muthukumar	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
K.Ravikumar	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
R.Saran Kumar	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
T. Karthick	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
M.A.Vignesh	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.
G.Vengadesh	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College, Kovilpatti.

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S.Abdul Azeez	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College. Kovilpattl
SUBASH M	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College. Kovilpattl
P.Yogeshwaran	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College. Kovilpattl
V.Rishikesh	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College. Kovilpattl
Sundar Rajan	11.03.2022 to 12.03.2022	Condition Monitoring and Diagnosis Techniques for High Voltage Power Apparatus using Soft Computing	National Engineering College. Kovilpattl
V.Rishikesh	30.04.2022	Hands on IOT	AAA College of Engineering and Technology

**SYMPOSIUM ATTENDED:**

<b>Name of the student</b>	<b>Date of the event</b>	<b>Title</b>	<b>Institute</b>
R.MUTHUSELVI	03.01.2022	Quiz	Kumaraguru College of Technology, Coimbatore
G.Guruvel Sarveshwar	03.01.2022	Online Quiz	Kumaraguru College of Technology
SUBASH M	03.01.2022	Online Quiz	Kumaraguru College of Technology
S.Gunadevi	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi
R.MUTHUSELVI	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi
G.Vengadesh	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi
K.Rajkumar	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi

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M.Manjula	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi
S.Abdul Azeez	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi
P. Yogeshwaran	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi
V.Rishikesh	12.01.2022	National Youth Day" E-Quiz	P.S.R.Engineering College, Sivakasi
V.Rishikesh	08.02.2022	Quiz	National Science Day 2022

**INTERNSHIPS:**

Name of the student	Date of the event	Institute
M.Dineshkaran J.Praveen Kumar C.Sankar Dhinesh S.Arjunsingh M.Ganeshkumar S.A.Sreegandh	20.12.2021 to 25.12.2021	TANCEM, Alangulam
Nandha Balan.A Manoj.M Sudarson.K Gurumaharaja.A Karan Kumar.S Manikandan.A Rengaraj.S Dhivakar.R	20.12.2021 to 24.12.2021	Tamil Nadu Generation and Distribution Corporation Kayathar Substation.
Ramesh.S Muthukumar.M Jeyasimman.V Gopala Krishnan.M Johnsolomon.S Sanjeevkumar.G Gobi Krishna.S	20.12.2021 to 24.12.2021	Tamil Nadu Generation and Distribution Corporation Sankarankovil Substation
Jeyakrishna N Krithickroshan S Mahesh Boopathi P Manoranjith P Palanivel S Raja S	24.12.2021 to 30.12.2021(Field Project)	Certification of project Completion Automatic car parking system using Arduino IDE with ultrasonic sensor and LCD- Code bind Technologies, T.Nagar, Chennai-17
N.Ushanandhini	25.04.2022 to 31.05.2022	Business Development at LUDIFU
N.Ushanandhini	25.04.2022 to 31.05.2022	HR Employer Branding at LUDIFU
N.Ushanandhini	25.04.2022 to 31.05.2022	HR Executive at LUDIFU

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N.Ushanandhini	25.04.2022 to 31.05.2022	Marketing Specialist at LUDIFU
N.Ushanandhini	25.04.2022 to 31.05.2022	Social Media Marketing at LUDIFU

**INPLANT TRAINING:**

<b>Name of the Student</b>	<b>Date of the Event</b>	<b>Place</b>
R.Arumugakani C.Arunprashath J.Dhinesh M.Dinesh Krishnan M.Mohammed Nazar R.Sarankumar E.Shanmugakumar A.Suriya M.Udhayakumar S.Veeramanikandan M.VinothKumar P.Krishnamoorthy	20.12.2021 to 24.12.2021	TTPS,Tuticorin
S.Anguraj R.Dhamotharakannan S.Vignesh	22.12.2021 to 24.12.2021	110/230KV Substation, Nallamanayaikanpatti.
Aravind.G Dinesh.R Gangatharan.P Gopikannan.J Rajesh.L	22.12.2021 to 24.12.2021	Tamil Nadu Generation and Distribution corporation Anuppankulam Substation.
Rengaraj.S	25.04.2022 to 04.05.2022	NCC Camp

**KNOW YOUR ALUMNI**

**Mr.V.CHIDAMBARAM**

Alumni: 2019

Department of Electrical and Electronics Engineering

PSR Engineering College,

Sivakasi.



**EDUCATION**

- Course: Diploma in Electrical and Electronics Engineering
- College: PACR Ramasamy Raja Polytechnic College Rajapalayam.
- Year of Passing: 2016
- Course: Bachelor of Engineering in Electrical and Electronics Engineering
- College PSR Engineering College, Sivakasi
- Year of Passing: 2019.

**EXPERINCE SUMMARY**

- Working in **REC Ltd- Warangal** as a post of **Project Engineer**.
- Worked one year in **Shree Abirami Engineering Works, Chennai** as a post of **Site Engineer**.
- Generator **Alignment and Assembly** work in Rengali hydro power station unit 2 (OHPC) Rengali, Power transformer Assembling, dismantling and oil filtration.



**PLACEMENT DETAILS**

<b>S. No.</b>	<b>Name of the student placed</b>	<b>Name of the Employer</b>
1.	SARAVANA KUMAR R	WIPRO Indi Pvt Ltd, Chennai
2.	SANJAY S	ZOHO Corp Pvt Ltd, Chennai.
3.	ARJUNSINGH S	Caliber Interconnect Solutions
4.	VIJAYAVENKATESH G	Caliber Interconnect Solutions
5.	AKASH J	Pinnacle Infotech Solutions
6.	KARTHIKEYAN S	Pinnacle Infotech Solutions
7.	MAHESWARAN M	Pinnacle Infotech Solutions
8.	SIVAPRAKASH P	Pinnacle Infotech Solutions
9.	VAIRA LAKSHMI B	Pinnacle Infotech Solutions
10.	SARAVANABHAVAN V	Ageas Federal Insurance Pvt Ltd, Erode
11.	MUKESH M S	Ageas Federal Insurance Pvt Ltd, Erode
12.	PETCHIMUTHU P	Worksbot Applications Pvt Ltd, Chennai
13.	SANKAR DHINESH C	Worksbot Applications Pvt Ltd, Chennai
14.	VIGNESH P	Worksbot Applications Pvt Ltd, Chennai
15.	MAHESHKUMAR M	PSG & Sons Charities Metallurgy and Foundry Division
16.	DHATCHANAA MURRTHY M A	PSG & Sons Charities Metallurgy and Foundry Division
17.	AARTHI SHUNMUGA LAKSHMI M	JBM Auto parts Pvt Ltd
18.	ABISHEIK I	JBM Auto parts Pvt Ltd
19.	CHANDRU M	JBM Auto parts Pvt Ltd,
20.	DINESHKARAN M	JBM Auto parts Pvt Ltd,
21.	KARTHIKEYAN K	JBM Auto parts Pvt Ltd,
22.	KARUPPASAMY R	JBM Auto parts Pvt Ltd,

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23.	MATHAN S	JBM Auto parts Pvt Ltd,
24.	POIYAZHISAMY N	JBM Auto parts Pvt Ltd,
25.	POOMINATHAN K	JBM Auto parts Pvt Ltd,
26.	RAMALINGAM S	JBM Auto parts Pvt Ltd,
27.	SHARUMATHI R	JBM Auto parts Pvt Ltd,
28.	VANARAJ M	JBM Auto parts Pvt Ltd,
29.	VISHAL M	JBM Auto parts Pvt Ltd,
30.	GANESH KUMAR M	JBM Auto parts Pvt Ltd,
31.	MUTHAMILSELVAN K	JBM Auto parts Pvt Ltd,
32.	RAJESH M	JBM Auto parts Pvt Ltd,
33.	ARMSTRONG A	METEC Design and Construction Engineers India Pvt Ltd, Chennai
34.	GOWTHAM S	METEC Design and Construction Engineers India Pvt Ltd, Chennai
35.	MANOJVEL B	METEC Design and Construction Engineers India Pvt Ltd, Chennai
36.	MUTHUKUMAR B	METEC Design and Construction Engineers India Pvt Ltd, Chennai
37.	PRAVEEN KUMAR J	METEC Design and Construction Engineers India Pvt Ltd, Chennai
38.	SARAVANAKUMAR B	METEC Design and Construction Engineers India Pvt Ltd, Chennai
39.	VIGNESH KUMAR J	METEC Design and Construction Engineers India Pvt Ltd, Chennai
40.	VIJAYASANKAR N	METEC Design and Construction Engineers India Pvt Ltd, Chennai
41.	ARUN KUMAR R	Shree Abirami Engineering Works Pvt Ltd, Chennai.
42.	VELSAMY M	Shree Abirami Engineering Works Pvt Ltd, Chennai.
43.	MAHALINGAM V	Shree Abirami Engineering Works Pvt Ltd, Chennai.
44.	VISWANATH S B	Shree Abirami Engineering Works Pvt Ltd, Chennai.

**STUDENT ARTICLE**

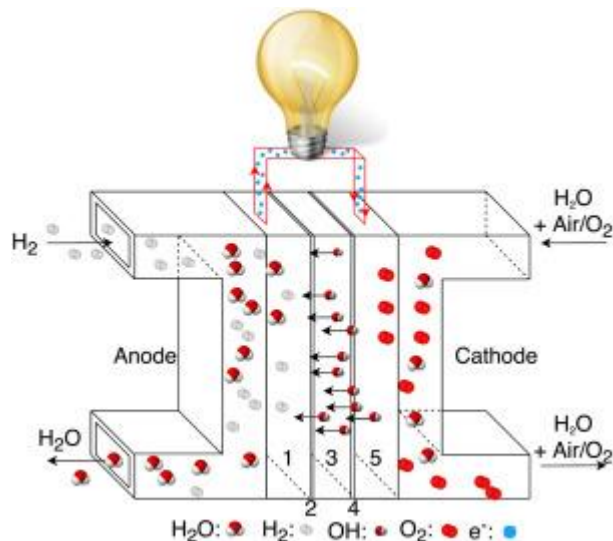
## **Alkaline fuel cell technology**

The alkaline fuel cell (AFC), also known as the Bacon fuel cell after its British inventor, Francis Thomas Bacon, is one of the most developed fuel cell technologies. Alkaline fuel cells consume hydrogen and pure oxygen, to produce potable water, heat, and electricity. AFCs are the cheapest fuel cells to manufacture. This is because the catalyst required on the electrodes can be selected from a number of materials that are relatively inexpensive compared with the catalysts required for other types of fuel cells.

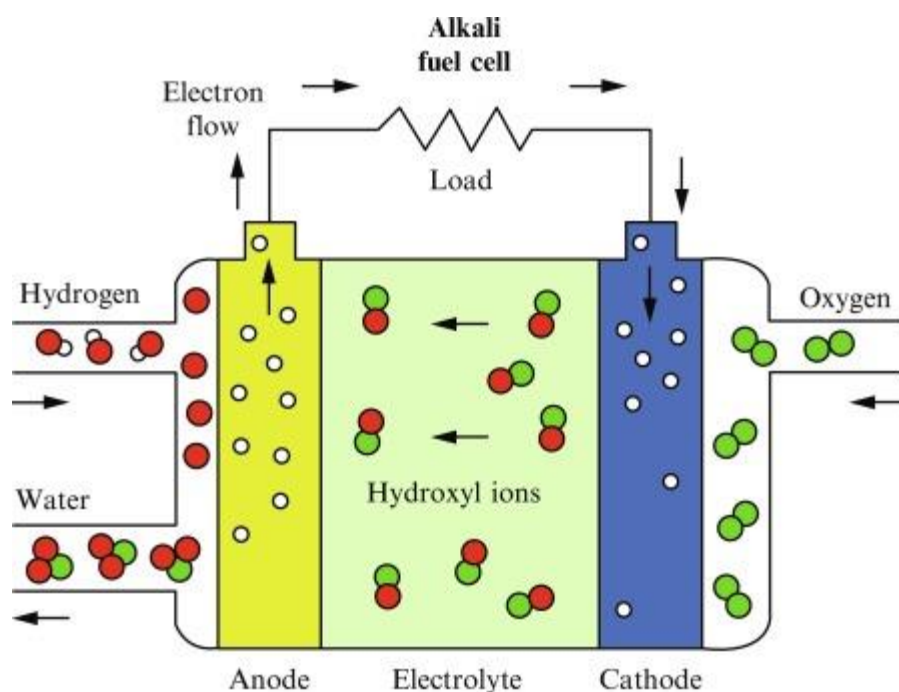
The charge carrier for an AFC is the hydroxyl ion ( $\text{OH}^-$ ) transferred from the cathode to the anode, where it reacts with hydrogen to produce water and electrons. Water formed at the anode is transferred back to the cathode to regenerate hydroxyl ions. When operated, the AFC produces electricity and the by-product is heat.

### **Universal components to alkaline-based fuel cells**

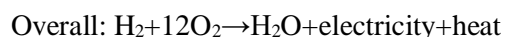
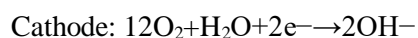
All fuel cells are based on the principle that fuel reacts at the anode, and air or oxidant at the cathode of an electrochemical system that produces electric power and some excess heat. In this regard, alkaline-based fuel cells are no different from acidic Proton Exchange Membrane Fuel Cells (PEMFCs). The general workings of an alkaline-based fuel cell, utilizing either a liquid or a polymer electrolyte.



The essentials of alkaline-based fuel cells, where layer 1 and 5 represent the anode/cathode Gas Diffusion Layer (GDL), layer 2 and 4 the anode/cathode Catalyst Layer (CL) and layer 3 the liquid/polymer electrolyte.



Reactions that take place in anodes and cathodes are written as



The electrolyte in this FC is mobilized or immobilized potassium hydroxide in asbestos matrix. Operation temperature is between 65°C and 220°C.

The charge carrier in AFC is  $\text{OH}^-$  and like other low-temperature FCs, AFC works with hydrogen and oxygen. CO and  $\text{CO}_2$  poison AFCs and reduce considerably the efficiency of an AFC, so it needs external reformer to provide pure hydrogen.

### **Alkaline catalyst materials**

The following sub-section is developments within the various classes of HOR and ORR catalyst materials in an alkaline environment.

### **Hydrogen oxidation reaction**

The hydrogen oxidation reaction and its complement the Hydrogen Evolution Reaction (HER) are two important reactions in several technologies such as fuel cells, chlorine manufacturing and water electrolysis. Comparative to the HOR, the HER has been thoroughly studied through the development of alkaline water electrolyzers. There is a notable asymmetry between the anodic (HOR) and cathode (ORR) fuel cell reactions in terms of applied R&D efforts due to the early focus on surmounting the

low Exchange Current Density (ECD) of the ORR ( $10^{-4}$  mA cm<sup>-2</sup> for ORR vs. 1 mA cm<sup>-2</sup> for HOR). Consequently, there are many remaining challenges related to developing and understanding electro catalytic materials for the HOR. There is a large variety of possible fuels for AFC anodes, specifically borohydride, hydrazine, ammonia, methanol, ethanol, and ethylene glycol. The choice of fuel will in turn determine which catalyst materials are available as these depend on the source of hydrogen. The ensuing sub-section pertains only to catalysts developed for the HOR using pure hydrogen gas as fuel.

HER/HOR have revealed notably slower reaction kinetics in alkaline electrolytes compared to acidic ones, lagging with approximately two magnitudes using the Exchange Current Density (ECD) as a measuring factor. A study on the pH dependence of the HER/HOR affiliated it to a change in the configurational entropy as the proton approaches the electrode surface. Other studies have suggested the Hydrogen Binding Energy (HBE) as a possible sole descriptor of HER/HOR activity.

#### **Platinum groups metals (PGM)**

Platinum (Pt) represents the pinnacle of electro catalytic performance regardless of whether hydrogen is reduced or oxidised. This has been a favoured material in AFCs as a single, binary, ternary or bimetallic combination similarly with PGMs like palladium, iridium and ruthenium. The acidic ECD of the HOR on platinum lays two orders of magnitude above its alkaline counterpart, in the region of 1 mA for polycrystalline Pt and carbon-supported Pt. The experimental ECD was investigated on commercial Pt/C (46 wt) and polycrystalline Pt in alkaline conditions, resulting in values of 0.57 and 0.69 mA respectively.

Despite the considerable price and scarcity of PGMs such as ruthenium and iridium, they are still used in the development of electro catalytic materials however their employment for AFC applications is increasingly niche compared to the increasing R&D focus on non-PGM catalysts. Where alloys of iridium, palladium and ruthenium on carbon were found to display greater HOR activity measured against both Ir/C and Pt/C in their pure forms. Namely, the alloys Ir<sub>9</sub>Ru<sub>1</sub>/C and Ir<sub>3</sub>Pd<sub>1</sub>Ru<sub>6</sub>/C were found as the most active. The growth in catalytic activity was partly credited a decline in HBE.

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