



Principal's Message

This research bulletin is a platform for our faculty and students to share relevant news and introduce useful research resources to colleagues. It provides an environment conducive for conducting research which helps our faculty and students to prepare innovative research proposals. I have no doubt that our research culture is taking root and I look forward to seeing enhancements in both quantity and quality. I wish all success.

Dr. Sheeba V S

A3 F Teacher Award to Dr. Ranjini Bhattathiripad T

A3 Foundation is an organization promoting sustainable and innovative architecture in India and abroad. It is one of the national organisations in India which acknowledges the contribution of teachers, journalists and writers in the profession of architecture besides promoting students through awards annually. Dr. Ranjini Bhattathiripad T, Professor and Head of Architecture Department of our college was selected for the A3 F TEACHER AWARD in Architecture for the year 2018 -19 by A3 Foundation, Chandigarh, and received the same on 16th February, 2019 at a function at Chandigarh.



GEC's Proud Moments



Heartfelt Congratulations...

Research Advisory Council of GEC Thrissur has immense pleasure to congratulate four of our faculty members Prof. Mubarak A K (ME), Prof. Suhara E M (EEE), Prof. Jayasree N (PE), Prof. Jayasree M (CSE), Prof. Sujatha I (PE), Prof. Roy Farancis (ECE) and Prof. Sunil DT (PE) for acquiring Ph. D.



Prof. MUBARAK A K

Prof. Mubarak A K, Dept. of Mechanical Engineering secured his doctoral degree from CUSAT. Title of his thesis was "Investigation on Shock Cell Parameters in Jets Emanating from Conical, Bell and Double Parabolic Nozzles". His research work was supervised by Dr. Tide P S, CUSAT Cochin.



Prof. SUHARA E M

Prof. Suhara E M, Dept. of Electrical & Electronics Engg. obtained Ph. D from University of Calicut. She accomplished it under the supervision of Dr. M. Nandakumar, Professor EEE. Title of her thesis was "Design, Analysis and Implementation of Bidirectional Converter for Grid Integrated Off Board Electric Vehicle Battery Charge and Discharge Control".



Prof. JAYASREE N

Prof. Jayasree N, Dept. of Production Engg. received Ph. D in Mechanical Engineering from NIT Calicut. Dr. T Radha Ramanan and Dr. R Sridharan, NIT Calicut were the research supervisors. Her topic of dissertation was "Aggregate demand forecasting in the context of Vector Integrated Moving Average Process"



Prof. JAYASREE M

Prof. Jayasree M, Dept of Computer Science & Engg. received Ph. D from Kannur University. Title of her Thesis was "Detection and analysis of human face images altered by disguise for computer recognition". She did her work under the supervision of Dr. N.K. Narayanan, Professor, Department of Information Technology, Kannur University.



Prof. SUJATHA I

Prof. Sujatha I, Dept. of Production Engg., took her doctoral degree from Indian Institute of Technology Madras, under the supervision of Prof. G. Venkatarathnam, Dept. of Mech. Engg., IITM. Her research topic was "Studies on Vapour Absorption Refrigerators and Heat Transformers operating with Ionic Liquids as the Absorbent".



Prof. ROY FRANCIS

Prof. Roy Francis, Dept. of Electronics & Communication Engg., took his Ph. D from Anna University Chennai. Dr. Meganathan D, Anna University Chennai was his supervisor. Title of his thesis was "Novel Modulation Strategies to Improve the Performance Metrics of Multilevel Inverters and Their Implementation".



Prof. SUNIL D T

Prof. Sunil D T, Dept. of Production Engg. secured his Ph. D degree from Anna University, Chennai. Title of his work was "Investigations on the Implementation of Agile Manufacturing Paradigm In The Production of Desiccant Compressed Air Dryer Through the Application of CAD Based Assembly Sequence Planning". Dr. Devadasan S R., PSG College of Technology, Coimbatore was his supervisor.

(Please find page 14 for Ph.D Abstracts)

Nodal Centre for Robotics & Artificial Intelligence' (NCRAI) Works in Progress!



Our prestigious research centre “**Nodal Centre for Robotics & Artificial Intelligence**” (NCRAI) is in the final stage of setting. “This centre will be inaugurated within four months. An artificial intelligence lab equipped with Dual Arm Collaborative Industrial Robot with features like ROS and High Accuracy manipulator will be the first of its kind in our nation. This has applications ranging from the manufacturing automobiles to health care”-said **Dr. Sudheesh R S** and **Dr. Lalu P P**, the coordinators of the centre. The centre intends to promote interdisciplinary research in visual based robotics, interdisciplinary projects, training programs to students and faculty of colleges, Polytechnics, THS under DTE. Presently the centre is forging collaborative engagement with TOYOTA Technical Institute Japan (TTI) in the field of self driving vehicles using artificial intelligence. After setting the laboratory the following research/technical facilities will be available to students and researchers.

- ✓ Dual Arm Collaborative Industrial Robot
- ✓ High Resolution LIDAR (Laser range finder)
- ✓ High level workstation with GPU
- ✓ Sound source mapping hardware
- ✓ Sensors and actuators
- ✓ Array of high resolution 3D cameras

National Doctoral Fellowship (AICTE)

We are happy to announce that four of our meritorious research scholars got National Doctoral fellowship under RPS-NDF Scheme. QIP center of AICTE was the selection body. The duration of the scheme is 3 years. IRAC congratulates the students and research supervisors and wish all the best in their venture. The Details of the awardees, title of the project, names of principal and co-investigator and the amount of fellowship are shown below.

Project 1: Title: *Efficiency and Reliability Improvement of traction Inverter in an Electric Vehicle.* Principal Investigator: *Dr. Jiji K S*, Research Student: *G. Pavan Kumar*, Grand-in-aid Sanctioned: Rs. 23,00,000/-

Project 2: Title: *Optimal robotic path planning in dynamic environment using soft computing technique.* Principal Investigator: *Dr. Jiji K S*, Co-investigator: *Dr. Abdul Saleem P K*, Research Student: *Najva N*, Grand-in-aid Sanctioned: Rs. 14,90,000/-

Project 3: Title: *Sliding Mode Control: Applications in Electric Vehicles.* Principal Investigator: *Dr. Jasmin E A*, Co-investigator: *Dr. Ramesh Kumar P* Research Student: *Dimna Denny C*, Grand-in-aid Sanctioned: Rs. 5,20,000/-

Project 4: Title: *Efficiency of iron removal from surface water using surface modified immobilized nano zero valent iron,* Principal Investigator: *Dr. Meera V.* Co-investigator: *Dr. Vinod P Rapheal*, Research Student: *Jismy Antony*, Grand-in-aid Sanctioned: Rs. 4,60,000/-



KTU TECHFEST 2019

The annual technological extravaganza "KTU Techfest 2019" was hosted by our college during 15-17 February 2019. KTU TECHFEST was jointly organized by APJ Abdul Kalam Technological University (APJAKTU) and Kerala State Council for Science Technology and Environment (KSCSTE). Major events organised as part of the TECHFEST were KETCON, TEKON, QUIZCON and IDEA IS MONEY. KETCON was a platform for paper presentation by students and researchers at the national level. A competition cum exhibition named TEKON was organized for innovative engineering projects. QUIZCON was the technical quiz competition organised separately for college students and high school students. IDEA IS MONEY was a venue for the students to present innovative ideas.

Dr. Thajudin Ahamed V I, Professor and HoD of ECE Department, was the General convener of KTU Techfest. *Prof. Premanand B*, Associate Professor ECE and *Dr. Suresh K. Damodaran*, Associate Professor EEE, were the Joint Convenors. *Shri Adarsh V.S.* and *Shri.Rahul Ravi R* were the General Convenor and Organising Secretary, respectively, from student's side.

The inauguration of KTU Techfest 2019 was held on 15th February 2019 at the Millennium Auditorium. The function, presided over by Adv. V. K. Sureshkumar, councillor of Thrissur Corporation, was welcomed by Dr. Vrinda V. Nair, Dean Research of APJAKTU. Inauguration was done by Dr. R. A. D Pillai, the former deputy director of VSSC. Dr. Ajit Prabhu V, Chief Scientist of KSCSTE, Dr. J. Sreekumar, Dean Academics of APJAKTU, Dr. Radhakrishnan G. Pillai, & Dr. Sudha T, Syndicate Members APJAKTU, Sri. E. Balakrishnan, PTA President, Prof. T. Balakrishnan, Vice President of Alumni Association, *Dr. N. Sajikumar*, Convenor

of Diamond Jubilee Celebrations and *Sri. Adarsh V. S*, College Union Chairman felicitated the function. *Dr. Jayanand B*, Principal, GEC Thrissur proposed the vote of thanks.

The Kerala State Technological Congress (KETCON) 2019 is an initiative of the Centre for Engineering Research and Development (CERD), the research arm of KTU to provide a platform to the students to showcase their ideas and research experience for the benefit of the society. The 2019 edition of KETCON was hosted by GEC Thrissur from 15-2-19 to 17-2-19. There were twenty presentation tracks in all. A total of 788 papers were received. After peer reviewing, 433 papers were accepted for presentation. 125 research articles were presented by our students. In general, the quality of the research papers and presentations were good. Three of our students received best paper award, which is listed below. IRAC take this opportunity to congratulate our students who secured the best paper award.



The programme TEKON was mainly intended to showcase the socially useful technical projects. A total of 140 project presentations & their exhibitions were done by various teams from different colleges. Three projects presented by our students got awards whose details are given below.

The programme QUIZCON was the technical quiz competition organised separately for college students and high school students.

The event IDEA IS MONEY was organised for fetching innovative ideas. It was a wonderful platform to share the innovative technical ideas of students. Our student bagged a prize for the same and details are given below.

OPEN HOUSE was a platform to showcase the facilities and developments of various departments to the students of nearby educational institutions and public. Thousands visited the campus during these days.

Details of various programmes under KTU TECHFEST 2019

Programme	Faculty/Staff Co-ordinators	Student Co-ordinators
KETCON	<i>Dr. Shalij K P and Dr. Nowshaja P T</i>	<i>Ejas Ahammed and Peeru Muhammed M</i>
TEKON	<i>Prof. Abdul Samad P A and Prof. Rahul K R</i>	<i>Jayadeep B Vinod and Nighin U</i>
QUIZCON	<i>Prof. Anil Rajagopal and Dr. Jiji K S</i>	<i>Abhilash M</i>
IDEA IS MONEY	<i>Prof. Sajit C Subramanian and Shri. Sajithkumar M</i>	<i>Swathy Krishna K K and Tony C A</i>
OPEN HOUSE	<i>Dr. G Venugopal and Prof. Asha B</i>	<i>Hijab C P</i>

Tracks and respective track chairs of KETCON

Track No.	Track Name	Track Chair
1	Internet of Things	<i>Prof. Gopi C, ECE</i>
2	Embedded Systems and VLSI Technology	<i>Prof. Mohamed Salih K K, ECE</i>
3	Robotics	<i>Dr. Lalu P P, ME</i>
4	Energy Technologies	<i>Dr. K K Ramachandran, ME</i>
5	Fluid and Thermal Engineering	<i>Dr. Rekha L, Dr. Pradeep Kammath, ME</i>
6	Innovations in Biomedical Engineering	<i>Prof. Sindhu N, ECE</i>
7	Image Processing Applications	<i>Prof. Latha K N, ECE</i>
8	Control and Instrumentation	<i>Dr. Ramesh Kumar P, EEE</i>
9	Innovations in Civil Engineering and Practices	<i>Dr. Subaida E A, CE</i>
10	Power Electronics and Power Systems	<i>Dr. Jaison Mathew, EEE</i>
11	Developments in Computer Applications	<i>Dr. Reena B, MCA</i>
12	Signal Processing and Communication	<i>Prof. Premanand B, Prof. Shamla B, ECE</i>
13	Artificial Intelligence in Engineering	<i>Prof. Rahmathulla K, CSE</i>
14	Trends in Computer and Information Technology	<i>Prof. Vipin Kumar K S, CSE</i>
15	Operation Management	<i>Dr. Rajesh Vanchipura, ME</i>
16	Manufacturing Technology	<i>Dr. Maneesh K K, ME</i>
17	Chemical Processing and Process Control	<i>Dr. Manju M S, CHE</i>
18	Nano Materials and Smart Materials	<i>Dr. Vinod P Raphael, Chemistry</i>
19	Sustainable Engineering	<i>Dr. Meera V, CE</i>
20	Rebuild Kerala	<i>Prof. Surya S, Architecture</i>



Details of Prize winners of GEC Thrissur in KTU TECHFEST 2019

Title of Project/Idea/Paper	Team members	Prize
Evaluation of Mrr And Twr In Micromachining of Shape Memory Alloy Using Wet And Dry Micro-Edm	Mr. Aneesh P D Dept. of Mechanical Engg.	Best paper award in the track Manufacturing Technology
Preparation and characterisation of activated carbon prepared from Aeglemarmelos Fruit Shell using Muffle Furnace for Fluoride Removal	Ms. Sony K Cherian Dept. of Chemical Engg.	best paper award in the track Chemical Processing and Process Control
Introducing Artificial Intelligence traffic management for a sustainable urban development”	Mr. Nikhil A S Dept. of Architecture	Best paper award in the track Rebuild Kerala, with cash award of Rs. 20,000/-
Synthesis of carbon catalyst from human urine and its performance in proton exchange membrane fuel cells	Ms. Srilekshmi M Dept. of Chemical Engg.	Best Idea in ‘Idea is Money’ contest with cash prize Rs. 1,00,000/-
Flight Force - Drones for Rescue	Athira P T, Anjali U, Dinusha P, Aishwarya N P, Dept. of CSE.	TEKON First prize (Rs. 50,000/-)
Automated Aquaponics System	Mohammed Nishad O, Anjana K, Nizamudheen, and Jinson, Dept. of ECE	NeST awards for Innovative Technologies (Rs. 50,000/-)
Parksglove	Alina Anee Furtado, Aswini S. Kamath, Annie Sajayan, Sebin Wilson, Dept. of ECE and Vaisakh Mohan, Dept. of EEE	Special prize of Rs. 5,000/-
Humanoid Teaching Robot	Mohammed Rishan N K, Jayakrishnan K, Aashik M S, Vijay A., Jamsheed P Dept. of ECE	Special prize of Rs. 5,000/-

The valedictory ceremony of KTU Techfest 2019 was held on 17th February 2019, at the Millenium Auditorium. Dr. Vrinda V. Nair, Dean Research of APJAKTU welcomed the gathering. The function presided over by Smt. Ajitha Vijayan, Hon. Mayor of Thrissur Corporation was inaugurated by Adv. V. S. Sunil Kumar, Honourable Minister for Agriculture. He also distributed the awards for KTU Researcher of the year 2018 and to the National award winning sports persons of APJAKTU. The Techfest summary was presented by Dr. Ajit Prabhu V, Chief Scientist of KSCSTE, and the valedictory address was given by Dr. P. B. Sunil Kumar, Director of IIT Palakkad. The prizes were distributed during this function. The felicitations were given by Adv. V. K. Suresh Kumar, Councillor of Thrissur corporation, Dr. S. Shabu, Controller of examinations, APJAKTU, Dr. Mohandas V P, Syndicate member of APJAKTU, Shri. Rahul Ravi R, Syndicate member of APJAKTU, Sri. Dinesh P. Thampi, Head of TCS, Kerala Centre, Dr. Poulouse Jacob, Senior Advisor of Nest SFO, Sri. Pius Varghese, C. O. O of Vinvish technologies, Sri. Srinivasan Ravindran, Program head of ICFOSS and Sri. E. Balakrishnan, PTA President. The Techfest review was presented by Dr. ThajudinAhamed V. I, Techfest General Convenor. Dr. Jayanand B, Principal, GEC Thrissur extended the vote of thanks.



CONFERENCE PAPERS

BEST PAPER AWARD

Needhu Varghese, Ph. D student EEE, secured the **BEST PAPER AWARD** in International Conference on Perception in Biomedical Engineering and Affordable Healthcare Technologies (MEDCON – 2019) for her presentation on the research topic “*Maximum Power Point Tracking of Standalone Photovoltaic System for a DC House*”. The research work was done under the supervision of Dr. Reji P. Hearty congratulation to award winner and her supervisor.

Albert P and **Kumar P R**, presented a paper on “Performance of Load Frequency Control for a Two-area Interconnected Power System Using Twisting Control”, in the International Conference on Intelligent and Control Systems, ISBN: 978-1-5386-8112-1, Madurai, 15-17 May 2019 (IEEE).

KETCON 2019: 125 Research articles have been presented by our PG/Research students in KETCON 2019. Due to the limitation of space the details are not included in this volume. IRAC congratulate all the students and their supervisors for their contribution to the conference.

D C Meeting and Open Seminar

- ✓ Synopsis submission and open seminar for **Smt. Divya A H**, Tradesman, Department of Chemical Engineering (Supervisor - Dr. Solomon P A) was conducted on 07.01.2019.
- ✓ The D C meetings for the Ph. D scholars of Department of Chemical Engineering **Mr. Francis John V** and **Mrs. Sosamony K J** (Supervisor - Dr. Solomon P A) were conducted on 13.6.2019.
- ✓ Ph.D pre-submission open seminar of **Mr. Ramkumar P N** (Supervisor - Dr. Satish K P), Department of Production Engg., was conducted on 17.06.2019.



Dear Colleagues,

GECT Research Bulletin is the official research news bulletin of GEC Thrissur, intended to publish research activities of Students and Teachers. Kindly send the details of your research activities (listed below) to the e-mail address gectresearchbulletin@gectcr.ac.in at the earliest.

The newsletter focuses on the following:

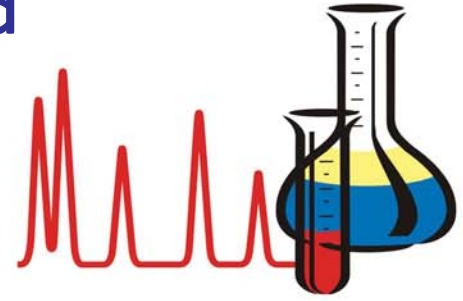
- ▶ **Publications of faculty/staff/students in International/National Journals/Conference proceedings (please send the abstract)**
- ▶ **Awards/Achievements of faculty/staff/students in Research and Development activities**
- ▶ **Award of project funding/grants from external agencies**
- ▶ **Achievements of GECT Innovation centre**
- ▶ **Articles on latest research trends by faculty/staff/students**
- ▶ **Details with photograph of faculty/staff/students who secured Ph. D degree**
- ▶ **Details of Ph. D registration of faculty/staff/students under various research guides of our college and other institution.**
- ▶ **Details of synopsis presented/DC meeting held etc.**

-Editors

Editors: **Dr. Vinod P Raphael** (Dept. of Chemistry) and **Prof. Anish Babu K K** (Dept. of Electronics & Commn. Engg.). Contact: Mob: 9287560416, 9288194930, E-mail: gectresearchbulletin@gectcr.ac.in
Design & Layout by **Smt. Shincy T P**, Dept. of Electronics & Communication Engineering

Wishes to the newly joined Ph. D scholars

IRAC wishes to the newly joined research students all the best in their future endeavours and offer whole hearted support. The details are given below.



Name of Scholar	Department	Research Guide	Research Area	University
Tennison K Jose Asst. Professor, ME	ME	Dr. K.K. Ramachandran ME, GEC Thrissur	Alternate IC Engine Fuels	KTU
Abitha K K	EEE	Dr. Solomon Antony P & Dr. Abdul Saleem, GECT	UAV-Trajectory control	KTU
Anish Babu K K Asst. Professor, ECE	EEE	Dr. Jiji K S GEC Thrissur	Image Enhancement	KTU
Biju C A Asst. Professor, ARCH	ARCH	Dr. Dili A S TKM college	Traditional & Modern buildings of Kerala	KTU
Sujith K M Asst. Professor, ARCH	ARCH	Dr. Dili A S TKM college	Light weight constructions	KTU
Bindu C A Asst. Professor, ARCH	ARCH	Dr. Subha V CUSAT	Community resilience in urban planning	CUSAT
Bindu A G Asst. Professor, CE	CE	Dr. George K Varghese NIT Calicut	Air pollution forensics	NIT Calicut
Asha B Asst. Professor, CE	CE	Dr. Manu Santhanam IIT Madras	Concrete Technology	IIT Madras

CHERUVATHUR 2040- A MASTR PLAN

(A VENTURE OF DEPT. OF ARCHITECTURE)

Cheruvathur is a village brimming a rich culture and history, with a strong community and heaps of potential for economic and social development. The uniqueness of the village is the existence of a strong rural and urban character. The panchayat has also won the Swaraj trophy numerous times as the best panchayat in Kasaragod. The village, like any other village, is in a state of transition from rural to urban and, thus, is an ideal time to create plans to aid the panchayat in its transition from a rural area to an urban area.



The project aims to prepare a holistic Master Plan for Cheruvathur, incorporating the guidelines in the framework for SAGY. The primary vision is to create a city, sustainable in nature with an emphasis on Tourism and infrastructure development, also aiding to the holistic development of its citizens. The study is primarily divided into two parts with the first part being, to gain a detailed insight into the various aspects of the panchayat, and the second part being focused on various proposals and to help achieve the objectives set along with improving the overall living conditions of the panchayat. In this regard, all aspects of the town were studied, from origin and history to the latest initiatives of Governance. The physical aspects of the town along with the spatial distribution and the concentration of the various Land Uses, aided in identifying the trends of land use and along with the growth pattern. The study of Transportation and Infrastructure facilities helped to identify the potential and rising issues which mainly affects the day to day life of the people and has a significant impact on the living conditions of the panchayat. The Demographical Study along with Socio-cultural and Socio-Economic aspects of Cheruvathur lead to the better understanding of the society and day to day life, enabling the team to gauge the development taking place in the panchayat area, together with economic growth over the years. It helped identify new areas of focus which can improve the economic growth and social development of the town. Tourism, one of the potential economic generating activities of the panchayat, is studied with an emphasis to protect the ecology of the region and ensuring the various tourist activities are within the carrying capacity

of the region. The first part concludes with the various inferences and observations of the various sectors. Each of the sectors ends with the a SWOC assessment indicative of their strengths, Weaknesses, Opportunities, and Challenges. This helped the team to understand the various positive and negative aspects of the panchayat, which aided in the creation of various strategies and proposals to help in addressing the various issues and thus enabling the Panchayat to grow into a strong Municipality.

Part II deals with the findings, its proposals, and the implementation strategies. The findings were consolidated based on an extensive primary and secondary studies, and household survey. The summary and findings of the detailed study was based on the suggestions from stakeholders and from Grama Sabhas that were held during the study. Child participation was also encouraged. The goals and objectives were formulated, focusing on the overall concept of development which focuses mainly on the development of Endogenous Tourism in the panchayat, environmentally sensitive areas, and connectivity. The population was projected and the demand of infrastructural facilities in the horizon year was checked. Based on the findings, strategies and detailed proposals were framed under the various categories of Heritage, Ecology, Economy, Endogenous Tourism, and Infrastructure.



Fuel Cells – The Future



Dr. K.K. Ramachandran
Dept. of Mechanical Engg.

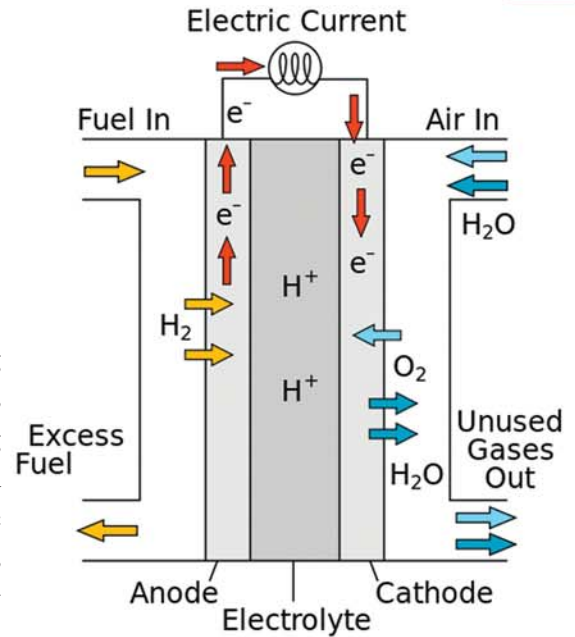
Depletion of fossil fuel reserves, uncertainty in petroleum prices and alarming environmental degradation due to the burning of fossil fuel are impending threats that the world is facing today. Among the alternatives, fuel cells are promising substitute for combustion based energy conversion devices such as IC engines and steam/gas turbines. In a typical hydrogen (H_2) fuelled fuel cell, direct current electric power is produced due to the electrochemical oxidation of hydrogen. Fuel cells produce much smaller quantities of greenhouse emissions as they mostly emit only heat and H_2O as by-products. They are, also, far more energy efficient than traditional combustion based IC engines and gas/steam turbines. All fuel cells have the same basic configuration; an electrolyte with two electrodes – the anode and cathode - on either side of the electrolyte. There are different types of fuel cells based on the type of electrolyte material but the polymer electrolyte membrane fuel cell (PEMFC) and solid oxide fuel cell (SOFC) are gaining more research attention due to their superior performance and application potential.

In a PEMFC, only pure H_2 and O_2 can be used as fuel and oxidant, respectively and noble metal electrodes such as platinum (Pt) are required to promote low temperature ionization of H_2 . But in SOFCs, due to its high temperature operation, use of different fuels such as H_2 , CO, CH_4 , diesel, methanol, LNG etc. are electrochemically feasible and air, chlorine etc. can be used as the oxidant. Also, non noble metal materials can be used as electrodes in SOFCs. Fuel cells have already found application in automotive, locomotive, marine, domestic, community and military sectors as independent or auxiliary power source and combined heat and power (CHP) units. The decrease in the cost of fuel cells (\$250 per kW in 2005 to about \$50 per kW in 2015) and the improved cell life have significantly contributed for the rise in application of fuel cells. Among other matters, the relatively short range of electric vehicles (about 200 km per full charge) and higher time taken to recharge the battery are the driving force towards fuel cell powered vehicles. The growing awareness and interest in microgrids and distributed generation concepts have encouraged the use of SOFCs as CHP units and stand alone power sources for townships and independent buildings.

Toyota's Mirai (launched in 2016), Honda's Clarity (launched in 2018) and Hyundai NEXO (launched in 2019) are cars powered by PEMFCs. By the end of 2018, Toyota has sold around 7,500 units of Mirai in 16 countries. Now,

they are switching over to mass production with a targeted annual sale of 30,000 units. Hyundai plans to invest over 6 billion Euros to make 7,00,000 fuel cell vehicles, annually, by 2030. Leading MNCs like Bosch, Delphi, BMW, Daimler, GM, Nissan etc. are currently carrying out intense research in the area of fuel cell vehicles, already launched prototypes and expected to come out with PEMC and SOFC powered commercial cars and trucks in the near future. In Japan, efforts are under way to increase the number of fuel-cell powered vehicles on its roads to 40,000 by 2020. At present, China has only about 1,500 fuel cell powered vehicles in use but they are planning to lead the way, targeting 2 million fuel cell vehicles by 2030. Citing the example of China, India is also, now, focusing on development of fuel cell vehicle technology and has set a target for over one million fuel cell vehicles and 1,000 hydrogen refuelling stations by 2030. Also, different power-train technologies are expected to converge, leading to an almost equal distribution of internal combustion engines (ICEs), plug-in hybrid electric vehicles (PHEVs), battery electric (BEVs) and fuel cell vehicles (FCVs) by 2040.

In a hydrogen driven future society, energy efficient production of H_2 from renewable sources will be a necessity for sustainability. At higher temperature, for electrolysis of water, the electrical energy required is less. Thus, focused research on solid oxide electrolysis cells (SOECs) employing high temperature electrolysis (HTE) of water and such other techniques for the efficient production of H_2 is required to nourish the technological advancements in the field of fuel cells.



Schematic diagram of H_2/O_2 fuel cell

Congratulations to the Contributors of Research Papers to the Journals

Mechanical Engineering

Shashi Kumar S, Murugan N, **Ramachandran K K**, “Identifying the optimal FSW process parameters for maximizing the tensile strength of friction stir welded AISI 316L butt joints”, *Journal of Measurement* (2019), 137, pp 257–271. <https://doi.org/10.1016/j.measurement.2019.01.023>

Abstract: *AISI 316L stainless steel sheets were friction stir welded in the butt joint configuration as per the design of experiment (DoE) developed using the response surface method; Box Benken design. The primary friction stir welding (FSW) process parameters; tool spindle speed, tool transverse speed, downward force and tool tilt angle were considered as factors of the experiment. A response surface (second order) regression model for the response, ultimate tensile strength (UTS) of the joints as a function of tool spindle speed, tool transverse speed, downward force and tool tilt angle was developed. Statistical tests such as ANOVA, F- ratio and values of actual and adjusted R^2 were used to verify the adequacy of the developed model and the model was validated using conformity experimental trials. The analysis of the model showed that the UTS of the joint is sensitive to all the primary FSW parameters. Also, the tool spindle speed, tool traverse speed and downward force have significant interaction effect on the UTS of the joints. The non-linear optimization of the FSW process yielded 604 MPa as optimal UTS corresponding to optimal tool spindle speed of 597 rev/min, tool traverse speed of 74 mm/min, downward force of 13 kN and tool tilt of 1.5°.*

Shashi Kumar S, Murugan N, **Ramachandran K K**, “Friction Stir Welding of AISI 316L Stainless Steel in a 3.5 NaCl Aqueous Solution: Metallurgical and Mechanical Characterization”, *Journal of Materials Performance and Characterization*. <https://doi.org/10.1520/MPC20180116>

Abstract: *Submerged friction stir welding (SFSW) was employed for joining AISI 316L stainless steel sheets. The effect of submerged friction stir welding on the metallurgical and mechanical properties of the weld joints was studied by varying tool rotational speed from 600 to 1,400 r/min, in steps of 400 r/min with other constant process parameters (welding speed of 55 mm/min, axial force of 12 kN, and tool tilt of 1.5°) in an artificially prepared 3.5 sodium chloride aqueous solution chamber. Characterization studies, such as scanning electron microscopy and electron backscattered diffraction, were used for studying the microstructural studies of the weld zone. The results of the experimental analysis reveal that the SFSW joints exhibited overall better joint strength, and the weld made at 1,000 r/min was superior in terms of strength and microstructural features to that of the base steel. The pitting corrosion behavior of the base steel and the weld joints depicts a stable pitting potential with no active passive behavior, in which the pitting corrosion resistance of all weld joints was marginally higher, especially the weld joint made at 1,000 r/min, which was superior to that of the base steel. The existence of the secondary precipitates was ruled out in all the cases, owing to lower peak temperatures and continuous (fast) cooling of the weld zone.*

Electronics & Communication Engineering

Roy Francis, Meganathan D, “A dual-mode cascaded H-bridgemultilevel inverter for improving THD” *Electrical Engineering* (2019), 101, pp. 225–237

Abstract: *Conventionally, multilevel inverters utilise multi-carrier pulse width modulation or multi-stepped (staircase) modulation to produce high-power quality waveforms. Though multi-carrier modulation schemes reduce total harmonic distortion (THD), they lead to considerable switching loss at higher modulation indexes. The staircase modulation, which operates at low switching frequencies, has a limitation of excessive high THD at low modulation indexes, making it unsuitable at lower modulation indexes. The proposed modulation technique blends the advantages of multi-carrier pulse width modulation and staircase modulation to improve the THD and reduce the switching losses over a wide range of modulation indexes. The proposed multilevel inverter employs a modified level-shifted multi-carrier modulation at lower modulation indexes and shifts to sinusoidally approximated multi-stepped at moderate and higher modulation indexes. The carrier frequency of the multi-carrier modulation is varied according to the switching loss analysis to further enhance the THD. A 1 KW prototype was built to confirm the practicality of the proposed method.*

Production Engineering

Anu P. Anil, Satish K P, “An empirical investigation of the relationship between TQM practices, quality performance, and customer satisfaction level”, *International Journal of Productivity and Quality Management* (2019), 26 (1), pp. 96-117, <https://doi.org/10.1504/IJPQM.2019.096993>

Abstract: *This paper is to investigate the significant impact of TQM practices on quality performance and customer satisfaction level of an organisation through an empirical approach. This also extends the research on exploring the mediating effect of quality performance on the relationship between TQM practices and customer satisfaction level. The empirical data was collected from 260 manufacturing organisations and the hypotheses were tested using structural equation modelling technique. The findings support the proposed hypotheses that there is a positive and significant relationship between TQM practices and quality performance as well as customer satisfaction level simultaneously along with the mediating effects.*

Anu P. Anil, Satish K P, “TQM practices and its performance effects – an integrated model”, *International Journal of Quality & Reliability Management*, <https://doi.org/10.1108/IJQRM-10-2018-0266>

Abstract: *The purpose of this paper is to investigate the direct and indirect effects of TQM practices on various performance indicators specifically in the Indian manufacturing context. This paper focuses on developing an integrated model encompassing significant structural relations showing the linkage between TQM practices and multiple performance indicators. The data were collected from manufacturing organizations. After confirming the reliability and validity using exploratory and confirmatory factor analysis, the proposed hypotheses were tested using structural equation modelling. Moreover, this work developed an integrated model showing the interrelationships between TQM practices and performance indicators identified.*

Ramkumar P N, Satish K P, Praveen V Venugopal, “Ranking of the seven wastes (Muda) for Lean Six Sigma Implementation in Indian SMEs”, International Journal of Applied Engineering Research (2019), 14 (6), pp. 1269-1274.

Abstract: *Lean manufacturing tries for the elimination of the seven kinds of wastes which is also known as Muda and six sigma tries to reduce the variations in processing and hence defects. This paper investigates whether these seven wastes affect the performance of Indian Small and Medium enterprises (SME). This research develops a new method to identify and rank the seven wastes in the SMEs by using suitable questionnaire and method. Data was collected from SMEs for exploring the influence of seven wastes and the inter-relation and ranking were done according to their influence on other wastes in certain manufacturing units.*

Abdul Samad P A, Shalij P R, Ramesh A, Mubarak A K, “Computational Fluid Dynamics Simulation on Particulate Distribution in Gyro Casting for the Manufacture of Al/SiC Particulate Metal Matrix Composite” Journal of Applied Fluid Mechanics (2019), 12, (5), pp. 1585-1597.

Abstract: *The enhanced specific strength of SiC Particulate Metal Matrix Composites (PMMC) has been the major contributing factor which helps to find applications in the aerospace and automotive industries. Uniform distribution of the particulates in PMMC controls the attainment of better mechanical properties. The most accepted method for producing such a composite is stir casting in which the homogeneity of particulate reinforcement is a significant challenge. This research work proposes a new method for mixing the particulate reinforcement with the liquid and semi-solid aluminium matrix to ensure a uniform mix of the particulates using a gyro shaker. Gyro shaker is a dual rotation mixer commonly used for mixing high viscous fluids. It rotates about two mutually perpendicular axes which help in thoroughly mixing of the ingredients. Developed Computational Fluid Dynamics (CFD) simulation model of the mixing device in finding the mixing performance while mixing SiC particulates with glycerol. The results of the simulation were also validated by experimentation. Analogue fluid simulation of gyro casting was carried out using water and glycerol/water mixture which are having a closer value of viscosity as that of liquid aluminium and semi-solid aluminium. The mixing time obtained in the water system at gyration speeds of 29.63 rpm, 58.18 rpm, 72.73 rpm and 87.27 rpm was 61.84 sec, 43.44 sec, 26.85 sec and 27.24 sec respectively. The mixing time obtained in glycerol/water system at gyration speeds of 58.18 rpm, 87.27 rpm, 116.36 rpm and 145.45 rpm was 26.34 sec, 15.97 sec, 9.8 sec and 6.26 sec respectively. The distribution of the SiC particulates obtained from simulation was compared with stir casting simulations. The homogeneous distribution of particulates was observed in the gyro casting simulation.*

Electrical & Electronics Engineering

Renukadevi V, Jayanand B, Sobha M, “A DC DC converter based infinite level inverter as DSTATCOM.” International Transactions on Electrical Energy Systems (2019), 29.2: e2724.

Abstract: *In this paper, a three phase, infinite level voltage source inverter (ILI) topology based DSTATCOM is put forth. The number of voltage levels of an ILI depends on the carrier frequency used. Its reduced harmonic content, high DC link utilization, and reduced THD outweigh other inverter topologies and switching techniques. In the proposed technique, a single high frequency switch alone is needed. The instantaneous reactive power theory is used for the compensation. The aim of this paper is to mitigate harmonics by a new circuit topology for inverter feeding current at the point of coupling which requires lesser dc voltage when compared with conventional bridge type inverter which requires more than 1.5 times the rms voltage of supply voltage as the dc link voltage. The converter models are implemented in the MATLAB/SIMULINK. The power quality performance of the ILI based DSTATCOM is analyzed, and its hardware model is developed.*

Chemical Engineering

Puthenkattil Abdukunji Fasnabi, Gopal Madhu, Poopana Antony Soloman, “Optimization of advanced oxidation processes for the removal of acetamiprid from wastewater” *Environmental Engineering and Management Journal* (2019), 18, (1), pp. 225-233.

Abstract: Advanced oxidation process is getting tremendous importance in the treatment techniques for the removal of nonbiodegradable organics from wastewater due to its ability to completely mineralize the pollutants. It uses different methods to produce hydroxyl radicals which are responsible for oxidation of pollutants. In this work, studies on Fenton, ultraviolet radiation (UV) and UV hydrogen peroxide processes for removing acetamiprid, a neonicotinoid insecticide from aqueous solution are carried out. Acetamiprid is now finding wide use as a substitute for organophosphates. The effects of pH for UV, H_2O_2 concentration and Fe^{2+} concentration for Fenton process and pH and H_2O_2 concentration for UV- H_2O_2 process are studied for a simulated wastewater containing acetamiprid.

The efficiency of the processes was evaluated by measuring acetamiprid concentration and total organic carbon concentration. The processes are optimized using central composite design of response surface methodology. A second order model has been suggested for the processes and the model is validated using statistical tools. The H_2O_2 and Fe^{2+} concentrations showed a positive effect on the removal of pesticide by Fenton process and the optimum conditions obtained are pH-3, H_2O_2 - 190 mg/L and Fe^{2+} -19 mg/L. For UV- H_2O_2 process, the optimum pH is found to be 6 at a H_2O_2 concentration of 110 mg/l. Kinetic studies were conducted for Fenton, UV and UV- H_2O_2 processes at the optimized conditions, which show the applicability of first order kinetics.

Divya Airattil Haridas, Soloman Poopana Antony, “Prediction of water quality index of an Indian river using arithmetic index model and regression model”, *Environmental Engineering & Management Journal* (Accepted)

Manilal A M, Soloman P A, Ahmed Basha C, “Removal of Oil and Grease from Produced water using Electrocoagulation” *Journal of Hazardous, Toxic, and Radioactive Waste* (Accepted)

Chemistry

Sini Varghese C, Joby Thomas K, **Vinod P. Raphael, Shaju K S**, “Corrosion inhibition capacity of two heterocyclic oximes on copper in nitric acid: electrochemical, quantum chemical and surface morphological investigations”, *Current Chemistry Letters* (2019), 8, pp. 1–12.

Abstract: Two heterocyclic oximes (*E*)-*N*-hydroxy-1-(pyridin-2-yl)methanimine (*Hp2ylm*) and (*E*)-*N*hydroxy-1-(pyridin-3-yl)methanimine (*Hp3ylm*) were synthesized from pyridine-2-carbaldehyde and pyridine-3-carbaldehyde, respectively. These oximes were characterized by various spectroscopic tools like UV, IR, MASS and NMR. The inhibition capacity of these oximes against copper

corrosion in 0.1 M HNO_3 was determined by polarization and impedance spectroscopic studies (EIS). At all concentrations, *Hp3ylm* exhibited higher inhibition efficiency than *Hp2ylm*. Attempt was made to illustrate the mechanism of corrosion inhibition by these oximes with the help of adsorption isotherm, scanning electron microscopic (SEM) and quantum chemical studies.

Sini Varghese Cheruvathur, Joby Thomas Kakkassery, **Vinod Raphael Palayoor**, Binsi M Paulson, Ragi Kooliyat, Electrochemically Synthesized Poly(2-aminobenzenesulphonic acid) An Efficient Protection for Carbon Steel Corrosion, Oriental Journal of Chemistry (2019), 35 (2), pp.678-683.

Abstract: *The corrosion protection efficacy of electrochemically synthesized poly(2-aminobenzenesulphonic acid) (P2ABSA) on carbon steel in 1.0 M HCl was investigated by electrochemical impedance spectroscopy, Tafel polarisation, scanning electron microscopy (SEM) and FT-IR spectral studies. The polymeric coating was prepared on the steel surface using cyclic voltammetry. Investigations established that P2ABSA effectively prevent the metal dissolution in HCl medium. Polarisation studies revealed that this polymer hinder both anodic and cathodic process of corrosion appreciably. The structures of the chemically and electrochemically synthesised polymers were compared using IR spectroscopy. Morphology of the steel surface confirmed the intact response of P2ABSA on steel surface treated with HCl.*

Ragi Kooliyat, Joby Thomas Kakkassery, **Vinod P. Raphael**, Sini Varghese Cheruvathur, Binsi M. Paulson “Synthesis, Cyclic Voltammetric, Electrochemical, and Gravimetric Corrosion Inhibition Investigations of Schiff Base Derived from 5, 5-Dimethyl-1,3-cyclohexanedione and 2-Aminophenol on Mild Steel in 1 M HCl and 0.5 M H₂SO₄” International Journal of Electrochemistry (2019), Article ID 1094148, <https://doi.org/10.1155/2019/1094148>

Abstract: *Schiff base 2,2'-(5,5-dimethylcyclohexane-1,3-diylidene)bis(azan-1-yl-1-ylidene) diphenol (DmChDp) was synthesized and characterized using spectroscopic methods (IR, UV, NMR, and Mass) and cyclic voltammetric (CV) studies. The corrosion inhibition potency of (DmChDp) on mild steel (MS) in 1M HCl and 0.5M H₂SO₄ was investigated. The corrosion monitoring techniques employed for this purpose are gravimetric and electrochemical methods (EIS and potentiodynamic polarization studies). The study reveals that the Schiff base, DmChDp, acts as excellent corrosion inhibitor on mild steel in 1M HCl. DmChDp obeys Langmuir adsorption isotherm both in 1M HCl and 0.5M H₂SO₄ on MS. Polarization studies show that DmChDp behaves as a mixed type inhibitor in both media. Scanning electron microscopic analysis established the protective nature of DmChDp on mild steel surface. The impact of temperature on the corrosion of MS was also evaluated using gravimetric method.*



Ph.D Abstracts

Prof. Mubarak A K

A novel concept of double parabolic supersonic nozzle has been introduced for increasing thrust by eliminating internal shock formation that causes thrust loss in conventional conical and bell nozzles. The investigation focuses on experimental measurements and computational predictions of flow characteristics and performance of supersonic nozzles with different profiles for the divergent portion. Tests were carried out on conical, bell, and double parabolic nozzles at a design Mach number of 1.5. After analysing the flow and performance characteristics together with the benefit of weight, the double parabolic nozzle with PM/3 profile seems to be better than conventional conical and bell nozzles.

Prof. Suhara E M

The concern on climate change, the scarcity of fossil fuels and the advancement in battery technology have convinced global electric vehicle (EV) manufacturers to invest more to develop and introduce modern EV models. The battery charging profile such as the charging time, battery life and its efficiency is determined by the characteristics of the charger circuit. The characteristics such as higher efficiency, low cost, less weight and reliability are considered as essential parameters for the choice of a topology and circuit for the charger. The operation of the charger circuit depends on the type, components and the control methods used for the converter implementation, switching techniques used and its overall cost. The control circuit also should be simple and flexible to implement. Furthermore the charger and the controller should be able to maintain high power quality at grid side. This should ensure lower harmonic distortion and high power factor to maximize the available real power drawn from the utility grid. The bidirectional converters for the battery

charger determines the overall power conversion efficiency of the system especially when the power level is quite high. The simple three phase converter (three phase, three leg, six switch) with bidirectional capability is considered for AC/DC conversion and synchronous buck converter is selected for DC/DC conversion. The reduced switching scheme is applied to control the AC/DC converter and adaptive hysteresis band is designed for the hysteresis controller to operate at a constant switching frequency. Apart from basic charge/discharge control, the system is controlled to function as active power filter, load compensator, load balancing and upf operation even with unbalanced and distorted input voltages. Moreover only a single feedback loop controller is used to control the various modes of operation such as grid to vehicle (G2V), vehicle to grid (V2G) and vehicle to vehicle (V2V). The design and simulation analysis of the system is carried out and a prototype is developed for concept verification.

Prof. Jayasree N

Aggregate demand forecasting, the basis of comprehensive business budgeting, is a key determinant of corporate/supply chain success. The study is an investigation into the different approaches for forecasting aggregate demand

when the demand data is auto-correlated, cross correlated and non-stationary. The study is focused on multivariate models, more specifically vector IMA(1,1) process, a possible candidate in such situations.

Prof. Jayasree M

This thesis investigates the potential use of machine learning techniques for solving the problem of automatic detection and recognition of disguised human face images. A novel and enhanced face detection technique has been proposed in this thesis using Speeded Up Robust Features (SURF) descriptor based boosted Support Vector Machine (SVM) cascade detection technique, with skin color filtering as an optimizer. A novel and efficient two-pass classifier has been proposed using Back Propagation Neural Networks (BPNN) and Support Vector Machine (SVM) to overcome the challenge of recognizing disguised face

images. Unlike conventional approaches, a granular feature set extracted at three levels of granularity, which makes use of both global and local features have been adopted for face recognition. The feature extraction is performed by utilizing Scale Invariant Feature Transform (SIFT) descriptors and dimensionality reduction is attained by Principal Component Analysis (PCA) technique. A database of disguised face images named as Kannur University Disguised Face Database (KNUDFDB) has been created with the desired type of disguises for evaluating the proposed face detection and recognition systems.

Prof. Sujatha I

The concerns for global warming has renewed interest in the improvement of energy efficiency of existing vapour absorption refrigeration systems as well the development of new types of green absorbent–refrigerant pairs, new refrigeration cycles, etc. The main aim of this work is to study the performance of vapour absorption refrigeration and heat transformer systems operating

with a combination of different ionic liquid–refrigerant combinations and to identify the combination that have potential to replace conventional working pairs. The performance of a heat transformer, single and double effect refrigerators have been estimated with different ionic liquids as the absorbent and ammonia, HFCs, HFOs as the refrigerants.

Prof. Roy Francis

An inverter is basically a DC to AC power electronics converter where the output voltage, frequency, and power of the inverter depending on the type of load requirement. The quality of power delivered to the load is mainly depends on the harmonic profile known as Total

Harmonic Distortion (THD). It is mandatory to keep the THD values of the inverter output waveform low to get a desired sinusoidal approximation. In this research work, new THD minimization based modulation techniques are proposed for multilevel inverters.

Prof. Sunil D T,

During the past few decades, the world has been witnessing the intensification of competition. Manufacturing companies have been striving to produce innovative products quickly in accordance with the dynamic demands of the customers. Such characteristics of the company is called as agility characteristics, and company possessing agility characteristics is named as agile companies. One of the enablers of acquiring agility is the time compression. Companies manufacturing traditional products have been slow in acquiring agility characteristics. The doctoral work is to conduct

investigations to examine the challenges of achieving time compression and thereby, acquiring agility characteristics through the development of feasible and optimum assembly sequences by applying CAD in the case of manufacturing traditional complex products. The outcomes of the researches carried out have indicated that achieving time compression for acquiring agility through the application of CAD based assembly sequence planning in the case of manufacturing Dryspell Plus will enable the companies producing similar traditional complex products to acquire agility characteristics and competitive strength.

Family Health Center (FHC) project



Execution of Family Health Center (FHC) project was done by School of Architecture, GEC in collaboration with IIT Madras for the government of Kerala, funded by VPS Group as per the MOU signed on Nov 2018. Ar. Aiswarya V Sudheer, Er. Ajisan K Shaji, Ar. Gary Gilson, Ar. Melba Rose and Ar. Minu Benny was involved in the project as mentors of various groups in coordinating the design development process under the guidance of Ar. Sujith, Ar. Biju C A, and Ar. Geetha A. The students of S9, S6 and S4 showed up a remarkable effort in developing the designs through active discussions.