Principal's Message

I think, with the digital age enveloping all of us along with almost every geographical boundary, research and related innovative ideas are attaining greater significance, in the present global scenario.Therefore, I am extremely delighted to note that the Research Wing, comprising of its very enthusiastic faculty members and students who indulge in various technology driven research activities, has become all the more alert and agile to take up new challenges, thereby playing a vital role in the opening of new sectors confronted by our society. This edition of the Research Bulletin throws light upon their achievements, and let me take this opportunity to congratulate each and everyone who contributed to this realm, in some way or other.

The entire GEC Family feels proud to note that six Research Scholars have been awarded PhD degrees, and on a personal note, let me congratulate each one o them and their Guides for this great achievement. Again, Dr Sudheesh.R.S. of Mechanical Department deserves special appreciation for receiving a patent and this certainly is a great honour to GEC .

Another achievement worth mentioning will be our college securing the position of NIRF in the Band 201-250. At the same time, this ought to be regarded as a motivation and also a gentle reminder for us to persevere still harder to attain a better score, next time - below 200. Let me also take this opportunity to inform that our college intends to play the role of a Host in organising an International Conference, and tentatively, this might happen in February 2023 and turn out to be an event spotlighting the relevant technological and social issues. Apart from taking it as a personal achievement, GEC takes pride in knowing that NPTEL has bestowed a Certificate of Appreciation to Prof.Binoy.B.B. of the Electrical Department for playing an instrumental role as Single Point Of Contact (SPOC).

Finally, my sincere thanks and appreciation goes to the Editorial Team of this Research Bulletin for the efforts they have taken, and also for releasing this research bulletin within the specified time limit.
My warm wishes for all the future prospects...

Dr Ranjini Bhattathiripad T
Principal

GEC's Proud Moments
Congratulations to PhD Holders...

Dr Shibily Joseph

Dr Pradeep M

Dr Jisha Kuruvila P

Dr Jayakumar P

Dr Anjali P Sasidharan

Dr Vishnu P Madhanmohan

Research Advisory Council of GEC Thrissur has immense pleasure to congratulate our faculty member Prof. Shibily Joseph, department of Computer Science and Engineering, Smt.Jisha Kuruvila P, Sri. Jayakumar P, Sri. Vishnu P Madhanmohan, department of Electrical Engineering, Sri. Pradeep M, department of Production Engineering and Smt. Anjali P. Sasidharan, department of Civil Engineering for acquiring Ph. D.

Details of Ph.D Awardees

Sl. No	Name of Ph. D Awardee	Dept.	Name of Supervisor	Title of the Work	Date of Award & University
1	Shibily Joseph	EEE	Dr. Jasmin E A	Dynamic Pricing Scheme from Cluster Based Load Profiles for Demand Response Programs in Smart Grid	25/2/2022, University of Calicut
2	Jisha Kuruvila P	EEE	Dr. Anasraj R	Enhanced Double Exponential Reaching Law based Sliding Mode Controller for EfficiencyOptimized Induction Motor Drive	16/02/2022, University of Calicut
3	Jayakumar P	EEE	Dr. Reji P	Management of Phase Unbalance in Low Voltage Distribution Network (LVDN) with Distributed Generators and Diverse Load	11/03/2022, University of Calicut
4	Pradeep M	PE	Dr. Satish K. P.	A cross cultural campus start-up strategy for engineering education: Outline of inquisitiveness of undergraduate mechanical engineering students in Kerala towards nascent entrepreneurship	24/3/22, University of Calicut
5	Vishnu P Madhanmohan	EEE	Dr. M Nandakumar & Dr Abdul Saleem P K	Generalized Algorithm for Enhanced Power Generationof Partially Shaded Photovoltaic Systems with Minimum Peaks in Electrical Characteristics.	8/4/22, Kerala Technological University
6	Anjali P. Sasidharan	CE	Dr. Meera V	Novel polyurethane foams loaded with nanoparticles - synthesis,characterization and evaluation of phosphate and coliforms removal efficacies.	12/05/2022, Kerala Technological University

Journal Articles

Congratulations to the Contributors....

Civil Engineering

Manu Devassy, Introduction of methods of partial sums for finding BOD first stage constants. Journal of Environmental Science and Engineering(NEERI), Vol.4, P.811-819, January, 2020.

Abstract: Biochemical oxygen demand (B.O.D) is widely adopted as a first-order reaction and several methods like least square, Thomas graphical, Fujimoto, daily difference method, etc. have been introduced for solving the equation based on experimentally determined B.O.D data. In all these methods tedious calculations are involved in the determination of B.O.D velocity constants and hence have deterred many researchers in expressing their results in terms of the velocity constants. It is for this reason; a new approach, the *method of partial sums (MPS)* is introduced, where the partial sums of applied B.O.D in successive intervals of time are made use in arriving at an expression for the velocity constants. The paper examines whether there is considerable variation in the velocity constant values predicted by the least square, Thomas graphical, Fujimoto, daily difference, and method of partial sums(MPS) for the Willamette River, Ohio River, and raw domestic wastewater, in addition to ranking the models using Nash-Sutcliffe model efficiency coefficient(NSE).The results of ANOVA tests indicate that there is no significant variation in the predictive power of the models as well as the velocity constant values of Willamette & Ohio River. The study revealed that the least square method is the best for predicting velocity constants and there is a close similarity of predictive skill of Thomas graphical and MPS methods.

Electrical Engineering

Vishnu , Abdul Saleem , Adaptive Integral Correction-Based State of Charge Estimation Strategy for Lithium-Ion Cells, *IEEE Access,* vol. 10, pp. 69499-69510, 2022, doi: 10.1109/ACCESS.2022.3187193.

Abstract: Lithium-ion (Li-ion) battery systems are critical elements of future energy systems and electric vehicles. Accurate prediction of the state of charge (SoC) is necessary for the safe and reliable functioning of Li-ion battery systems. Achieving a precise SOC estimate is challenging due to the nonlinear characteristics and variations of model parameters caused over the cell lifetime. This paper introduces an adaptive estimation strategy that can compensate for the effect of cell degradation for achieving high accuracy SoC estimation. The proposed method uses an integral correction-based SoC estimation loop utilizing a Li-ion cell model. The effect of model parameter variation is corrected by introducing two additional correction factors, the cell model resistance, and capacity correction factor. These correction factors are employed to update the Li-ion cell model, resulting in an adaptive integral correction-based SoC estimation technique that can compensate for the influence of cyclic degradation-induced parameter change. The proposed method is validated through extensive simulations in the Matlab-Simulink environment, and its output is compared to the existing unscented Kalman filter-based SoC estimation method. The proposed estimation strategy can adapt to the cell circumstances and correct for model uncertainties. The results indicate that the proposed adaptive SoC estimation strategy provides more precise and accurate SoC estimates for the entire lifespan of the Li-ion cell.

Abdul Saleem , E. R. Lisy, Three Dimensional Nonlinear Guidance Law for Exact Impact Time Control, *IEEE Access*, vol. 10, pp. 67350-67362, 2022, doi: 10.1109/ACCESS.2022.3185606

Abstract: This paper presents a nonlinear guidance law for controlling the impact time of a missile-target engagement in three dimensions. The guidance law is initially formulated for a two-dimensional encounter before being extended to a three-dimensional scenario. The guidance law is constructed such that nonlinear kinematics are neither linearized nor approximated. The guidance law offers a precise closed-form expression for impact time, which is the principal contribution of this work. Choosing an integrable heading error profile is the central concept of this research for determining an accurate impact time. A two-step strategy is utilized to accomplish an interception at a predetermined time. Because the control parameter is related to the desired impact time with an exact expression, a simple and accurate control of impact time is attained. The method provides equations for calculating the minimum and maximum impact times, enabling the determination of the range of impact times that can be achieved. The proposed guidance law can ensure that the seeker field of view restriction is not violated, If the initial heading error is within this limit. The developed method is utilized in salvo attacks, in which multiple missiles simultaneously strike an enemy target, increasing the missiles' effectiveness against the target's self-defense mechanism. To validate the effectiveness of the proposed strategy, MATLAB-based numerical simulations of 2D and 3D engagements, including salvo attacks, are conducted.

Abstract: Trajectory tracking control is indispensable for a wheeled mobile robot to achieve successful navigation. The classical tracking control systems that are used in wheeled mobile robots do not compensate for the parameter uncertainties and external disturbances. For control strategy, this paper presents a novel hybrid approach, combining a neural network-based kinematic controller and a model reference adaptive control. The controller parameters are adaptively determined online using neural networks. The adaptively tuned kinematic controller ensures a fast convergence to the desired trajectory. The model reference adaptive controller retains the desired tracking performance when parameter and model uncertainties occur. The Lyapunov stability method is used to obtain the adaptive gains which guarantee the asymptotic stability of the error dynamics, where the error is the difference between the outputs of the reference model and the actual plant. The performance of the proposed controller is compared with that of the PID controller, kinematic controller, and adaptive dynamic controller using different performance analysis indices such as integral absolute error, integral squared error, and mean absolute error. Simulation studies demonstrate that the proposed controller achieves high tracking accuracy and fast convergence as compared to the PID, kinematic, and adaptive dynamic controllers considering parameter uncertainties and slip disturbances. The outcomes of the simulation studies also illustrate that the proposed controller achieves the best transient performance. Experiments using real-world tests based on a two-wheeled differential drive robot architecture have elucidated the feasibility of the developed controller regarding tracking accuracy, total control effort, and robustness against uncertainties.

Mechanical Engineering

Abstract: In India, the manufacturing industry is beset by issues. Lack of innovation and machine capabilities, scarcity of skilled labour, power supply shortages, inadequate R&D conduct, and the cost of basic facilities are just a few of the major issues. At present, the manufacturing firms are mostly concentrating on the enhancements of the production process, and thereby developing innovations for enhancing the products' quality. A lean and sustainable integrated Quality Management System is proposed to enhance the quality in addition to manufacturing performance. For this study, small and medium enterprises (SME) are deemed. Here, the artificial neural networks (ANN) computational prediction technique is implemented to envisage the optimum manufacturing parameters. For adjusting the weight in the neural networks (NN)for prediction, the ANN optimization is performed by utilizing an imperialist competitive algorithm (ICA) which is basically a competitive algorithm for verifying the firm's performance with reference to manufacturing cost. The proposed effort is executed in the Mat Lab, which is an analysing software platform that models the ANN-ICA algorithm relating to manufacturing cost in addition to lead time of SMEs. The outcomes established that the proposed work is an effective method for envisaging the chief parameters that influence the manufacturing enterprises.

Mechanical Engineering & Mathematics

Abstract: Fault tree analysis (FTA) is a promising quantitative technique for risk analysis in chemical process industries, (CPIs). In FTA, a certain sequence of basic events (causes) leads to one specific Top event (critical event of in-terest). However, the conventional fault tree analysis has the limitations of staticity and uncertainty. The staticity in conventional FTA arises due to its inability to accommodate time-dependent characteristics of the process system. Whereas uncertainty primarily lies in the failure probability data of basic events. This paper proposes an innovative methodology that uses a time-dependent covariate model to update the failure probability values of major contributing basic events in FTA. A novel subclass of the family of phase-type distributions is used to model the covariates corresponding to the basic events. The newly developed methodology is applied for a case study in a chlorine manufacturing facility to estimate the chlorine release probability. The blockage in the pipeline was identified as the significant reason for chlorine release from expert opinion and sensitivity analysis. The results of the proposed model of FTA are compared with that of conventional FTA.

Mathematics

Seema Varghese, Seethu Varghese, Power domination in Mycielskian of spiders**,** International Journal of Graphs and Combinatorics ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/uakc20 DOI: 10.1080/09728600.2022.208290

Abstract: The power domination problem in graphs consists of finding a minimum set of vertices S†"VS†"V that monitors the entire graph G governed by two '*monitoring rules*'- domination and propagation. A set S†"VS†"V is a power dominating set (PDS) if it can monitor all vertices of G. The minimum cardinality of a PDS of G is called the power domination number, γP(G)γP(G), of G. In this paper, we study the power domination problem in Mycielskian of spiders.

For a spider T, we have γP(T)=1γP(T)=1 and γP(μ(T))d"2γP(μ(T))d"2.

We characterize spiders, T, for which γP(μ(T))=1γP(μ(T))=1 and γP(μ(T))=2.

Seema Varghese Some results on star-line graphs , CREAT. MATH. INFORM. Volume 31 (2022), No. 2,Pages 267 - 271

Abstract: Let H be a connected graph with at least three vertices. The H-line graph, HL(G), of a graph G has all the edges of G as its vertices, two vertices of HL(G) are adjacent if the corresponding edges in G are adjacent and belong to a common copy of H. In this paper we investigate some properties of the star-line graph K1,n L(G) of a graph G. We also obtain a Krausz type characterization for star-line graphs. Traversability of star-line graphs is also studied.

Conference Publications

Manu Devassy, A simple proof of Fermat's last theorem, International Conference: e-ICMTA 22 AIP Conference Proceeding : ISSN:0094-243XE-ISSN:1551-7616.(SCI INDEXED).

Sandra Ann Jacob, P. A. Soloman, "Dynamic Simulation of Demethanizer Column, International Conference on Sustainable Technology and Innovation for Industry" 4.0-2022, April 21-22, 2022, CUSAT, Kalamassery.

Dhanya Menon P., P. A. Soloman, Kinetic-Based Simulation of Biogas Steam Reforming, International Conference on Sustainable Technology and Innovation for Industry 4.0-2022, April 21-22, 2022, CUSAT, Kalamassery.

C Dimna Denny, Ramesh Kumar P, Saghil A,"Optimum Gain Selection of Sliding Mode Control using Grey Wolf Optimization Technique", 2022 IEEE First International Conference on Advances in Electrical, Computing, Communications and Sustainable Technologies (ICAECT 2022),Bhilai,India, April 2022.

Prashanth K Prasad , Ramesh Kumar P,"A Higher-Order Sliding Mode Observer for SOC Estimation with Higher-Order Sliding Mode Control in Hybrid Electric Vehicle", International Conference on Communications and Cyber-Physical Engineering (ICCCE 2022),Hyderabad, India, April-2022.

The Ph.D Abstracts

Enhanced Double Exponential Reaching Law based Sliding Mode Controller for Efficiency Optimized Induction Motor Drive

Jisha Kuruvila P

Since, energy saving has become an exciting research area nowadays, this research work addresses the efficiency optimization of induction machines during partial load conditions. In the first phase, the general strategies for efficiency optimization, called the loss model-based controller (LMC) and search controller (SC), are validated by simulation and hardware in a vector-controlled IM drive. In this study, a new hybrid method combining the advantages of the LMC and SC methods for loss minimization is implemented. This technique has the advantage of fast convergence as in LMC, and also mitigates the drawback of sensitivity towards parameter variations. It is highly recommended to implement nonlinear control strategies, such as sliding mode control, in induction motor drives. In the second phase of the work, a study of the existing reaching lawbased SMC is conducted on a vector-controlled IM drive. A novel reaching law-based sliding mode controller called 'Enhanced Double Exponential reaching law' is introduced. The performance of the proposed reaching law is tested by implementing it in an IM drive. The reaching law guarantees fast response, negligible chattering and superior dynamic tracking performance in the presence of uncertain disturbances compared to conventional reaching laws.

Novel polyurethane foams loaded with nanoparticles - synthesis, characterization and evaluation of phosphate and coliforms removal efficacies.

Anjali P Sasidharan

The ability of three novel sorbents, formed by immobilising chitosan nanoparticles, silver/silver oxide nanoparticles, and combination of chitosan nanoparticles and silver/silver oxide nanoparticles on PUF, viz. PFC, PFA, and PFCA, to remove phosphate ions and coliforms from aqueous solutions were investigated in this study. The study proved the enhanced potential of PFCA over PFC and PFA, in removing phosphate and coliforms from aqueous solutions. This was due to the greater surface area and pore volume of PFCA along with the presence of suitable functional groups (amino group and silver) that provide sorption sites for phosphate ions and bactericidal effects for coliforms. The phosphate and coliform concentrations in the treated real greywater using PFCA met the reuse standards and can be used for non-potable purposes without any further treatment. The optimum pH for the simultaneous removal of phosphate and coliforms by PFCA is nearly neutral. This increases the effectiveness of PFCA in water/wastewater treatment. The study proved the enhanced potential of PFCA which makes it a promising adsorbent for phosphates and an effective disinfectant in water/wastewater treatment.

Dynamic Pricing Scheme from Cluster Based Load Profiles for Demand Response Programs in Smart Grid

Shibily Joseph

Aim of demand response (DR) programs is to change the usage pattern of electricity in such a way that, beneficial to the consumers as well as to the distributors by applying some methods or technology. This way additional cost to erect new energy sources can be postponed in power grid. Best method to implement demand response (DR) program is by influencing consumer through the implementation of real time pricing scheme. To harness the benefit of DR, automated home energy management system is essential. This paper presents a comprehensive demand response system with real time pricing. The real time price is determined after considering price elasticity of various classes of consumers and their load profiles. A real time clustering algorithm suitable for big data of smart grid is devised for the segmentation of consumers. This paper is novel in its design for real time pricing and modelling and automatic scheduling of appliances for home energy management. Simulation results showed that this new real time pricing method is suitable for DR programs to reduce the peak load of the system as well as reducing the energy expenditure of houses, while ensuring profit for the retailer.

Management of Phase Unbalance in Low Voltage Distribution Network (LVDN) with Distributed Generators and Diverse Load

Jayakumar P

The research work finds high neutral current contributed by the zero-sequence components due to phase unbalance and harmonics as one of the main challenges in LVDN. A low voltage feeder model using minimum ûeld data was suggested for a more realistic analysis and to decide the limit of DG penetration. As a sustainable solution, a novel neutral grounding strategy to improve the power quality of an LVDN was also analysed. The new custom power device developed to reduce the zero-sequence components while providing ancillary services such as adaptive power factor correction, neutral current reduction, and harmonic mitigation is under patent examination.

Generalized Algorithm for Enhanced Power Generation of Partially Shaded Photovoltaic Systems with Minimum Peaks in Electrical Characteristics.

Vishnu P Madhanmohan

One of the main factors that adversely affect energy production using solar panels is partial shading. This thesis proposes four different solar reconfigurations (i) Diagonally dispersed Total Cross Tied (D-TCT), (ii) Reformed-Total Cross Tied (R-TCT), (iii) Durer's Square Total Cross Tied (DS-TCT), and (iv) Algorithm based Total Cross Tied (A-TCT). The performance of various methods introduced in this thesis are evaluated and compared by numerous simulation and hardware experiments.

A cross cultural campus start-up strategy for engineering education:Outline of inquisitiveness of undergraduate mechanical engineering students in Kerala towards nascent entrepreneurship

Pradeep M

A sustainable livelihood for the world's poor can be achieved only through entrepreneurship. In Kerala, engineering colleges are producing graduates in large numbers than they can manage to final placement for or industry can absorb. Business is passion for the educated youth in the current global market scenario. The number of student's start-ups in the mechanical engineering stream is relatively less when compared to the ones spawned by other engineering streams. This research analyses the entrepreneurial inquisitiveness of under graduate mechanical engineering students in the state of Kerala, India, in terms of their attitude, involvement in entrepreneurial programs in the campus, policies of universities, influence of Government organizations, barriers faced by the students and the different components behind campus start-ups. It also evaluates the catalytic property of innovation and entrepreneurship development centre in the campus towards student's start-ups. The data collected from undergraduate mechanical engineering students of APJ Abdul Kalam Technological University in Kerala was analysed using a multiple regression approach, testing the study hypotheses using Structural Equation Modeling (SEM) technique by IBM AMOS software. Results from this research are aimed at providing insights to State Governments in their start-up policy, to the Universities in their curriculum revision and to the Higher education department in the states to sire an entrepreneurial ecosystem in the engineering campus.

Congratulations

Dr. Sudheesh R S. Professor of Mechanical was a team inventor for developing *"Method and System for Predicting Location and Depth of Abnormal Tissues in Breast of Subject"*. The team obtained a US patent (No.US 11,375,901 B2, dated Jul. 5, 2022) for the development of this system. The team consisted of 8 investigators. The abstract of the work is given below.

Abstract: The present disclosure relates to method for predicting location and depth of abnormal tissue in breast tissue by prediction system. The prediction system predicts location based on 2D thermal image generated based on temperature values and intermediate temperature values. The intermediate temperature values are estimated using triangular and rectangular patterns formed on pre-defined model of breast, thermal conductivity of breast tissue, , 2D coordinates on one of triangular and rectangular patterns and temperature values at steady state of breast tissue. The depth is predicted based on 3D thermal image of breast tissue generated using temperature values and intermediate temperature values and error parameter. The intermediate temperature values are estimated based on one of tetrahedral and hexahedral patterns formed on predefined model of breast , density value, thermal conductivity of tissue, blood perfusion rate, specific heat capacity of blood, D coordinates, arterial temperature.

Dr. Sudheesh R S

Congratulations!

Congratulations to Prof. Binoy B B-our NPTELS brand ambassador.

NPTEL appreciated **Prof. Binoy B B** for his instrumental role as SPOC for the SWAYAM-NPTEL Local Chapter. IRAC congratulates Prof. Binoy B B for his achievement.

congratulations

Ministry of MSME, Govt. of India

Congratulations to Dr.Ajay James

Happy to inform you that our college has been selected as a host institute to set up/establish a business incubator under the scheme **"Support for Entrepreneurial and Managerial Development of MSMEs through Incubator"** by the Ministry of Micro Small Medium Enterprises (MSME), Govt. of India.Ideas in MSME Idea Hackathon 2022 are being invited from Innovators and MSMEs from all over India under this scheme. The Host Institutions (HI) approved for the scheme will be supported by MSME. Incubatees' selected ideas will be provided funding support up to **Rs. 15 lakhs** per approved idea, through the Host Institutes chosen by them. Guidelines for participation in MSME Idea Hackathon are attached with the mail.

Congratulations!

Congratulations to NCRAI Team Members

The design, construction, control, and analysis of a Delta Parallel Robot were successfully completed by the students **Anto Thomas Rayon, Jons Paulson, Jovan Babu** and **Jovin B Manjila** under the Guidance of **Dr. Lalu P P**, Professor of Mechanical Engineering.

Share Your Expertise...

Dr. P. A. Soloman

Dr. M. S. Manju

Dr. P. A. Soloman, Professor of Chemical Engineering delivered a talk on "Prototype/process Design and Development" in a Workshop organized by PG Department of Chemistry Institution Innovation Council, Vimala College (Autonomous), Thrissur on 13th July 2022.

Dr. P. A. Soloman and **Dr. M. S. Manju**, Professors of Chemical Engineering coordinated a 3-day offline Training programme on "Statistics for Researchers" from 23-05-2022 to 25-05-2022 sponsored by TEQIP phase II.

Dr. Seena P

Dr. Seena P, Professor of Civil Engineering took charge as CERD coordinator of GEC Thrissur on 01/07/2022. IRAC expresses immense gratitude to Dr. Manju S, former CERD and IRAC coordinator of our college.

Dr. Jiji K S, Professor of Electrical Engineering took charge as Research Dean of GEC Thrissur. IRAC appreciates Dr. Meenakshy K for her valuable efforts as the former Research Dean of our institution.

Dr. Jiji K S

Dr. Rameshkumar P, Professor of Electrical Engineering, took charge as the Coordinator of Institute Research Advisory Council (IRAC)

Dr. Rameshkumar P

Carbon Dots ~ a new member of carbon nanomaterials

Dr. Venugopalan P
Associate Professor in Chemistry

Carbon dots, accidently discovered in 2004 during the purification of single-walled carbon nanotubes, are zero dimensional carbon nanomaterials with quasi-spherical shapes and specifications below 10 nm consisting of sp^2/sp^3 carbon skeleton with many functional groups on their surface. The structural core of carbon dots can be amorphous, crystalline, or partially crystalline. Crystalline carbon dots are usually derived from graphene via top-down synthetic methods and are denoted as graphene quantum dots (GQDs). Carbon dots with crystalline graphitic core obtained via bottom-up synthetic methods are also referred to as GQDs. The amorphous or partially crystalline carbon dots usually prepared from carbon rich precursors via bottom-up synthetic methods are described as carbon nanodots (CNDs). The term carbon dots (CDs) is widely used in a broader sense to describe both.

Various preparation methods employed to synthesize CDs are categorized into two groups: top-down and bottom-up. Top-down groups contain the CDs synthesized from relatively large carbon source molecules like carbon nanotubes, carbon soot, graphite electrode rod, etc. Those big carbon molecules were then gradually broken down into smaller carbon atoms and formed the CDs carbogenic core. Since CDs were first discovered in arc-discharge method, researchers in early perod followed the same patterns to break down large carbon precursors. Breaking down the carbon sources being difficult, the experimental conditions are usually harsh, such as using arc-discharge, electrochemical etching, and laser ablation.

The bottom-up category developed around 2008 build CDs from relatively small carbon precursors are less expensive and easier than harsh and dangerous top-down methods. Carbon precursors can be readily available pure organic compounds like citric acid, sugar, etc. or a complex mixture of organic compounds like plant extracts. Both synthetic routes produce CDs with physical sizes, below 10 nm and exhibit similar physicochemical properties. Since 2008, bottom-up methods became dominant because of the mild experimental conditions and affordable starting materials and completely replaced top-down methods by 2010.

CDs have unique photophysical and chemical properties such as light absorption over a wide range, bright photoluminescence, electron mediation, excellent photostability, high aqueous solubility, photosensitization, chemical inertness, facile functionalization, and low toxicity. The easy synthetic procedure from inexpensive precursors and aforesaid interesting properties lead to their explosive utilization in distinct areas such as photocatalysis, biomedical imaging, sensors, photovoltaic panels, drug delivery and as therapeutic agents in photodynamic and photothermal therapies.
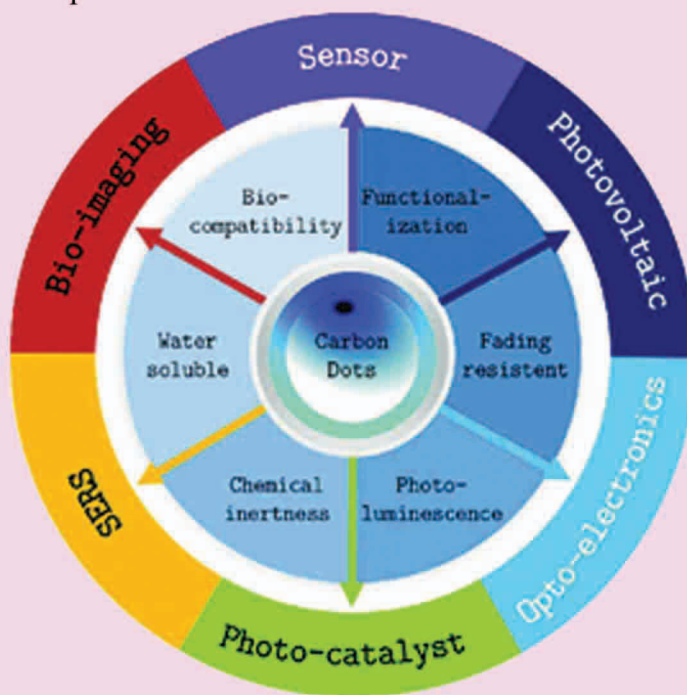
In summary, CDs as a new type of carbon-based nanomaterial possess unique optical features, excellent biocompatibility, low cost, easy modification, and functionalization, and show important and remarkable potential for a wide spectrum of applications.

Congrats!
Best Paper Award

Dr. Ajay James

Technology Business Incubator GEC TCR under the project Swavalamban Chair for MSME Solutions prepared and presented a research paper on the **International conference on role of ICT in Management and Business: Practices, Trends and Prospects (ICRIMB-2022)** which was organized by Institute of Information Technology and Management, Janakpuri, Delhi on 25th and 26th of March 2022. The title of the paper was "**Role of technology Business Incubators in building new ventures in Kerala**". The study mainly focused on different TBI's and startups from Kerala and also included a case study about a startup journey. The paper was prepared by Muhammed Arif and Haritha K Chandrasenan along with **Dr. Ajay James** (Assistant Professor, Department of Computer Science), under his expert guidance and mentorship. The paper was prepared under the category Entrepreneurship and innovation. The presentation received good appreciation and was also **awarded as the best paper in the conference**.

MSME Idea Hackathon 2022

Government Engineering College Thrissur has been selected as a host institute to set up/ establish a business incubator under the scheme "Support for Entrepreneurial and Managerial Development of MSMEs through Incubator" by the Ministry of Micro Small Medium Enterprises (MSME), Government of India.

Ms. Rosemary Benny S6 CSE Student secured Rs. 15 Lakhs grant for the Idea proposal " Namaste- The No Waste App" and **Mr. Adhil Saeem** S4 ECE student also secured Rs. 15 Lakhs grant for the Idea proposal "Automated coconut harvester with maturity detector".

"Ente Keralam": Kerala Government Mega Exhibition

Government Engineering College Thrissur's pavilion was selected as the **second best pavilion** under the Department of Technical Education in the "Ente Keralam Mega Exhibition" held as part of the first anniversary celebration of the Kerala State Government.

Nidhi Prayas

National Initiative for Developing and Harnessing Innovations (NIDHI) programme conceived and developed by the Innovation & Entrepreneurship division, Department of Science & Technology, Government of India, for nurturing ideas and innovations (knowledge-based and technology-driven) into successful startups. As part of Promoting and Accelerating Young and ASpiring technology entrepreneurs (PRAYAS) is specifically to support young innovators turn their ideas into PoC.

The startup "Qnayds" operating under the Technology Business Incubator of Government Engineering College has been awarded a **productization grant of Rs.5 lakhs** from the Kerala Startup Mission for the product Voice Amplifier. Startup "Estro Tech Robotics and Innovation pvt. Ltd." incubator under TBI GEC TCR has also awarded **Rs.4 lakhs as productization grant** from Maker Village for the Idea RobAd.

Short Term Training Programmes sponsored by TEQIP

Sl No.	Name of the Programme	Date of the Programme	Coordinator	Dept.
1	Advances in Bridge Engineering Design and Research perspective	21-25 March 2022	Dr.Miji Cherian., Asst.Prof.,	CE
2	Building Information Modelling"	04-08b April 2022	Mr.Deepak B., Asst.prof., Mr.Renjith S.Anand., Asst.Prof.,	CE
3	Climate change induced challenges in civil Engineering	14-18 March 2022	Dr.Reeba Thomas., Asso.Prof., & Ms.Smitha Mohan., Asst.Prof.,	CE
4	"Open Source Library Software Koha awareness Training Programme"	05.04.2022	Ms.Shyla P.K., Scientific Information Officer, Central Library,	Library
5	Statistics for Researchers	23-25 May 2022	Dr.Soloman P.A., Prof., Dr.Manju M.S., Asso.Prof.,	ChE

GECT RESEARCH BULLETIN
Compiled by Institute Research Advisory Council (IRAC)

Dear Colleagues,

GECT Research Bulletin is a bimonthly 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.

- Publications of faculty/staff/students in International/National Journals/Conference proceedings (Article title, Authors' names, Journal name, volume, issue, page number and 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 and contribution to book chapters by faculty/staff/students
- Faculty/staff/students who acquire Ph. D degree.

- Editors

Editors: **Dr. Vinod P Raphael** (Dept. of Chemistry) and **Dr. Rameshkumar P** (Dept. of EEE).
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Design & Layout by **Smt. Shincy T P** (Dept. of ECE, GEC Wayanad).