

Department of Botany

Title of Projects

2020-21

- A comprehensive review on phytochemical analysis and biological activities of *Adenanthera pavonina* L. and *Pongamia pinnata* (L.) Pierre.
- A review on some of the important indigenous ayurvedic medicines used as immunity booster.
- A comprehensive review on phytochemical and pharmacological applications of *Morinda citrifolia* Linn. (noni) and *Morinda tinctoria* Roxb.
- A review of the medicinal potential of selected plants from Dasapushpa.
- Medicinal importance of Nakshathra Vanam plants.
- A role of plant based antiviral compounds against COVID-19.

2021-22

- Comparative study of *Alstonia venenata* and *Pittosporum dasycaulon*.
- Polyamines: a biomolecule in plant growth regulation.
- A review on phytochemical and pharmacological potential of *Dirinaria* genus.
- A comprehensive review on phytochemical and pharmacological potential of *Parmotrema* genus.
- *Pterocarpus santalinus*. Linn. F(Raktachandanam): A review of its medicinal properties, phytochemistry, pharmacology and conservation status.
- Nanobiosensors for sustainable agriculture.
- A short review of antiviral activities of selected medicinal plants.

2022-23

- Antibacterial and antioxidant efficiency of *Pterocarpus marsupium* Roxb. leaf extract.
- Effect of biopriming agents on seed germination and stress tolerance among selected vegetables.
- Morphological, phytochemical and larvicidal study on four *Ocimum* species.
- Phytochemical and pharmacological analysis of *Catheranthus roseus* (L.) G. Don Flower extract.
- Study on *Clerodendrum paniculatum* Linn. Flower mediated green synthesis of silver nanoparticles and their biological activities.
- Chemical composition and biological activities of essential oil extracted from the leaves of *Alpinia calcarata* (Roscoe.), a multipotent medicinal plant.
- Phytochemical Analysis and Anti-inflammatory activity of *Anisomeles indica* (L.) Kuntze and *Phaleria macrocarpa* (Scheff.) Boerl.

Projects: 2020-21

A comprehensive review on phytochemical analysis and biological activities of *Adenanthera pavonina* L. and *Pongamia pinnata* (L.) Pierre.

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Abstract

Adenanthera pavonina L. and *Pongamia pinnata* (L.) Pierre is two massive medium sized deciduous trees belonging to the Leguminosae family. They are commonly used as herbal drugs for the treatment of various diseases. Extracts procured from each part of these plants are traditionally claimed to be used for the healing of broad spectrum of illnesses due to the presence of phytoconstituents such as flavonoids, terpenes, tannins and alkaloids. Accordingly, a sizable number of studies are carried out on the basis of the specialties of each part. It includes both the isolation of phytoconstituents as well as the identification of various biological activities such as anti-inflammatory, anticancer, antidiabetic etc. This study provides a comprehensive review on phytochemistry, pharmacological activities, biological activities, medicinal uses together with its role in the biofuel industry. Results suggests that *Pongamia pinnata* is rather more explored than that of *Adenanthera pavonina* which leads to the gaps that can be further investigated with future intervention.

Keywords: *Adenanthera pavonina*, *Pongamia pinnata*, Phytoconstituents, Biological activities

A review of the medicinal plant potential of selected plants from Dasapushpa

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Abstract

This review describes morphology, distribution, ethnomedicinal uses, studies conducted on the bioactivity and phytochemistry of selected plants from Dasapushpa. Recently, there has been an increase in the search for potential drugs of plant origin which could prevent or cure various ailments plant-based drugs have significant effect in minimising the side effects of synthetic drugs. Several plants were used in folk medicine as herbal remedies for various diseases. One such group include Dasapushpa, which constitutes ten sacred medicinal herbs. As the indigenous knowledge about folk uses of plants mostly comes from oral history, they lack valid evidence. Even though

Dasapushpa has many uses in traditional and complementary medicine, the modern generation lacks awareness. Therefore, it calls for the proper documentation of the ethnomedicinal uses of Dasapushpa and preserves our indigenous knowledge. This could serve as the basis for further studies to validate these claims. With more intensive research, especially from the effectiveness and safety perspectives, the gap between modern and traditional medicine can be lessened. We have conducted an exhaustive literature survey of some selected plants from Dasapushpa and summarised the available information in the best possible way. By analysing this information, researchers could undertake further studies on the unexplored uses of Dasapushpa. As the ethnopharmacological data contains already existing information, there is a wide scope for manufacturing potential phytomedicines. In addition, different classes of bioactive compounds have been reported to exist in Dasapushpa. Pharmacological activities related to their traditional uses have been evaluated through several studies. Among Dasapushpa, most of the herbs are widely distributed throughout our country, which could be easily availed for research. Despite their wide distribution, only a small fraction has undergone in vitro studies. In-depth investigations, toxicity studies and clinical trials must be conducted on these species. On the other hand, certain species of Dasapushpa are disappearing due to human intervention. They could not be found abundantly in our surroundings, as in the past. Therefore, efforts should be taken to conserve such species of medicinal plants from endangerment. In conclusion, this review reveals that Dasapushpa has immense medicinal potential, which could be utilized to discover novel drugs. This study shall help popularise our traditional knowledge and in vivo conservation of these medicinal plants. This would also promote research on similar plant species, which have remained unknown or have become obsolete over time.

Keywords: Phytochemistry, ethnomedicine, bioactivity, drug development.

***Morinda citrifolia* Linn. (Noni) and *Morinda tinctoria* Roxb. : A Comprehensive review on Phytochemical and Pharmacological applications**

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Abstract

Morinda citrifolia and *Morinda tinctoria*, both members of the Rubiaceae family, have long been revered in traditional medicinal practices owing to their therapeutic properties and rich phytochemical profiles. *M. citrifolia*, commonly known as Noni or Indian mulberry, boasts a wide distribution from Southeast Asia to Australia and exhibits a plethora of medicinal attributes. Its various parts—leaves, fruit, roots, bark, flower, and seed—are laden with phytochemical constituents like terpenoids, alkaloids, flavonoids, carotene, and amino acids. Traditional usage spans across diverse cultures, employing Noni as an antihelminthic, analgesic, antibacterial, and

anti-inflammatory agent, among others. Its extensive applications encompass addressing ailments such as diabetes, arthritis, high blood pressure, and even cancer.

Similarly, *Morinda tinctoria*, colloquially known as Nunna, thrives in South East Asia and is revered for its medicinal value. With its leaves and roots employed for their astringent and pain-relieving properties, this shrub finds traditional use in treating gout and respiratory infections. Additionally, *M. tinctoria*'s ripe fruits hold therapeutic significance in addressing conditions like arthritis, cancer, and gastric ulcers.

Both species are not only renowned for their medicinal prowess but also for their role in dye production. *M. tinctoria* yields morindone dye, utilized to color fabrics, while *M. citrifolia*'s health benefits have been extensively explored, showing promise in combating cancer, infections, arthritis, and hypertension. The rich phytochemical diversity present in these plants underscores their immense potential as sources of alternative medicine. Their traditional uses combined with modern investigations into their bioactive compounds hint at a treasure trove of health benefits, offering avenues for further exploration and development of therapeutic interventions.

Keywords: *Morinda citrifolia*, *Morinda tinctoria*, Pharmacological, Phytochemical, Rubiaceae.

The role of plant based antiviral compounds against COVID-19

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Abstract

The global pandemic of COVID-19 caused by the SARS-CoV-2 virus has brought about unprecedented challenges to public health, societal norms, and economies worldwide. The rapid spread of this highly contagious virus has led to a staggering number of infections and fatalities, disproportionately affecting vulnerable populations and disrupting various facets of everyday life. As the search for effective therapeutic strategies intensifies, there's a growing interest in exploring the potential of plant-based antiviral compounds as a means to combat the virus.

The role of phytochemicals found in medicinal herbs in inhibiting viral entry, replication, and propagation. Various secondary metabolites from plants, including flavonoids, terpenoids, lignins, alkaloids, and coumarins, exhibit promising antiviral properties. Through mechanisms such as interference with viral attachment, inhibition of RNA and protein synthesis, and enhancement of host immunity, these compounds showcase potential as therapeutic agents against SARS-CoV-2. Highlighted within this work are specific medicinal herbs known for their antiviral properties and the phytochemicals they contain. *Allium sativum*, *Citrus aurantium*, *Curcuma longa*, *Salvia rosmarinus*, *Ficus religiosa*, *Artemisia annua*, *Withania somnifera*, *Eucalyptus globulus*, *Lycoris radiata*, and *Scutellaria baicalensis* are among the herbs under consideration, each harboring unique antiviral compounds that merit exploration in the fight against COVID-19.

In the current landscape of escalating infections, a thorough understanding of these phytochemicals and their potential as antiviral agents becomes crucial. As the search for effective treatments continues, harnessing the therapeutic potential of plant-based compounds offers a promising avenue for developing novel therapeutics with minimal side effects and significant health benefits in combating the COVID-19 pandemic.

Keywords: COVID-19, SARS-CoV-2 virus, pandemic, antiviral.

Biosynthesis of silver nanoparticle using flowers of *Calotropis gigantea* (L.) W.T. Aiton and activity against pathogenic bacteria

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Abstract

Silver nanoparticles (AgNPs) from silver nitrate solution are carried out using the flower extract of *Calotropis gigantea*. Silver nanoparticles were characterized by UV–vis spectrophotometer, X-Ray diffractometer (XRD). Reduction of silver ions in the aqueous solution of silver during the reaction was observed by UV–vis spectroscopy. Crystalline nature of synthesized silver nanoparticles was studied by XRD pattern, refraction peak using the Scherrer’s equation. Antibacterial activity of the silver nanoparticles was performed by disc diffusion method against *Bacillus subtilis*, *Pseudomonas putida* and *Escherichia coli*. The antibacterial activity of synthesized silver nanoparticles by flower extract of *C. gigantea* was found against *B. subtilis* (10 mm). Synthesised AgNPs has the efficient antibacterial activity against Gram positive bacteria.

KEYWORDS: Silver nanoparticles; *Calotropis gigantea*; Anti-bacterial UV–vis spectrophotometer; XRD.

Projects: 2021-22

A short review of antiviral activities of selected medicinal plants

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Abstarct

The purpose of this review is to discuss the significance of developing therapeutic herbal formulations from various medicinal plants using knowledge based on the Ayurvedic traditional system of medicine. The current situation necessitates the use of appropriate herbal drugs to prepare the population's immunity to fight the infection. Research into the antiviral activity of

numerous potential medicinal plants has been limited due to (a) the highly infectious nature of viruses and (b) a lack of effective separation procedures for the identification of antiviral components from plants. The antiviral activity of five medicinal plants is summarized in the available data in the best way possible. This review discusses the antiviral properties of various plants including *Curcuma longa*, *Zingiber officinale*, *Allium sativum*, *Tinospora cordifolia*, *Nigella sativa* which help to understand the mechanisms of infection and their antiviral properties. This review revealed that medicinal plants are an important natural resource for the treatment of more chronic diseases. Plants produce and store a diverse array of biochemical products, many of which can be extracted and used in scientific research. This paper describes the potential antiviral properties of medicinal plants against a wide range of viruses and suggests screening for plants with broad antiviral activity against emerging viral infections. Overall, the evidence presented in this study supports the notion that medicinal plants have significant therapeutic potential, especially in the case of antiviral herb preparations.

Keywords: *Curcuma longa*, *Zingiber officinale*, *Allium sativum*, *Tinospora cordifolia*, *Nigella sativa*

A review on phytochemical and pharmacological potential of *Parmotrema* genus

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Abstract

The *Dirinaria* genus of lichen has shown potential in treating various illnesses. Several pharmacological studies have examined its antimicrobial, antioxidant, mosquito-repellent, pesticidal, thrombolytic, and in vivo activities, such as hepatoprotective, anti-inflammatory, antipyretic, analgesic, anti-ulcer, anti-diabetic, and hypolipidemic effects. However, further research is required to determine the exact molecular mechanism of action of the isolated compounds. This can be achieved by standardising phytoconstituents and conducting clinical trials and scientific animal experiments.

Keywords: Phytochemistry, antioxidant activity, drug development

A review on phytochemical and pharmacological potential of *Parmotrema* genus

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Abstract

Parmotrema is a large genus of foliose lichens that belong to the Parmeliaceae family. *Parmotrema* genus is a diverse and ubiquitous group of lichens that have been used in several traditional medicine systems. Studies reveal that *Parmotrema* exhibits numerous biological activities, such as anti-microbial, anti-fungal, anti-oxidative, and anti-proliferative properties. These properties can be attributed to pharmacologically active compounds like depsides, depsidones, phenolics, polysaccharides, lipids, diphenyl ethers, and dibenzofurans. The presence of free radical scavenging activity and cytotoxicity specifically towards cancer cells suggest that *Parmotrema* lichens can have potential anti-cancer properties and should be extensively investigated for pharmaceutical purposes. This review discussed the potentiality of this novel lichen *Parmotrema* species and its role in pharmacology.

Keywords: Phytochemistry, antioxidant activity, drug development

Nanobiosensors for Sustainable Agriculture

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Abstract

Nanotechnology emerges as a gift to mankind in our daily lives and scientific fields. Nano-biosensors are biosensors that are built from nanomaterials, such as nanoparticles and nanostructures. Because of their ability to detect changes at the molecular level, nano-biosensors have a lot of potential in sustainable agriculture. As a result, it's used to figure out how plant metabolites, gas exchange, volatiles, hormone, and ion concentrations have changed. They are indications of a variety of harsh environmental challenges, biotic and physiological stress, and their early detection can aid us in avoiding plant damage and yield losses caused by stress. Nanosensors can be used in smart farming, where all environmental factors related to plant growth, such as water, temperature, humidity, PH, nutritional factors, and so on, can be measured and preventative measures taken to control factors that reduce crop production using an IOT platform, thereby increasing productivity. Nano-biosensors have the potential to aid in the development of sustainable agriculture and agricultural productivity. The different applications of nano-biosensors and their promise in agriculture were reviewed in this review.

Key words: Nanobiosensor, agriculture and smart farming.

Comparative Study of *Alstonia venenata* and *Pittosporum dasycaulon*

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Abstract

Alstonia venenata and *Pittosporum dasycaulon* are members of the family Apocynaceae that shares a prominent place in Ayurveda system of medicine and also among different tribal groups in India for a variety of diseases such as fever, epilepsy, malaria and a variety of skin diseases. *A.venenata* was investigated with bioactive properties. Various plant parts like leaves, stem-bark, root-bark, flowers and fruits were extracted with a variety of solvents ranging from non-polar to polar and screened for bioactivity. The stem bark of *P. dasycaulon* has been used in folk medicine as an antibacterial and antifungal agent to treat infection. Essential oil obtained from the stem bark of this plant shows antibacterial activity. However, *Pittosporum dasycaulon* has yet to receive sufficient attention. Furthermore, little information about the antioxidant activity of Pittosporum is available and further studies have to be investigated.

Key words: *Alstonia venenata*, Antioxidant activity, Bioactivity, Conservation, *Pittosporum dasycaulon*

Polyamines: A biomolecule in plant growth regulation

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Abstract

Polyamines are universal organic polycations that are involved in a variety of essential activities in plants, including signalling, genome expression, plant growth and development, and abiotic stress response. Low molecular weight cations such as PAs, putrescine, spermidine, and spermine are found in all living creatures. Polyamines also control the expression of genes that code for stress proteins and also have anti-oxidant qualities. More than 40 years ago, the physiological link between abiotic stress in plants and polyamines was discovered. The purpose of this study is to highlight some recent breakthroughs in understanding the role of polyamines in plant stress tolerance. The complicated dynamic kinetics of polyamine production were observed when exposed to unfavourable environmental conditions such as salt, dehydration, low temperature, and ozone. Overall, the molecular processes discovered imply that PAs play an important role in a variety of stress and developmental pathways in plants throughout their lives. Polyamines, some of which are conjugated with cinnamic acids and proteins, have a role in a range of physiological

processes in plants. Plant polyamine research, such as its biosynthetic and catabolic routes and the functions they play in cellular activities, has exploded in popularity in recent years, making it an intriguing subject of study. This review examines the experimental strategies used to understand the functional significance of this relationship with the goal of improving plant productivity, especially under abiotic stress, and provides a comprehensive and critical evaluation of the published literature on interactions between abiotic stress and polyamines in plants.

Keywords: Polyamines, Spermidine, Abiotic stress, Putrescine.

***Pterocarpus santalinus* Linn. F. (Rakthachandanam): A review of its medicinal properties, Phytochemistry, Pharmacology and Conservation status**

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Abstract

Pterocarpus santalinus Linn.f., commonly known as Red sanders, is endemic to India and considered globally endangered.. The plant has a characteristic timber of exquisite color with superlative technical qualities. The red wood yields a natural dye santalin, which is used in coloring pharmaceutical preparations and foodstuffs. In the traditional system of medicine, the decoction prepared from the heartwood is attributed various medicinal properties. It has been used in inducing vomiting and treating eye diseases, mental aberrations, and ulcers. The heartwood of Red sanders is known to have antipyretic, anti-inflammatory, anthelmintic, tonic, hemorrhage, dysentery, aphrodisiac, and diaphoretic activities. It has also been used as a cooling agent. Ethanol extract of stem bark was reported to possess anti-hyperglycaemic activity. The wood in combination with other drugs is also prescribed for snake bites and scorpion stings. Phytochemical investigations of aqueous and ethanol extracts of stem bark revealed the presence of alkaloids, phenols, saponins, glycosides, flavonoides, triterpenoides, sterols, and tannins. The heart wood contains isoflavone glucosides and two anti-tumour lignans, viz., savinin and calocedrin. However, the species has remained unexplored for many pharmacological activities claimed. The present paper reviewed botany, uses, phytochemistry, and pharmacology of *P. santalinus*.

Key words: Conservation, Pharmacology, *Pterocarpus santalinus*, Wood

Projects: 2022-23

Phytochemical analysis and Antiinflammatory activity of *Anisomeles indica* (L.) Kuntze and *Phaleria macrocarpa* (Scheff.) Boerl.

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Abstract

In the present study extracts of *Anisomeles indica* and *Phaleria macrocarpa* were evaluated to compare the phytochemical and anti-inflammatory properties. The preliminary phytochemical screening marked the presence of secondary metabolites like alkaloids, tannins, steroids, flavonoids, terpenoids, phenols and glycosides. Anti-inflammatory activity of *A. indica* and *P. macrocarpa* was measured by inhibitory activity against protein denaturation method. The ethanolic extracts of *A. indica* and *P. macrocarpa* leaves possess anti-inflammatory activities. Anti-inflammatory activity of ethanolic extracts of *A. indica* and *P. macrocarpa* showed more than 90% inhibition in *P. macrocarpa* where as it was below 50% in *A. indica*, which shows that the anti-inflammatory activity of *P. macrocarpa* is more compared to that of *A. indica*. The results of the present study clearly indicates that ethanolic extracts *A. indica* leaves and pericarp of *P. macrocarpa* contain phytochemicals such as alkaloids , tannins , steroids, terpenoids, flavonoids, phenol and glycosides . Highest phenol quantification is shown in *P. macrocarpa* compared to *A. indica*. *Phaleria macrocarpa* has in vitro anti – inflammatory activity since, it possesses more inhibition compared to that of *Anisomeles indica*. The present data will help us to understand the therapeutic use of *P. macrocarpa* and *A. indica* in various diseases.

Keywords: *Anisomeles indica*, *Phaleria macrocarpa*, phytochemical analysis, Anti-Inflammatory Activity

Phytochemical and Pharmacological Analysis of *Catharanthus roseus* (L.) G. Don flower extracts

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Medicinal plants are the most important source of life, providing medicines for most of the world's population. Plants continued to be important therapeutic agents for relieving the ailments of humankind. The growing needs of man led to explore green medicine without intricacies of synthetic drugs. The family Apocynaceae was found to be the major contributor of health-giving plants and *Catharanthus roseus* is a medicinally potent plant with countless ailment healing

properties. The plant possesses boundless phytochemical constituents, which account for the various medicinal administration. The plant also holds characteristic anti-oxidant and anti-microbial traits. The present research demonstrates the presence of phenols and flavonoids quantitatively in various extracts, among which water extract showed the highest properties in phenol and hexane extract in flavonoids. The anti-oxidant activity investigated by the DPPH radical scavenging assay revealed the highest activity in water extract, ethanol extract and hexane extract, respectively. Based on the study it is evident that the species *Catharanthus roseus* can be used as a promising source of easily accessible natural anti-oxidants and in pharmaceutical applications. The ethanolic extract showed the highest anti-bacterial activity against many microorganisms such as *E. coli*, *Pseudomonas spp*, *Staphylococcus spp*, and *Bacillus spp*. The results show beyond doubt that *Catharanthus roseus* has significant capability for many pharmacological and phytochemical activities, which makes the flower a potent lifesaving drug that reduces inflammation and DNA damage, resists infections, and slows cancer cell growth. The main objective of this research was to reveal the diverse potentialities of *Catharanthus roseus* flower extract and to help with numerous future applications in the medical field by being a basic source for making ointments, band-aids, disinfectants, and many more. This research attempted to add to the ongoing discourse on phytochemical and pharmaceutical analysis by opening doors to upcoming medical interventions.

Keywords: Antimicrobial, flower extract, disinfectant.

Effect of Biopriming agents on seed germination and stress tolerance among selected vegetables

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Abstract

Biopriming usually refers to the use of beneficial microorganisms, particularly plant growth-promoting bacteria (PGPB), able to survive under various harsh environmental conditions. It is a pre-sowing procedure that increases seed resistance and tolerance. This is a novel method which integrates biological and physiological aspects of disease control. Alternate method for soil and seed-borne pathogens. Helps reduce the risk of potentially harmful pesticides. This treatment increases the seed germination and the seedling vigour. The study aimed to determine the effectiveness of *Pseudomonas* on the seed germination parameters of Okra. The results revealed that seed biopriming successfully alleviated biotic as well as abiotic stress conditions in agricultural systems and improved the seed quality and yield in limiting environments. These interventions will make them self-reliant and harness multiple benefits from nature-based solutions. Seed bio-priming is useful in almost all cereal, pulse, vegetable, horticulture and forest

crops. Under favourable or unfavourable conditions, the bio-priming agents have positive effects on the seedlings.

Keywords: Biopriming, *Pseudomonas*, Okra, abiotic stress

Morphological, Phytochemical and Larvicidal study on Four *Ocimum* Species

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Abstract

Larvicidal application is a vital strategy to interrupt a mosquito's life cycle for vector control. Many plants in this plant kingdom have such larvicidal properties. One of such family is Lamiaceae with most important phytochemical components. This study was conducted to evaluate the larvicidal properties of the extract of sweet basil leaves against the wild strain of. Qualitative analysis of the plants revealed that flavonoids, alkaloids, and steroids present in all four plant extracts are responsible for the larvicidal action. The larvicidal activities of the leaf extracts were studied under laboratory conditions. Some of the phytochemical compounds present in them have the free radical scavenging properties. The current study was undertaken to investigate Morphological, Phytochemical and Larvicidal study on Four *Ocimum* Species. The extracts of *Ocimum* plant in different solvents like petroleum ether, ethyl acetate and distilled water were prepared for the study.

Keywords: Alkaloids, Larvicidal properties, *Ocimum*, Phytochemical analysis

Antibacterial and Antioxidant Efficiency of *Pterocarpus marsupium* Roxb.

Leaf Extract

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Abstract

Plant tissues are commonly rich in secondary metabolites including phenolic compounds, flavonoids and carotenoids, which exhibit antioxidant and antibacterial activities due to their redox properties and chemical structures. The present study was carried out to screen and evaluate the antimicrobial activity of leaf extracts from *Pterocarpus marsupium* Roxb. Results indicated that phytochemical extracts of *P. marsupium* exhibited significant antibacterial activity at all dosage. However, the inhibitory activity was found to be dose dependent. This study depicts that ethyl acetate and methanol extracts of leaves of *Pterocarpus marsupium* can be used as a potential source of novel antimicrobial agents.

Keywords: Antibacterial agents, medicinal plant, phytochemicals, *Pterocarpus marsupium*
Study on *Clerodendrum paniculatum* linn. flower mediated green synthesis of silver nanoparticles and their biological activities

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Abstract:

The synthesis of nanoparticles, particularly silver nanoparticles (Ag NPs), using plant extracts has emerged as a sustainable, cost-effective, and environmentally friendly alternative to conventional chemical and physical methods. This approach harnesses the natural reducing and capping agents present in plant extracts, circumventing the use of toxic chemicals and energy-intensive processes associated with traditional methodologies. Among the vast array of plant-based synthesis routes, *Clerodendrum paniculatum*, a species known for its diverse phytochemical composition and medicinal properties, stands out as a promising candidate for the synthesis of Ag NPs.

This study focuses on the flower extract of *Clerodendrum paniculatum*, exploring its potential in the green synthesis of Ag NPs. The flower extract of this evergreen woody shrub contains a rich array of metabolites, including flavonoids, phenolics, terpenes, steroids, and volatile constituents, which serve as efficient reducing and capping agents in nanoparticle synthesis. The biologically active constituents present in the flower extract are evaluated for their ability to facilitate the rapid reduction of silver ions and the formation of high-quality Ag NPs. The biosynthesis of Ag NPs using *Clerodendrum paniculatum* flower extract showcases its capability as a viable alternative in large-scale nanoparticle production. The eco-friendly nature of this approach, attributed to the inherent properties of plant materials and their rapid reduction potential compared to microbial sources, underlines its significance in the field of nanoscience and nanotechnology.

This study highlights the potential of *Clerodendrum paniculatum* flower extract as a sustainable and effective bioresource for the synthesis of Ag NPs, shedding light on its diverse applications in various fields such as microbiology, pharmacology, and cell biology. The environmentally benign nature of this green synthesis route holds promise for advancing nanomaterial production while minimizing adverse ecological impacts, making it a significant advancement in the synthesis of silver nanoparticles.

Keywords: *Clerodendrum paniculatum*, silver nanoparticle, antimicrobial.

Chemical composition and biological activities of essential oil extracted from the leaves of *Alpinia calcarata* (roscoe.), a multipotent medicinal plant

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Abstract

Alpinia calcarata is a rhizomatous perennial herb, which belongs to the family Zingiberaceae. Its importance is far and wide due to its virtue as folk medicine especially in countries like India, China, Sri Lanka and many more regions. Experimentally this study shows that essential oil extracted from the leaves of *Alpinia calcarata* shown to possess antioxidant, antilarval, and antibacterial activities. The antioxidant property is tested using DPPH scavenging assay and antibacterial by disc diffusion assay which all showed positive results. In antibacterial test, activity of essential oil is tested against three species including *Proteus vulgaris*, *Bacillus sp.* and *E.coli*. The antilarval activity of the oil is tested against *Culex quinquefasciatus*. GC/MS test revealed that it contains 1,8- cineole as major component along with other components including Carotol, Methyl 11,12-tetradecadienoate, Atractylenolide III and other 44 components.

Keywords: *Alpinia calcarata*, Antibacterial, Antioxidant, GC/MS, Zingiberaceae.

Plant regeneration in *Cardiospermum Halicacabum* L. through Nodal Segments, Callus Organogenesis and True Two-Type Conformity of Plant by Histological Studies

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ABSTRACT

Cardiospermum helicacabum L. known as the balloon plant or love in puff, belongs to the family Sapindaceae, is a long lived, scrambling vine. *C.halicacabum* leaves contain some pharmaceutically important compounds like saponin, stigmasterol. In the present investigation an attempt has been made to study rapid micro propagation from nodal explant of *C.halicacabum* and to check the anatomical features in the invitro and exvitro level. The nodal segments were cultured on MS medium supplemented with various plant growth regulators. The main reason for the micro

propagation of this species is its high medicinal value in ayurveda, siddha, homeopathic and unani. Highest direct regeneration percentage is shown in MS+BAP (0.3 mg/l) and induction of friable the callus from the cut end of nodal explants showed in the hormonal combination of MS+BAP+2,4-D at 0.3+0.2/L produced green, compact callus. The minimum period for callus induction from nodal plant was 11 days. Anatomical studies in the exvitro and invitro studies revealed that the presence of 5-8 vascular bundles in stem, and pith is present in the centre. In leaves, the non-glandular and glandular trichomes are present in both cases. Also the contamination frequency was checked and showed 85% in the combination of MS+2,4D (0.03mg/l). The propagation method in *Cardiospermum halicacabum* is highly useful in the conservation and mass clonal propagation. It will definitely help in the horticultural and ornamental improvement of this medicinal plant and can lead to the analysis of secondary metabolites and bioactivity of *C.halicacabum*.

Keywords: *Cardiospermum halicacabum*, Tissue culture, Sapindaceae, organogenesis, Callus.

Department of Zoology

Title of Projects

2020-21

- Association between BMI, Age and lifestyle diseases
- A Study on Butterfly diversity in central District of Kerala
- Distribution and diversity of Lepidopterans and Odonates in different geographical divisions of Kerala and Tamilnadu

2021-22

- Evaluation of microbial mediated degradation of Revalciterant Azodye Methyl orange
- Analysis of the involvement of bacterial endosymbionts complimenting the carbohydrate metabolism of *Rastrelliger Kanagurta*
- Screening of bacterial adhesion inhibition property of *Rhinoceros* larval extract

2022-23

- UV Protection Activity of Carotenoid Pigment by *Lentibacillus juripiscarius*
- Eco Friendly Biosynthesis of iron nanoparticles and screening for Mosquito larvicidal activity
- Molecular based analysis of bacteria biodiversity of amyolytic bacterial isolates from the gut of *Hermetiaillucens*

Projects 2020-2021

Association between BMI, age and lifestyle diseases

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Abstract

BMI is a convenient and simple measure of health, and it allows individuals to assess their health independent of medical authorities. It is a simplest and most cost-effective option for tracking obesity at the population level. Informations were collected through a Google Form survey. The data were collected from different regions of southern Kerala, from 7-9-2020 to 8-26-2020. Both female and male sexes were included belonging to Age categories of 1 to 60 and above. Total 425 data were collected of which, 160 were sorted out and 40 participants were selected using random sampling as a representative of whole data collected. The categorizations were as follows: 1-19, 20-39, 40-59, 60 and above.

BMI is calculated as weight in kilograms divided by the square of height in meters. In the age group 1 to 19 a major percent were having a normal weight. Underweight and the rates of obesity are very low in people belonging to this particular age group. In the age group 20-39 there are cases of normal weight and a moderate number of cases of underweight. In the Age range of 40 to 59, here a considerable number of people had an abnormal BMI, and a comparatively high rate of obesity was seen in them. In the age group above 60 there is a moderate number of cases of normal weight and a less underweight. . In 20 to 30 age groups obesity is due to consumption of unhealthy food, alcohol, less exercise etc. In age group 40 to 50 obesity is mainly due to food routine, lack of sleep, consumption of medicine etc. The main reason of obesity in the people of age group above 60 is due to consumption of medicine and a lack of work. .

Key words: BMI, Obesity

A Study on Butterfly Diversity in Central Districts of Kerala

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Abstract

Butterflies are a dominant part of the food web and they are ecologically important. Butterflies are the tools that can be used for the assessment of environment. Their presence and absence is the indication of natural vegetation in a locality. Larval host plants have a vital role in butterfly's life cycle. A study was conducted in 10 different localities (Viyur, Padukkad, Thiroor, Vellanissery, Ollur,

Kattilapoovam & Varavoor in Thrissur district; Attappady & Alanallur in Palakkad district and Ponnani in Malapuram district). 49 species of butterflies belonging to 5 families were documented throughout the study period. Kattilapoovam of Thrissur district has the most number of species (34) and Thiroor and Viyoor regions have the least number of species (15). Nymphalidea was the foremost preceding family with 21 species, accompanied by Papilionidea (9), Pieridae (7), Hesperidae (7) and Lycaenidae (5). Kattilapoovam area is rich in natural vegetation with almost all species of larval host plants whereas Viyyur and Thiroor regions lack some of the important larval host plants. In order to maintain the excellent population of butterflies, ample amount of host plants have to be maintained and if absent, they have to be introduced.

Key words: butterflies, host plants, pollinators

Distribution and Diversity of Lepidopterans and Odonates in Different Geographical Divisions of Kerala and Tamil Nadu

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Abstract

The unique distribution and composition of Lepidopterans and Odonates in different regions of the world makes the study relevant forever. The threat of different species can be revealed by studying the spatio-temporal variation in composition and distribution of species. Here an attempt is made to study the diversity of Lepidopterans and Odonates from different geographical localities of Kerala and Tamil Nadu, to analyse how different geographical features affect the distribution and diversity of Lepidopterans and Odonates and to understand the effect of anthropogenic activities on the abundance and distribution on lepidopterans and odonates. Twenty five different locations were randomly selected for the observation of lepidopterans and odonates. 102 species belonging to order Lepidoptera and Odonata were identified out of which 82 species were Lepidopterans (51 species of butterflies and 31 species of moths) and Odonates included 20 species. 51 species of butterflies under 4 families, 31 species of moths comprising 9 families and 20 species of Odonates coming under 6 families were recorded from the present survey. Monitoring the density and diversity of moths will help to analyse the change in our environment and they are also used as model organisms to study the impact on environment such as habitat loss, fragmentation and climate change. The results of the current survey reveal that highlands support a rich diversity of odonates due to the least anthropogenic disturbances, better water quality, shade cover and rich floral diversity in these habitats. The species which are rich in highlands are common widespread species which can tolerate comparatively low water quality and human disturbances. The coastal plains shows less species abundance and diversity of odonates and this may be due to the presence of brackish water in water bodies.

Key words: odonates, lepidoptera, climate change, diversity index

Projects 2021-2022

Evaluation of Microbial Mediated Degradation of Revalciterant Azo Dye Methyl Orange

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Abstract

A project was conducted on the topic Evaluation of Microbial Mediated Degradation of Revalciterant Azo Dye Methyl Orange. The main objective of the study was to investigate the potential of bacterial strains isolated from water in remediating azo dyes. It was evident that maximum bacterial growth may be obtained by allowing the bacteria to grow in 37 degree Celsius. Bacteria showed maximum growth in pH-9.2 and growth was reduced immensely in low pH. The test showed 88.07% reduction in bioremediation by azo dyes at concentration of 15 mg/ml of methyl orange and 77.31% of degradation in 5mg/ml. i.e methyl orange suggesting that only 11.93% and 22.69% of the actual pigment remained. The effect of azo dye concentration of 5 and 15mg/ml. they showed death 900 minutes (15 hrs) in 5mg/ml of degraded azo dye concentration and they capable of surviving up to 1920 minutes (30 hrs) in 15mg/ml of degraded azo dye

Key words: azo dyes, bioremediation

Analysis of the involvement of bacterial endosymbionts complimenting the carbohydrate metabolism of *Rastrelliger kannagurta*

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Abstract

Cellulose metabolism in many fishes are found to be controlled by bacterial symbionts. In this study, the amylolytic efficiency of the symbiotic bacteria in the gut of the mackerel was studied. The result of the study indicated that, in mackerel, bacterial symbionts perform digestion of cellulose matter and enzyme assay study also confirmed the result.

Key words: Bacterial endosymbionts, Mackerel, Cellulose digestion

Screening of Bacterial adhesion inhibition property of Rhinoceros larval extract

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Abstract

In this study, it was investigated the effect of insect extract as an anti-bacterial and anti-adherent agent. Evaluating the anti-microbial and anti-biofilm activity of the extract was investigated using *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *E.coli*.

Human pathogenic strains i.e. gram negative (*E.coli*) and a gram positive (*Staphylococcus aureus*) bacterial strains were used for antimicrobial studies of given sample by well diffusion method. From the results it was clearly visible that the insect extract had no anti-bacterial activity against both gram positive and gram negative bacteria as no clearance zones were visible around wells containing the samples. Result of the biofilm production revealed that bacterial strain were capable of biofilm formation. The effect of extract in anti-biofilm activity was analyzed, by crystal violet assay. The active extract showed positive anti-adherence effect on the biofilm formation in glass surface. It inhibits the biofilm formation on the glass surface and show turbidity due to the presence of bacterial strains

The results showed that the surface adherence of biofilm onto glass slide reduced considerably on application with the insect extract. This investigational analysis can be effectively used in hospitals and laboratories to treat the medical instruments of *Staphylococcus aureus* biofilm formation in turn helping in reduction of spread of infections. However it was not effective against *Pseudomonas aeruginosa*. Bacteria tend to behave differently in vitro and in vivo thereby making it essential to further investigate the behavior of these biofilms.

Keywords: Rhinoceros beetle, gram positive bacteria, anti-adhesive effect, anti-biofilm activity

Projects 2022-2023

UV Protection Activity of Carotenoid Pigment by *Lentibacillus juripiscarius*

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Abstract

Pigments are compounds with characteristics significance. In food businesses they serve as additives, colour enhancers, anti-oxidants etc. Bio-pigments derived from microorganism are stable than those derived from plants and their availability for cultivation of microbes are more feasible. Therefore, they are more commercially preferred. Numerous microbes are capable of producing bioproducts. Among them bacteria possess greater potential for this purpose.

The methods used for the extraction are the sample collection, isolation of pigment producing bacteria from soil samples, identification of pigment producing bacteria species, test for carotenoids in bacteria, thin layer chromatography, isolation of carotenoid pigments by column chromatography, determination of the anti-microbial activity of the bacterial pigment, GC – MS analysis, confirmation test for carotenoids etc. The conclusion is that natural colour pigments were extracted from bacteria. The isolated yellow pigmented Bacteria were identified as *Lentibacillus juripiscarius* by 16SrRNA sequencing. The extracted pigment from the bacteria was subjected to UV protection activity and it was found that the onion root tips which was treated with the pigment had no abnormalities compared to the control which was treated with water had abnormalities in their cell cycles. Key words: bio pigments,

Key words: bio pigments, Anti-microbial activity, UV protection activity, cell cycle

Eco Friendly Biosynthesis of Iron Nanoparticles and Screening for Mosquito Larvicidal Activity

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Abstract

A project was conducted on the topic Eco Friendly Biosynthesis of Iron Nanoparticles and Screening for Mosquito Larvicidal Activity. The main objective of the study was the green synthesis of iron nanoparticles from bacteria in the gut of earthworm, Characterization of iron nanoparticles using SEM analysis. Evaluation of toxicity of iron nanoparticles against mosquito larvae. The synthesized nanoparticle was weighed and diluted in 5 ml distilled water to get aqueous solutions of varying concentrations. Nanoparticle dust of 0.01g, 0.025g, and 0.05g were diluted

in 5ml of distilled water in 3 different bottles, making up 3 different concentrations of nanoparticles. Into each bottle of nanoparticle solution, 5 mosquito larvae were introduced. These bottles with the live larvae were separately observed for death of the larvae due to nanoparticle toxicity. The solution with high concentration all larvae will die within one day. Death rate of larvae decreases with decrease in concentration.

Key words: Iron nanoparticles, larvicidal activity, mosquito larvae

Molecular Based Analysis of Bacteria Biodiversity of Amylolytic Bacterial Isolates from the Gut of *Hermetia illucens*

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Abstract

Bacterial communities are distinct in different organisms and environments. Research using new and efficient tools for the identification and characterisation of bacterial communities has been the key for expounding bacterial diversity studies. DNA-based molecular methods have a key role in enhancing our knowledge of bacterial diversity. A study was conducted here to isolate the bacteria from the gut of *Hermetia illucens* and to identify the amylase degrading capacity of isolated organisms. RAPD is widely used for evaluating genetic relationship and here an attempt is made to understand the concept of DNA fingerprinting by Random Amplification of Polymorphic DNA (RAPD) in context of bacterial strain identification. In the present study a total of 7 culturable bacterial isolates were obtained from the intestinal tract of the *Hermetia illucens*, out of which 4 had the ability to produce amylase enzyme. All the bacterial isolates were cultured and maintained in nutrient agar media. DNA isolation was done followed by RAPD studies and it was determined that the bacterial isolates showed bacterial diversity among themselves.

Key words: amylolytic bacteria, RAPD, bacterial diversity

Department of Physics

Title of Projects

2020-21

- A study on various applications of opamp using the virtual electronic circuit simulator falstad
- Ultrasonic and ir proximity sensor-based circuit using arduino
- Analysis of stellar data by plotting color diagram and h r diagram
- X-ray diffraction analysis
- Effects of wifi radiation on the germination of seeds and egg hatching
- Dynamics of double pendulum
- Fourier series and its applications
- Astrometry of selected stars using data from various space missions

2021-22

- Numerical Techniques for Integration.
- Effects of Ultrasonic Cavitation on Various Materials.
- Study on Diffraction Patterns.
- FTIR Spectral Studies of Household Plastics for Identification Tool Design of Hazardous Microplastics.
- Structural and Optical Characterization of Green Synthesized Silver Nanoparticles Using Neem, Banyan and Moringa Leaf Extracts.
- Synthesis of Iron Oxide Nanoparticles Using Different Leaf Extracts.
- Enhanced Fingerprint Security by Amalgamation of Features.
- A Study on Various Factors Affecting the Performance of a Solar Cell

2022-23

- Viscosity measurements of newtonian and non-newtonian liquids using ostwald and brookfield viscometers
- An investigation on the performance of single/ multimode optic fibres
- Python tool for crystallographic data analysis
- Towards quantum dot characteristics in metal nanoparticles
- Methylene blue dye degradation studies with ferrites as photocatalysts
- Thermal conductivity study of engine oils
- Green synthesis of iron oxide nanoparticles using *Momordica charantia* plant extracts
- Extraction and strength studies of fibres extracted from *Pandanus veitchii*
- Analysis of fourier integrals and transforms

A study on various applications of OPAMP using the virtual electronic circuit simulator falstad

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Abstract

The disruption to traditional classroom learning experiences had a serious impact during COVID-19 pandemic. Laboratory based disciplines were significantly affected by lab shutdowns. Amidst such adverse situations, 'virtual labs' evolved as a powerful educational tool that enabled students to conduct experiments at the comfort of their home. This project explored the idea of using online electronic circuit simulation labs for learning and research purposes. Among numerous virtual electronic circuit simulators, we have chosen a free and easy online Circuit Simulator Applet Falstad for studying operational amplifier (Op-Amp) applications. In this report, we have presented various basic applications such as Op-Amp as a summing amplifier, Op-Amp as a subtractor, Op-Amp as an inverting and non-inverting amplifier, Op-Amp as integrator and differentiator. Also, further investigations were done towards solving simultaneous equations with two-, three- and four- variables using Falstad. The tabulated values of virtually created circuits were found to exactly match theoretical counterparts.

Though the virtual electronic stimulators cannot provide and replace the real time laboratory experience, they can truly add towards better understanding of electronic circuit. Circuit simulators can be used for designing electronic circuit layouts for better visual understanding prior to the hands-on practical sessions. The software gives the user the freedom to design a circuit from scratch, run the circuit, make alterations and redo the procedures for receiving in depth insights into the working of the circuit. The endless possibilities of correcting the given circuit before performing the actual experiment at the lab makes it genuinely unique.

Key words: Circuit simulator, Falstad, Operational Amplifier

Ultrasonic and IR Proximity Sensor Based Circuits Using Arduino

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Abstract

A sensor is a device, subsystem, or module that helps us to detect a change in its environment. Sensors will send this information to other electronic devices like computer processors. In general, a sensor converts one form of energy to another. Sensors are widely used in our daily life. Sensors find applications in touch sensitive elevator buttons, light intensity modulators based on motion, parking sensors, driverless cars, assistive technologies etc. Proximity sensors are those which detect objects without direct contact. It converts the information about the movement of an object to an electrical signal. They detect the target with the help of specific characteristics like sound, light, electromagnetic field etc. depending upon the type of proximity sensor. In this project the basic working principles of ultrasonic sensor and IR sensor were discussed and basic circuits were constructed. The Arduino sketch for these sensor based circuits were prepared and the programmes executed in Arduino IDE. Ultrasonic sensor circuit was also constructed and simulated using Tinkercad software. It was observed that the IR sensor is used for detecting the presence of an obstacle, however the exact distance of separation between the obstacle and the sensor could not be determined. Ultrasonic sensors can provide an accurate estimation of proximity of the obstacle from the sensor. In the present study the exact distance was displayed in a serial monitor as well. The circuits for the real life applications were reviewed and simulated using ultrasonic sensors in Tinkercad. A social distancing alarm, an automatic hand sanitizer dispenser and a smart waste bin based on ultrasonic sensors were realized using Tinkercad. The circuits discussed can be upgraded for IoT applications where the sensor detected data is stored in the cloud and accessed remotely.

Key words: Proximity sensor, Ultrasonic sensor, Arduino

Analysis of Stellar Data by Plotting Color Diagram and H R Diagram

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Abstract

We humans are always fascinated by stars and everything related to stars from medieval times. Some believed these heavenly bodies had mystical powers. Observing the stars and their life cycles gives us an idea about how the cosmic forces work. A star is a huge ball or collection of dust and gases, which are held together by gravity. A star's life is always under risk, because it is always in a war with gravity. Because of this, there are many stages of stars, from its birth to maybe even after its death. In this project we are mainly trying to plot Color- Color Diagram and H R Diagram of a collected number of stars. Discussing preliminary topics like luminosity, magnitudes, spectral classes, temperature and color. SDSS Sky Server has helped us in collecting the data, studying about the topic and to understand more about it. Data collected, recorded and plotted into a graph. Most stellar data we collect for this project are of stars far above the plane of the Milky Way. When working on Color-Color diagrams, we got to learn about how to quantify color, how to interpret color as a temperature. Stars closer to the origin are hotter. These stars are more greenish bluish than red. Stars which are grouped together in the graph are neither greenish nor reddish, they are either yellow or orange-red.

Key words: Stellar data, SDSS

X-RAY Diffraction Analysis

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Abstract

X-ray Diffraction Analysis (XRD) emerges as a crucial technique in materials science, offering profound insights into the crystallographic structure of materials. The process involves subjecting a material to X-rays, measuring resulting intensities and scattering angles to unveil a distinctive diffraction pattern. XRD primarily serves material identification, relying on the unique diffraction

patterns of crystals. Crystals, characterized by orderly atomic arrangements, interact with incident X-rays, behaving akin to electromagnetic radiation waves. Elastic scattering occurs as X-rays engage with electrons in crystal atoms, generating spherical waves. While these waves typically undergo destructive interference, specific directions of constructive interference are dictated by Bragg's law.

This paper centers on the analysis of X-ray diffraction data using specialized software, aiming to determine crystallographic parameters such as grain size, interplanar spacing, and lattice constants. The analysis encompasses the overall evaluation of X-ray diffraction data for the sample. The lattice constants for the given compound were determined, and the crystal system was identified. To achieve this, the interplanar spacing, d , was calculated using Bragg's equation. The crystallite size of the samples was assessed through two approaches: a) employing the Debye-Scherrer equation, and b) utilizing Williamson-Hall plots. A comparison of crystallite sizes obtained through these approaches revealed lower values with the Debye-Scherrer equation, attributed to microstrain in the crystals. The strain in the crystals, reflected in the slope of the Williamson-Hall plot, was quantified.

Overall, a comprehensive analysis was conducted based on the provided XRD data. Additionally, the paper briefly explores the variation in crystal properties with changes in dopant concentration, revealing a discernible trend linked to dopant ion properties.

Key words: XRD, interplanar spacing, Williamson-Hall plot

Effects of wifi radiation on the germination of seeds and egg hatching

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Abstract

Due to the rapid increase in the number of artificial sources of electromagnetic fields, there is a need for research in the effect of these radiations on the living organisms. Level of microwave radiation in our environment from wireless technology continues to increase as Telecom providers endeavor to supply their users with hundred percent coverage. Also a wide range of wireless devices are developed for use in homes, school and office environments. The global growth in the usage of Wi-Fi has been developed considerably during the past few years especially in the last 2 years due to the world pandemic, covid-19. The situation is we are more dependent on these wireless devices than human or other resources for all needs. Hence studies on the effect of these radiation on the living cell are fruitful.

This project mainly deals with the observation of the effect of Wi-Fi radiations in the germination and growth of the seeds, namely mung bean and mustard seeds and the hatching of chick eggs. Here, the studies that we have done through this project are given, which includes the detailed description about electromagnetic spectrum, various radiations, their applications and side effects, the theory's detailed explanation about the experimental methods that we used and our interference regarding the side effect of radiation on the hatching of chick eggs, germination of mung bean and mustard seeds respectively. These are explained vividly with the observed readings, images and graphs.

The plant placed at 300 cm has grown shorter but healthier than other plants. The plants at 50cm, 100cm, 150cm seem to be unhealthy and the number of leaves is less compared to others.

Keywords: Wi-fi, Electromagnetic spectrum

Dynamics of Double Pendulum

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Abstract

A double pendulum, known for its chaotic behavior, proves to be easily approximated and analyzed, presenting a nonlinear coupled oscillator with chaotic motion. Despite its chaos, this system lends itself to straightforward interfacing with a computer. In this study, we employed a Python program to vividly illustrate the diverse behaviors of the double pendulum. While the chaotic dynamics of the double pendulum have not been fully explored by physicists and mathematicians, our investigation delves into its intricacies. We examine the system's chaotic behavior by exploring expressions for angular displacement, angular velocity, angular acceleration, as well as kinetic and potential energy, culminating in the determination of the total energy of the system.

Transitioning from theoretical considerations to practical implementation, the parameters for constructing the double pendulum based on literature. Once constructed, captured high-quality video footage of the oscillating double pendulum using a handycam. The subsequent video processing, facilitated by Python, involved frame extraction and pixel extraction, constituting a crucial aspect of investigation. Pixel values extracted from the video are then applied to create graphical representations, with each graph generated by its respective Python code. Graphs include angular displacement versus time for both upper and lower pendulums, the relationship between the angular displacements of the two pendulums, angular velocity versus time for both pendulums,

angular acceleration versus time for both pendulums, and kinetic and potential energy versus time for the double pendulum system. Upon analyzing the graphs, a distinct nonlinear behavior is observed in the time intervals of 2s-4s and 7s-8s, indicating chaotic motion. Notably, the threshold for nonlinearity is higher in this region compared to others. It is concluded that even minor changes in initial conditions lead to significant variations in graph behavior. In the identified chaotic region, the lower pendulum gains additional kinetic energy transferred from the upper pendulum, portraying the upper pendulum as a driving force. Ultimately, damping forces cause the motion of the double pendulum to slow down until it reaches the equilibrium position. This comprehensive analysis provides a clear insight into the varied behaviors of the double pendulum

Key words: double pendulum, Python, chaotic motion

Fourier series and its Applications

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Abstract

Fourier series is used in the analysis of periodic functions. It represents any periodic waveform as the sum of sine and cosine waves plus a constant. We have done a thorough review of the mathematical foundations of the Fourier series. Various mathematical functions are Fourier analyzed and the corresponding Fourier series are simulated using python code. Some of the common periodic waveforms which are of interest in electronics are also analyzed and computationally simulated.

Key words: Fourier series, periodic waveforms

Astrometry of selected stars using data from various space missions

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Abstract

Space missions are helpful in providing information about the stars as they give us information about their distance, velocities, magnitudes, coordinates, etc.. Every space mission aims at

gathering information about the stars and other celestial objects with more and more accuracy. In this project, we have used astrometry to estimate the distance and transverse velocities of different types of 60 stars. The data for the calculation is taken from data releases of space missions - Hipparcos, Gaia DR1, DR2 and EDR3. The star data releases of these missions were collected from VizieR -the astronomical catalog e-library. The interactive sky atlas ALADIN is also used to obtain the images of stars. Data of sixty stars belonging to different spectral types, star types and colors have been used for our distance and transverse velocity measurements. The distance of these stars are estimated in Parseconds from the parallax data released in the star catalogs. The errors involved in the distance measurement for each star data is also calculated and plotted using Python programming. From the values and plots, a comparison in errors involved in space mission measurements is carried out . It can be seen that the values from Hipparcos are not as accurate as Gaia, in large distances (above 500 pc). At a distance of 0-100 pc , almost all the values of different missions are similar and contain only negligible errors. But when distances increase the values of Hipparcos and GaiaDR1 contain large errors. At larger distances Gaia EDR3 is more trustful. Gaia significantly improves on Hipparcos for a number of different reasons also. The primary mirrors of Gaia collect more than 30 times the light of Hipparcos, allowing for more sensitive and accurate measurements. Gaia measures a star's position and motion 200 times more accurately than Hipparcos.. Comparing data from these two helps us to understand that Gaia EDR3 is more trustworthy.

Keywords: Astrometry, Hipparcos, Gaia DR1, DR2 and EDR3, ALADIN, VizieR

2021-22 Projects

Numerical Methods for Integration

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Abstract

Numerical integration comprises a wide family of calculating the numerical esteem of a clear indispensably and by expansion, the term is additionally now and then utilized to portray the numerical arrangements of differential equations. There are numerous strategies in numerical integration to explore and through this paper we would like to correlate numerical integration and python programmes. All subjects are backed by numerical illustrations with basic python codes for simpler understanding. This venture comprises four strategies of numerical integrative. The primary portion of the paper gives a brief presentation of numerical integration. Afterwards we see

distinct sorts of strategies and its application for a given function. For each given strategy of numerical integration we have a python programme with basic codes.

Numerical methods are very helpful in solving theoretical problems where all analytical methods fail. But every problem has a solution in a numerical method. Solutions obtained using one method can be checked and rectified using other methods thus a most feasible solution can be achieved. When we deal with real time physics problems, parameters are numerous and the equations representing them cannot be solved in most of the cases. Numerical methods are proving a real breakthrough to many problems in this scenario.

In this project we tried to find the integral of three functions where analytical methods are not possible. The functions chosen here are continuous but analytical methods could not be derived. We calculated the integral values Trapezoidal method, Simpson's 1/3 method and Simpson's 3/8 method. Optimization was done by using Romberg's method. All values thus obtained were tabulated and Python programs of each case were present in the report.

As an introduction to theoretical research using numerical methods was the main objective of this project and it was attained satisfactorily. This work can be extended further by finding more such integrals, evaluating them and exploring their uses. A comparative study of values obtained using different methods can be done to minimize error. Moreover the best method for each type of function may also be explored and finalized.

Keywords: Numerical integration, python programmes, Trapezoidal method, Simpson's method

Effects of Ultrasonic Cavitation on Various Materials

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Abstract

When ultrasound was initially introduced for research purposes, it unveiled a remarkably diverse range of phenomena. This included the erosion of solid surfaces, alterations in chemical reaction rates, and impacts on biological systems. The applications of ultrasound have expanded significantly, encompassing cavitation-based devices employed by physicists to detect high-energy particles. In dentistry, instruments utilizing cavitation for descaling have become prevalent, while devices for ultrasonic cleaning and soldering rely on cavitation for enhanced effectiveness. Moreover, there is a proposition suggesting that cavitation plays a crucial role in generating the high pressures necessary for the formation of natural diamonds.

However, cavitation can also give rise to challenges, as observed in sonar propagation, oil drilling,

erosion of ship propellers, and in the use of liquid sodium as a coolant for nuclear reactors. It is also a consideration in decompression after diving or during space activities. Small gas bodies significantly amplify the effects of ultrasound on plants and insects. The potential dangers of cavitation during medical applications of ultrasound are a subject under careful scrutiny. In everyday life, inventive approaches are essential for optimizing the use of bubbles, whether it be in the production of bread, foaming beer, whipping egg whites, or in the design of children's toys and comfortable walking shoe soles.

Key words: Ultrasound, Chemical reaction rates

Study on diffraction patterns

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Abstract

Diffraction refers to various phenomena that occur when a wave encounters an obstacle or opening. It is defined as the bending of waves around the corners of an obstacle or through an aperture into the region of geometrical shadow of the obstacle or aperture. The diffracting object or aperture effectively becomes a secondary source of the propagating wave. The characteristic bending pattern is most pronounced when a wave from a coherent source (such as laser) encounters a slit that is comparable in size to its wavelength. The diffraction phenomenon has some latest applications like the imaging of single biological macromolecules.

This project mainly focuses on the analysis of different diffraction patterns produced by a single slit, double slit, and thin wire/human hair. The project also includes the analysis of the laser beam produced by the coherent source. We undertook a thorough revision of the theories of interference and diffraction of light. We analyzed the Gaussian profile of the laser beam from the light of a coherent source by determining its spot size. Diffraction patterns due to single slit, double slit and a thin wire (hair) using laser source of wavelength 532nm were studied. Theoretical diffraction patterns were plotted using python programming language. In each case, the dimensions of the geometries involved were determined. The diffraction fringes in the case of hair are observed to be much wider compared to that formed with a single slit. This is based on the principle which says that the diffraction due to an obstacle is identical to that due to an opening of the same size. Thus the diffraction pattern due to, single wire is identical to that due to a single slit of the same size. As the thickness of the wire is very small, the equivalent slit width is also small and hence the diffraction fringes are wide.

Key words: Diffraction, laser

FTIR Spectral Studies of Household Plastics for Identification Tool Design of Hazardous Microplastics

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Abstract

Plastic pollution has become one of the most pressing environmental issues, as rapidly increasing production of disposable plastic products overwhelms the world's ability to deal with them. Microplastic especially are the sad result of the use of plastics that pollute the environment. Strategies to solve the problems of microplastic pollution should focus on source control, remediation and clean up. Remedial measures include engineering tools, use of biodegradable polymer, bio-engineering based solutions and we can use innovative technologies to replace plastics. In the study, a detailed survey on the seven types of household plastics (1 to 7 category) are identified and studied by observing the plastic resin codes in the plastic covers, food containers, plastic bottles, bags, cosmetics etc. Survey conducted to understand the extent of use of single-use plastics at households. It was found that a major share of the house hold plastics are PET, HDPE and PP types. From our survey we also understood how the increased usage in plastic bags which is made up of polyethylene is creating so much environmental pollution. Remedial measures that can be implemented at home for reducing the usage of plastics include the replacement of plastic bags with cloth or paper bags, plastic bottles can be replaced with steel or glass bottles. Bamboo toothbrushes, paper straws, paper pens, compostable garbage bags can be also utilized to reduce plastic pollution. The tools for identification and analysis of microplastics are discussed. The scope of FTIR analysis for microplastics determination is studied in detail. The FTIR spectrum of plastics (type 1 to 7) were taken and analyzed. The FTIR spectrum of household plastics collected showed good matching with the standard FTIR spectra

Key words: FTIR, Microplastics

Structural and Optical Characterization of Green Synthesized Silver Nanoparticles using Neem, Banyan and Moringa leaf Extracts

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Abstract

Development of reliable and eco-accommodating methods for the synthesis of nanoparticles is a vital step in the field of nanotechnology. Silver nanoparticles are important because of their exceptional chemical, physical, and biological properties, and hence applications. In the present work, the green synthesis of silver nanoparticles using plant extracts of neem, banyan and Moringa leaves as reducing agents. Studies on Structural characterization of the synthesized silver nanoparticles using X-Ray diffraction technique and Optical characterization of the nanoparticles using UV-Visible spectroscopy were also conducted. Structural characterizations of AgN (using Neem leaf extract) and AgM (using Moringa leaf extract) precipitates using XRD confirmed the formation of Ag nanoparticles using Neem and Moringa leaf extracts. The fcc phase of Ag Silver nanoparticles were identified from the XRD patterns of AgN and AgM. The average crystallite size of the Ag nanoparticles in the AgN and AgM samples are 9.4nm and 8.5nm respectively. Silver oxide phase was present in AgN and AgM samples which indicated the oxidation of the reduced silver nanoparticles. The oxide phase was lower in the case of an AgM sample. The UV-Visible spectrum of AgB (using Banyan leaf extract) sample exhibited Surface Plasmon resonance behavior observed in silver nanoparticles which confirmed the formation of Ag nanoparticles in AgB sample. The SPR peak at 416 nm is reported to correspond to a particle size less than 10 nm. There was no significant SPR peak in the filtered AgN and AgM solution which indicated the precipitation of Ag salt completely by the leaf extracts. Our work confirmed the reducing action of the leaf extracts of Neem, Moringa and banyan.

Key Words: Silver nanoparticles, green synthesis, plant extracts, Neem, Moringa, Banyan, Surface Plasmon resonance

Synthesis of Iron Oxide Nanoparticles using different Leaf Extracts

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Abstract

Magnetic iron oxide nanoparticles known as Magnetite are having potential applications in various fields.¹ In the present study, magnetic iron oxide nanoparticles are synthesised using green synthesis techniques. Leaf extracts are used as the reducing agents. The phytochemicals act as reducing agents precipitating iron nanoparticles from metallic salts². Without using chemical reducing agents, this process is an environmentally sustainable method. It is the most reliable method with which it is cheap and easy to work³. In this work, ferric and ferrous chlorides are used as the metal salts and the leaf extracts of *Ficus religiosa* and *Hemigraphis colorata* are used as reducing agents. The structural characterization of Iron oxide nanoparticles synthesized are carried using X Ray Diffraction techniques and compositional analysis carried out using FTIR. The peaks corresponding to the face centered cubic phase of magnetite are clearly visible in the XRD pattern. The particle size of the iron oxide nanoparticles are found to be around 20 to 30 nm. The FTIR Spectra shows the presence of the iron oxide nanoparticles. The highlight is that the plant extracts can be used as reducing agents instead of the non- biocompatible chemical reducing agent. The medicinal value of the leaves^{4,5} selected adds to the biomedical application of the synthesized iron oxide nanoparticles.

Key words: Iron oxide, green synthesis

Enhanced Fingerprint Security by Amalgamation of Features

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Abstract

The field of biometric recognition, encompassing distinguishing anatomical and behavioral traits such as fingerprints, face, iris, voice, and hand geometry, has witnessed significant advancements. Referred to as biometrics, these technologies rely on factors like universality, distinctiveness, permanence, collectability, performance, acceptability, and circumvention for comparison

between different biometric identities. Fingerprint recognition stands out as a widely utilized biometric feature due to its distinctive and persistent nature, coupled with its cost-effectiveness and maturity. Recent years have seen a substantial surge in the application of fingerprint recognition systems across various domains. It has become a pivotal technology in smartphones, marking a remarkable leap in mobile biometrics. The success of fingerprint technology is a result of years of scientific progress and recent breakthroughs in the field.

This study introduces an algorithm aimed at enhancing fingerprint biometric security through the feature-level combination of two fingerprints. Implemented using the Python programming language, the algorithm extracts minutiae features from one fingerprint and orientation from the second, generating a virtual fingerprint. This innovative approach not only bolsters security for storage but also enhances matching accuracy for biometric applications, thereby contributing to the advancement of biometric technology.

Key words: Biometric, Python, Minutiae, Orientation

A study on various factors affecting the performance of a solar cell

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ABSTRACT

It is well-known that a solar cell uses photovoltaic effect to directly convert light energy into electrical energy. Unlike batteries or fuel cells, they do not use chemical reactions or require fuel to generate electricity, and they do not have any moving parts, as do electric generators. Light enters the device through an antireflection layer, which reduces light loss due to reflection by effectively trapping the light falling on the solar cell by boosting its transmission to the energy-conversion layers below. In this project, an investigation on the effect of various ambient factors on the performance of a solar cell were extensively studied based on solar cell parameters such as short circuit current (I_{sc}), open circuit voltage (V_{oc}), maximum power point (P_{max}), fill factor etc. Solar cells were positioned according to the conditions of 'no illumination' and 'maximum illumination,' and graphs were plotted.

It has been verified that as the illumination is turned on, the value of the fill factor increases. Also, a rise in fill factor is observed with respect to increase in the intensity of light falling on the solar cell. Various soakants were introduced in the path of light illuminating the solar cell such as dust, gum, oil and water. It was observed that the presence of soakants reduced the solar cell output as evident from the reduced value of fill factor. Using an incandescent bulb and various coloured filters (red, blue, yellow and green), the wavelength dependence on solar cell performance was

checked. It was found that the green filter is more efficient than the others. This also revealed that different colors are present in varying amounts in an incandescent lamp.

Key words: Photovoltaic effect, Fill factor, Short-circuit current, Open-circuit voltage

2022-23 Projects

Viscosity Measurements of Newtonian and Non-Newtonian Liquids Using Ostwald and Brookfield Viscometers

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Abstract

The present study involved the viscosity measurement of liquids using two techniques: Ostwald viscometer – Poiseuille equation and Brookfield viscometer – Rotatory viscometer. The viscosity of the salt solution, sugar solution, sucrose solution, and glycerol-water mixture was determined using the Ostwald viscometer method. It was found that the increasing amount of the solutes, resulted in an increase in viscosity of water. It is also observed that the increase in temperature results in decrease of viscosity. The Ostwald technique is applied ideally to low viscous Newtonian fluids. The Brookfield viscometer on the contrary to Ostwald viscometer is a rotation viscometer. The measurements of viscosity taken using the AMETEK DV2T Brookfield Viscometer gave more insights into the flow behavior of liquids. The variation of viscosity with temperature as well as shear stress was taken for corn oil and gelatin. Corn oil exhibits Newtonian behaviour with viscosity increasing at a uniform rate with shear stress. Gelatin exhibits non – Newtonian behaviour with increase in viscosity with shear stress is not uniform. Both the samples manifested a decrease in viscosity with temperature-decreased intermolecular interactions at higher temperatures.

Key words: Newtonian fluids, Non-Newtonian fluids, Viscometer

An investigation on the performance of single / multimode optic fibres

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Abstract

Optical fibre technology is a non-flammable and less power consuming data transmission mode

using light pulses that travel along long fibres usually made of plastic or glass. Metal wires are preferred for transmission in optical fibre communication, wide application in telecommunication, local area networks, sensors, computer networks, etc. owing to its high information-carrying capacity, low attenuation and least electromagnetic interference. In this project, we have aimed at a basic understanding of the performance of an optical fibre, mainly multi-mode optic fibre. One of the basic fibre parameters, the numerical aperture, was calculated for both single and multimode fibers. It was confirmed that as distance between the optic fibre end and the XYZ translation stage increases, the light from the optic fibre disperses more. The bending loss of an optical fiber increased with the number of turns and decreased with the radius of the turns. No considerable change in the maximum output current was observed when the optic fibre was immersed in water or saline solutions. It was also concluded that the optic fibre output had no severe change on varying the temperature of the surrounding medium from 45 to 85 °C.

Key words: Optical fiber, Numerical aperture, Bending loss

Python tool for crystallographic data analysis

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Abstract

Crystallography is the scientific field focused on understanding the arrangement and bonding of atoms in crystalline solids, as well as the geometric structure of the lattice in three-dimensional space. Within this space, the basis locus forms an array, and there are 14 distinct three-dimensional configurations known as Bravais lattices in which atoms can be organized in crystals. The X-ray diffraction method is employed to gather detailed information about the crystallographic structure, chemical composition, and physical properties of materials. Diffracted peaks are identified using Miller indices. By comparing the d-space equation with Miller indices and diffraction data, the crystallographic structure of an unknown material can be determined.

In order to streamline the crystal structure identification process, we have developed a Python software that processes diffraction data based on Miller indices. This program aims to predict the crystal structure and lattice vectors, providing users with an interactive interface to input details of their desired crystal structure in an Excel sheet. Additionally, the software generates a statistical estimation of error to assess the effectiveness of the identification process.

Key word: Crystallography, Bravais lattices, X-ray diffraction, Python

Towards Quantum Dot Characteristics in Metal Nanoparticles

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Abstract

The quantum confinement effects are observed in colloidal nanoparticles as a function of particle size, particle shape and use of different solvents. In the present investigation we have made an attempt to probe the quantum confinement effects particularly the quantum dot behaviour observed in metal nanoparticles when they are reduced to sizes less than 10nm. We have chosen two metallic systems -Copper and Silver in the present study. We have synthesized two copper nanocolloids from Copper chloride (CuC) and Copper sulphate metal precursors (CuS) with NaBH₄ as reducing agent and Citric acid as capping agent. Six colloidal Cu samples were synthesized from increasing the amount of the reducing agent. From the UV characterization of Cu colloids samples, we observe an increase in intensity and also a blue shift in the absorption peak with an energy gap varying from 2.566 eV to 3.995eV in the case of CuC samples and a band gap in the range - 4.036 eV to 4.568eV in the case of CuS samples. This blue shift has been theoretically explained as quantum confinement effect in nanoparticle systems as the particle size decrease. From PL spectra it was found that emissions are in the blue region with excitation in the UV region. Compared with CuC samples the band gap values are larger pointing towards the smaller colloidal particle formation in this case. PL spectra are similar in both CuC and CuS samples, but excitation and emission peaks were found to be narrower in CuS samples. This may be due to the smaller size of particles in CuC samples compared with CuS samples. The silver colloids are obtained using trisodium citrate and sodium borohydride as precipitating agents. UV-Vis spectra of the AgC, AgT and AgR samples exhibited Surface Plasmon Resonance band around 423 nm which is typical characteristics of Ag nanoparticles. AgT and AgR showed an increase in intensity of the absorption peak than Ag C samples. C samples were found to be unstable as we haven't used the trisodium citrate in this case. AgR sample showed a blue shift of around 19 nm from SPR band with a peak at 404nm indicating decrease in particle size. The absorption peak blue-shift (2.068 to 2.70 eV) are reported to be as particle size decreases from $d \sim 20$ nm to ~ 12 nm. The highest bandgap was obtained in AgT samples where in no visible precipitate was observed except for a greenish yellow colour. This showed that the smallest particles are formed in AgC samples. PL emission in 370nm with UV excitation also typical of silver nanoparticles with a semiconducting behaviour due to quantum confinement effects. From our observation it can be concluded that the metal nanoparticles can be band engineered by varying the size of the nanoparticles.

Keywords: metal nanoparticles, nanocolloids, quantum dots, band gap, surface plasmon resonance

Methylene blue dye degradation studies with ferrites as photocatalysts

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Abstract

Dye degradation potential of spinel and perovskite ferrites were studied as part of this project. A review of the uses, advantages and disadvantages of methylene blue dye was carried out initially. The degradation of methylene blue under sunlight in the presence of six catalyst namely Zinc ferrite (ZFO), Nickel Zinc ferrite (NZFO0.5), Cobalt Zinc ferrite (CZFO0.5), Bismuth ferrite (BFO), and two samples of Strontium doped bismuth ferrites namely BSFO0.5 and BSFO0.7 were investigated by studying the absorption intensities of the solution containing the photocatalysts after exposure to sunlight for known durations. The time of irradiation was varied and a maximum time of 240 minutes exposure to sunlight was given to all samples. The studies show that all ferrites show photocatalytic activity and are useful for photodegradation of methylene blue dye. However, the rate of activity is different for different ferrites. Replacing zinc with Cobalt or nickel in zinc ferrite spinel is found to enhance the catalytic potential and also the dye degradation potential. Both CZFO and NZFO showed a higher value of degradation percentage of methylene blue. The studies on the dye degradation of BFO, BSFO0.5 and BSFO0.7 indicate that bismuth ferrite can act as an efficient photocatalyst when compared to spinel ferrites. From this study we conclude that ferrite nanoparticles are “efficient photocatalytic semiconductor” for degradation of organic pollutants. The advantage of using these as photocatalyst is that after dye degradation the catalyst can be removed easily by using a magnetic field

Key words: Photocatalysis, Dye degradation, ferrites

Thermal Conductivity Study of Engine Oils

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Abstract

Thermal conductivity is the most important characteristic of engine oil as they have a significant impact on overall performance of a motor. Thermal conductivity describes a material's ability to transfer heat. Materials with a high thermal conductivity, such as copper or silver can facilitate rapid heat transfer whereas insulative materials, such as foam or cotton, are slow to take up and transfer heat from their environment. Engine oil will absorb heat from contact surfaces and transport it to another location such as an oil sump where it can be safely dispersed. Most oils are engineered to help cool a number of engine parts including piston assembly, heads and valves. Generally, most formulated oils consist of either a mineral, semi or fully synthetic base material combined with a varying number of additives. The quality of an engine oil depends on the base stock as well as the properties of the additives. Engine oil is available at a range of SAE grades designed to best suit the climate where it is being used. The relationship between thermal conductivity and efficiency of the engine is strongly correlated as engine oils with a higher thermal conductivity value will have greater efficiency and minimize friction loss. The engine oil of higher thermal conductivity and specific heat are rated as more efficient, and play a vital role while designing an effective engine cooling system.

Moreover the studies show the variation of thermal conductivity for various engine oils so the thermal conductivity study is important for the checking of quality.

Key words: Thermal conductivity, SAE

Green Synthesis of Iron Oxide Nanoparticles from Momordica Charantia Extract

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Abstract

The green synthesis of nanoparticles is a promising and novelty tool in bio-nano technology. Green synthesis is an environmentally friendly alternative to conventional synthesis techniques They aim

to reduce toxic elements used or produced in conventional methods. This method is preferred due to its eco-friendly, clean, safe, cost-effective, easy, and effective sources for high productivity and purity. The present work on the “Green Synthesis of Iron- oxide Nanoparticles using Plant Extracts” we have demonstrated a novel method of synthesizing iron oxide magnetic nanoparticles. In the present investigation a green approach is carried out to prepare iron oxide nanoparticles. Iron oxide nanoparticles were synthesized using Momordica charantia plant extract. Several types of samples were prepared from fresh leaf extract, dry leaf extract, fresh fruit extract, dry fruit extract and salted dry fruit extract. Green synthesis of iron nanoparticles using plant extracts is a promising method for obtaining environmentally friendly nanomaterials for biological applications. The synthesized nanoparticles are analysed using XRD and FTIR. The peaks in FTIR represent iron oxide nanoparticles and XRD analysis shows a mixture of hematite and magnetite. From XRD analysis particle size for fresh fruit extract, fresh leaf extract and dry fruit extracts were 151.316 nm, 50.349 nm, 38.4648 nm respectively.

Key words: Green synthesis, Iron oxide

Extraction and strength studies of fibres extracted from Pandanus veitchii

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Abstract

The project mainly deals with the extraction and strength studies of fibres extracted from Pandanus veitchii. The study mainly deals with general comparison of the fibres of Pandanus veitchii with that of cotton, and linen, the preparation of samples from Pandanus veitchii, and preparation methods of cotton and linen, the determination of the radius of the fibres obtained and the young's modulus for the fibre.

We extracted fibres from Pandanus veitchii and studied its strength compared to linen and cotton. In general, cotton is known to have a high tensile strength and is suitable for making sturdy and durable textiles. Linen is also known for its high strength and durability, making it a popular choice for household items like tablecloths and napkins. Pandanus veitchii, also known as screw pine, is a tropical plant native to Southeast Asia and the Pacific islands. Its fibrous leaves are used to create traditional mats and baskets from very old times. From our studies it is established that the fibres of Pandanus veitchii have good elastic strength. It is easy to cultivate in tropical conditions. Its large-scale cultivation in Kerala has to be explored as we have so much fertile land left without any cultivation. Applications in various frontiers such as textiles, mats and bandages are to be studied further. Overall the fibres extracted from Pandanus veitchii require more attention as it is natural, eco-friendly and easily available.

Keywords: Pandanus veitchii, tensile strength, fibres

Analysis of fourier integrals and transforms using Python

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Abstract

Here we undertake the study of Fourier series, Fourier transforms, Discrete Fourier transforms and Fast Fourier transforms and their applications. Fourier series is used in the analysis of periodic functions. It represents any periodic waveform as the sum of sine and cosine waves plus a constant. Fourier transform is a transform that converts a function into a form that describes the frequencies present in the original function. We have done a thorough review of Fourier Series, Fourier transform, Discrete Fourier transform and Fast Fourier transforms. Various mathematical functions are Fourier analyzed and the corresponding Fourier series are simulated using python code. Some of the common periodic waveforms which are of interest in electronics are also analysed. Various input signals are analysed using Fourier transform. The results of Discrete Fourier transform and Fast Fourier transform for input signals are compared. Various applications of Fast Fourier transform are performed using python codes. Thus, the project aims at developing analytical, mathematical and computational skills.

Key words: Fourier series, Fourier transforms

Department of Chemistry

Title of Projects

2020-21

- Decay of Ascorbic Acid
- Chemical methods for detection of adulteration in milk
- Corrosion Inhibition of natural compounds
- Effect of increasing carbon content on climate change
- An overview of antiviral drugs based on their mode of action
- Plant natural products as antiviral agents against coronavirus

2021-22

- Canoli Canal: Water Quality Assessment
- Nanomaterials as antiviral agents
- Silver and carbon modified TiO₂ nanocomposite for photocatalysis
- Recent advances in synthesis of natural products and heterocycles via pericyclic reactions
- An overview on various biodegradable polymers and its biomedical applications
- Anticorrosive activity of Schiff base on various metals

2022-23

- Green Synthesis of NiO and Co₃O₄
 - Nanoparticles Using *Loranthus Longiflorus* Desr. Leaf Extract and Their Characterization
 - Nickel Cobaltite Based PVDF Nanocomposites
 - Formulation and evaluation of herbal lipsticks
 - Study of schiff base and a natural compound as corrosion inhibitor
 - Green synthesis of ZnO and FeO nanoparticles using *Psidium Guajava* leaf extract
- Reduction of graphene oxide by sustainable and eco-friendly approach in usage of *Hemigraphis colorata* plant extract

2020-2021

Effect of Increasing Carbon Content on Climate Change

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Abstract

Global attention on the issue of climate change has intensified as anthropogenic activities continue to contribute to an unexpected shift in the Earth's climate equilibrium. This review focuses on the effects of increasing carbon content, particularly carbon dioxide (CO₂), on climate change. The heightened emissions of greenhouse gases have resulted in a rise in the global mean temperature, commonly referred to as global warming, with far-reaching consequences for various aspects of the environment and all forms of life.

This article aims to provide a comprehensive summary of the existing impacts associated with the surge in carbon content and its influence on climate change. The review covers diverse manifestations such as the melting of ice caps, rising sea levels, early flowering of trees, heightened heatwaves, and alterations in precipitation patterns. By synthesizing the current knowledge, this review contributes to a better understanding of the intricate relationship between increasing carbon content and the multifaceted impacts on our planet's climate. The urgency for collective and prompt action to mitigate these effects is underscored throughout the discussion.

Keyword: Carbon, Climate Change

Corrosion Inhibition of natural compounds

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V S *

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*Post Graduate Department of Chemistry, Vimala College (Autonomous), Thrissur, Kerala.

Abstract

Corrosion is the degradation of a metal either by direct chemical or electrochemical reaction when in-tuned with aqueous corrosive surroundings. Corrosion inhibitors are substance which added in ppm concentrations to a corrosive environment minimize or prevent corrosion. Through physisorption and chemisorption an honest corrosion inhibitor should have adsorption capacity on the metal surface. Some research groups have reported the successful use of present substances to inhibit the Corrosion of metals in acidic and alkaline environment. A review of various studies of

plant extracts as green corrosion inhibitors, green inhibitor gums, and corrosion inhibitors from essential oils, on the low steel was done. The anticorrosive behaviour was evaluated with potentiodynamic polarization resistance technique, weight loss method and open circuit potential measurements.

Key words: Corrosion inhibitor, potentiodynamic polarization studies.

2021-2022

Canoli Canal: Water Quality Assessment

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Sreeparvathy Mohan***

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Abstract

This project proposal aims to address the critical issue of pollution and deteriorating water quality in the Canoli Canal, a significant surface water source in the Kerala region. The canal, established in the mid-19th century for commercial trade between Kochi and Calicut, has witnessed neglect and abandonment over the past decade due to pollution concerns. The study focuses on the Punnayur Panchayat in Thrissur district, where the canal was once a primary water source for the local community. The research involves a comprehensive analysis of pollution sources, including untreated effluents, solid waste, and discharge from various industries. Interviews with households living near the canal and a survey reveal that domestic solid waste and wastewater are major contributors to pollution. The relevance of the project is emphasized by the canal's historical significance, its impact on coastal towns, and its role in transporting goods. The literature review highlights similar studies globally, emphasizing the urgency of addressing water pollution for environmental and public health reasons. The project objectives include studying water quality parameters, comparing them with standards, and raising public awareness. The methodology involves surveys, interviews, and scientific testing for parameters such as pH, dissolved oxygen, salinity, hardness, and bacterial content. The expected outcomes include qualitative information on water characteristics, identification of contamination sources, and proposing a water quality index for the canal. The project aims to draw attention from authorities for proper waste management, enforcement of regulations, and reduction of harmful waste disposal. Recommendations stress the importance of community awareness, solid waste management, and regular water quality monitoring for sustainable canal management.

Keywords: Canoli Canal, water quality, pollution

Anticorrosive activity of Schiff base on various metals

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Abstract

The corrosion inhibition effects of various Schiff's bases on different metals like mild steel, carbon, copper and aluminum were considered for review. The studies on corrosion inhibition by Schiff's bases were conducted using techniques like gravimetric, potentiodynamic polarization and LPR, CR, SEM measurements. Among the Schiff's bases used most of them were mixed type inhibitors. In all cases of anti-corrosive activity, the study revealed that inhibition efficiency increases with increase in inhibitor concentration and decreases with temperature. The corrosion inhibition activities of Schiff's bases are mainly through adsorption mechanism and they followed Langmuir adsorption isotherm.

Key words: Schiff's base, corrosion, corrosion inhibition, carbon steel, mild steel, copper.

2022-2023

Reduction of graphene oxide by sustainable and eco-friendly approach in usage of *Hemigraphis colorata* plant extract

Nancy Mathew¹, Greeshma A K*, Namitha Jayaprakash A*, Praveena K*, Shelin K Sunny*, Shyama K S*, Sonagrace Jos*

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Abstract

This research project focuses on the green synthesis of reduced graphene oxide (rGO) using plant extracts, particularly *Hemigraphis Colorata*, as a cost-effective and environmentally friendly alternative to conventional methods. The project begins with the synthesis of graphene oxide (GO) through a modified Hummers method, and subsequently, GO is reduced to rGO using plant extract as a reducing agent. The structural properties of the resulting rGO/GO nanohybrid are characterized through X-ray Diffraction (XRD). The study demonstrates the successful conversion of graphene oxide to reduced graphene oxide, highlighting the potential of plant-mediated synthesis for scalable and sustainable production of graphene-based materials. The project emphasizes the significance of such green synthesis methods in mitigating environmental impact and offers insights into the structural aspects of the synthesized graphene materials. Further

exploration into morphological and structural characterization, as well as novel applications in the biological sector, is proposed for future research directions.

Keywords: Graphene oxide, reduced graphene oxide, Hemigraphis Colorata

A study of Schiff base and natural compound as corrosion inhibitors

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*Post Graduate Department of Chemistry, Vimala College (Autonomous), Thrissur, Kerala.

Abstract

Organic compounds which act as corrosion inhibitors are not only expensive but also toxic to living beings. So the anticorrosive activity of natural compounds like ginger extract are evaluated. In presence of a Schiff base the inhibition efficiency values in con HCl and con H₂SO₄ media were found to increase with their concentration. While studies using ginger extract as the inhibitor the efficiency is found to be increasing and then decreasing with increase in concentration. The adsorption isotherm provided a formal description of the adsorptive behaviour of the studied compounds on metal pieces. For the Schiff base in con H₂SO₄ medium, Langmuir adsorption isotherm and in con HCl medium Freundlich isotherm is plotted.

Key words: Schiff's base, weight loss measurements, adsorption isotherms

Department of Mathematics

Title of Projects

2020-21

- Statewise comparison of Covid 19 pandemic in India
- Comparison between Indian & International Economics
- Economy during Covid 19 pandemic
- Application of Group theory in chemistry
- A brief Study on some special functions of Mathematical Physics
- Mathematical Modelling for the study of *Diabetic mellitis*
- Mathematics in Parkinson's disease
- Role of mathematical modeling in Immunology
- Mathematics behind Data Science and Machine learning
- Sieve Out Flood Victims using Fuzzy Decision Making
- Application of Mathematics in Forensic Science
- How mathematics can be used to determine the fall of economy during Covid 19 Pandemic

2021-22

- Application of Mathematics in Music
- Application of Mathematics in Architecture.
- Importance of Mathematics in Weather Prediction
- Applications of Mathematics in Google Pagerank
- Introduction to cyclic numbers
- Mathematics in Celestial Navigation
- Application of Differential Equations in Chemistry
- Application of Mathematics in Economics
- Mathematics in Human Heart
- Mathematics in Epidemic Analysis

2022-23

- Elliptic Partial Differential Equation
- A Study on Impact of Petrol Price Raising in India
- Application of Mathematics in Sports
- Crypto Currency: A New Leap of the Modern World
- Pre and Post COVID Effect on Eye Diseases
- Traffic Flow Analysis using Queuing theory
- Impact of COVID 19 Pandemic on Gold Price
- Eye Disorders Study in Students of Age 10-18
- Data Analysis on Women's Health
- Dirichlet Multiplication in Arithmetic Function and Mangoldt Function
- Earthquake Analysis and Forecasting Magnitude

2020-21 Projects

Statewise comparison of Covid 19 pandemic in India

Arya Prasad, Aneesha P H, Architha Udai,Glenna Maria, Therese Joseph, Karthika R

Abstract

In the absence of an effective vaccine or drug therapy, non-Pharmaceutical Interventions are the only option for the outbreak of the coronavirus disease 2019, a pandemic with global implications. The coronavirus disease pandemic, which originated in the city of Wuhan, China, has quickly spread to various countries. In this paper we analyse the case of the south Indian state Kerala, which received much praise in the International media for its success in containing the spread of the disease in the early months of the pandemic, but is now in the grips of the second wave. This disease is particularly dangerous to those with underlying medical conditions and older people. In Kerala, the pattern has been different from the rest of India. To analyze the Covid-19 cases and effective measures taken by the Kerala government in India to fight against the pandemic. To conduct an exploratory analysis of the model put forward by Kerala. Data were collected from various sources. The first case of Covid-19 in India was reported on January 30, 2020, in Kerala, a southern state in India. In this paper, a data analysis of the Covid-19 cases in Kerala is analyzed for a period starting from March 1, 2020 to November 30, 2020. Here we collected district wise data of confirmed cases and month wise recovered cases and deceased cases. Various statistical measures were used to analyze data collected which include measures of central tendency, measures of dispersion, correlation, regression, bar chart, scatter diagram. For the analysis we used softwares such as MS excel and Jamovi.

Application of Group theory in chemistry

Adithya P V

Abstract

In group theory, the symmetry group of a geometric object is the group of all transformations under which the object remains unchanged with the group operation of compositions. Symmetry is very important in chemistry research and group theory is the mathematical tool to determine symmetry. Using group theory one can easily find the symmetry of molecules and study their physical properties. In order to determine the molecule symmetry one has to apply the general properties of groups to get the symmetry operations that molecule. By doing this one can examine chemical bonding, visualize molecular orbitals, predict whether a molecule absorbs light of a given polarization, investigate vibrational motions of the molecule and so on. Here is a mild approach to the vast topic 'Applications of group theory in chemistry' by detailing the process of application of group theory on symmetry of molecules in order to determine their physical properties by use of character tables.

A brief Study on some special functions of Mathematical Physics

Agna dineshan V

Abstract:

This project covers selected topics on mathematical methods in physical science. My aim is to introduce some special functions of mathematical physics and to develop some ideas based on those techniques that would be most useful for the students to enter the B.Sc programme. This includes differential functions, integrals, polynomial functions, power series etc. Bessel functions are therefore especially important for many problems of wave propagation and static potentials. The applications of Bessel functions like heat transfer and analyzing FM signal which is very useful for the student who undergoes post graduation.

Mathematical Modelling for the study of *Diabetic mellitis*

Amrutha mol Joshy

Abstract: This project studied a mathematical model to deal with the dynamics of the population of diabetics. Main tool used is ordinary differential equations. Additionally numerical approximations used to obtain numerical results. These models can also make use for future prediction of possibility of Diabetics, for evaluating diagnosis tests, developing glucose controllers, predicting risks etc

Keywords : critical point, ordinary differential equation, Runge-Kutta Method, Stability Property

Mathematics behind Data Science and Machine learning

Anjitha Jayakumar V

Abstract

In this project Machine Learning based on Statistics is more concentrated. Various Sampling techniques like Simple, Systematic, Stratified, Cluster, Convenience, Quota, judgment, snow-ball are well explained. Brief study on different distributions namely Bernoulli, Binomial, Multinoulli & Multinomial, Gaussian, Exponential are provided. A sketch of various machine learning ideas as supervised, unsupervised, semi-supervised, reinforcement are also handled. One programming language is used in calculations

Keywords: Machine Learning, Statistical Distributions, C++

Application of Mathematics in Forensic Science

Ashitha E, Dr Anjaly Kishore

Abstract

Impact of Trigonometry in Forensic Science is the main discussion in this project. Unfortunately nowadays society is greatly faced with an increase of anti-social activities, murders, and various

kinds of criminal activities. Authorities need more tools to curb this and to identify the people behind this. This project aims at how mathematics can act as a prime tool in this scenario. Based on blood stains, there are trigonometric tools to analyze the situations and are able to give mind-blowing results to the authorities. One such method is discussed in this project. Kim's Rossomo's formula & Graphical Method, Age determination from bone or tooth etc are well-explained.

Keywords: Kim's Rossomo's formula, Beer Lambert Law, Newton's Law of Cooling, Shotgun pellet patterns

2021-2022 Projects

Application of Differential Equations in Chemistry

Bincy Babu

Abstract

Differential equations contribution in real-life especially in nuclear chemistry is a notable area. This project concentrated on this side and produced a vast study on different disease detection and spreadings. Modeling GDP in Economics is also discussed.

Keywords: Chemical Kinetics, Kinetic Characteristics

Application of Mathematics in Architecture.

Jasna Jose

Abstract

The relationship between architectural design and geometry starts with the notion of harmony as the principle of all sciences and creation. Today the various sciences and arts are in most cases strongly separated. The concept of emergence, self organization evolution and cosmo genesis rejected the concepts of determination, mechanism, materialism etc. Fractal geometry can help us understand and analyze the complexities we can find in cities of antiquity and middle ages, but also in temples, cathedrals, mausoleums, and other structures built to these days by civilizations that precede us. This is a brief overview of one of the greatest secrets of nature's design, rugged, irregular, self-similar, infinite objects.

2022-23 Projects

Data analysis on Women's Health

Aardra Raghunath, Sivapriya. P. S, Devika. K.R, Anjali Kishore

Abstract

Data analysis is a process for obtaining raw data, and subsequently converting it into information useful for decision-making. Data is collected and analyzed to answer questions, test hypotheses, or disprove theories. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of

names, and is used in different business, science, and social science domains. Data analysis plays a role in making decisions more scientific and helping to operate more effectively. It focuses on reaching a conclusion based solely on the researcher's current knowledge. Women of all fields of life irrespective of their ages, their profession or family circumstances should be mandatory to undergo periodic health checkups. Families should also support and assist the women of every household to take care of their health. Awareness of medical hazards to women should be spread throughout the country. Medical checkups should be conducted as a right to the women and not as a privilege and every woman of all ages should be accounted for these checkups. The study of Women health issues is conducted to understand the impact of COVID on the health issues of women. Responses from women of age group other than 20 to 25 years is studied using different data analysis tools. Some remedial measures are also suggested in the project.

A Study on Impact of Petrol Price Raising in India

Archana Sudheer Arya RajiArya. V, Swarna K.L

Abstract

The growing price of petrol has an impact on the prices of everyday necessary commodities that are transported on a regular basis. Because impoverished households spend more than half of their income on food and only a tenth on fuel, price increases will have a significant impact on them. It's a chain reaction that, once initiated, will have an impact on everyone. Increases in the price of petrol will raise transportation costs, which will raise the price of products, forcing people to loosen their purse strings even more, and so on. The ups and downs push more people into poverty, leaving those who are already impoverished in a pitiful situation. In this project, we have collected state wise data of petrol price in 4 years from 2019 to 2022. Various statistical tools were used to analyse the data collected which include mean, Regression analysis, bar graph and pie chart. Regression analysis like linear have been used for analysis of petrol price which helps to predict the future Price of fuel. By state wise comparison we can understand the highest and lowest petrol price rate of states in India. The main aim of this project is to figure out how much the price of petrol has been increased and to investigate the impact of petrol price raising in India. We have also find some alternatives for petrol for the future.

Pre and Post COVID Effects on Eye- Diseases

Raihana. P. R, Sona Babu, Sreelakshmi. N.S, Izhabel Joseph, Swarna. K. L

Abstract

The Covid-19 infection could cause post - acute Covid-19 infection or long Covid ocular morbidities which necessitate the ocular meticulous follow-up of Covid-19 patients after recovery. This study has presented an exploratory data analysis on the Covid -19 eye cases in Thrissur. We have collected the data among the age group 15 to 25. Also, we have sent questionnaire based on Covid-19 symptoms as a result we got eye problems is also affected during Covid. From 124 participants 21% of the respondents were affected by eye symptoms during the Covid-19. As this result we decided to collect data of various eye problems before and after the Covid- 19 pandemic. We have collected the data from Ivision Eye Hospital and Dr. Rani Menon's Eye Clinic on 09-01-2023. Here we have collected the data from the year 2017 to 2022. Then by using various statistical tools like Shapiro Wilk normality test, Wilcoxon sign rank test, mean, standard deviation, bar chart, box-plot, q-q plot to analysis the data collected. As a result of this we got that there is

significant difference in the number of patients affecting various eye problems before and after Covid- 19. That is, there is an increase in eye problems After Covid.

Traffic flow analysis

Manya. K, Krishnaveni. M. S, Sona Wilson, Anjali Kishore

Abstract

Aim of traffic flow analysis is to create and implement a model which would enable vehicles to reach their destination in the shortest possible time using the maximum road way capacity. In our everyday life queues or waiting lines are common phenomena. If the customers arrive to frequently, they will have to wait for getting service for some time for some circumstances. The formation of traffic queues during congested periods is the source of considerable time delay and results in a loss of high way performance. It is essential in traffic analysis that one develop a clear understanding of the characteristic of queue formation and dissipation along with mathematical formulations that can predict queuing related elements. Thus, traffic congestion is a serious issue in every big city, not only does traffic congestion have a harmful effect on ecology cause air and noise pollution and impact the quality of life, it also unproductive time and fuel consumption.

Department of Statistics

Title of Projects

2020-21

- A Statistical study on Covid-19 cases in Kerala
- A study on impact of social networking sites on teenagers in Thrissur district
- Accident data analysis using statistical methods - a case study of Thrissur district, kerala
- Study of child marriage in kerala
- A study on economic parameters of Saarc countries
- A study on the online classes via victers channel, Thrissur district

2021-22

- Influence of advertisements in purchase of cosmetic products
- A comparative study between offline and Online classes for the students at vimala College
- Study on the significance of digital media Literacy
- A statistical analysis of pocso cases in Kerala
- Application of statistical techniques in manufacturing of polymer bag industry
- Statistical Analysis of health indicators based on NFHS 5

2022-23

- A statistical study on consumer behaviour towards online v/s offline shopping
- A statistical analysis of drug seizures across India
- Forecasting tax revenue of Thrissur district, Kerala using ARMA Model: A time series analysis
- A statistical study on road accidents in Kerala during the period 2019-2021
- Statistical study on the suicide rates in India
- A statistical analysis of persons incarcerated in India
- A statistical study of NIRF score of top ranked universities in India
- A statistical study on NIRF score of top ranked colleges in India

2020-2021 PROJECTS

A STATISTICAL STUDY ON COVID 19 CASES IN KERALA

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Abstract:

Coronavirus disease 2019 (Covid-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has emerged as a global health crisis, prompting extensive research into its transmission, effects, and management strategies. This study focuses on understanding the dynamics of Covid-19 in Kerala, India, examining aspects such as recovery rates, mortality patterns, and public attitudes toward the pandemic. Data collected from 14 districts of Kerala forms the basis of analysis, sourced from official Covid-19 databases. Statistical methods including correlation, regression, and the Kruskal-Wallis test are utilized for data interpretation, with the normality of data distribution assessed using the Shapiro-Wilk test. Key objectives of the research include studying the recovery rates of Covid-19 patients, analyzing death cases among positive cases, and assessing public attitudes toward the pandemic. Findings reveal that patients with pre-existing respiratory conditions such as asthma and tuberculosis face higher mortality risks. Moreover, the study sheds light on public perceptions and attitudes, providing valuable insights into community response strategies and healthcare interventions.

Keywords: Coronavirus disease 2019, Covid-19, SARS-CoV-2, transmission, recovery rates, mortality patterns, public attitudes, Kerala, India, secondary data analysis, statistical methods, correlation, regression, Kruskal-Wallis test, Shapiro-Wilk test, respiratory diseases, pandemic management.

A STUDY ON IMPACT OF SOCIAL NETWORKING SITES ON TEENAGERS IN THRISSUR DISTRICT

Anamiya Baby¹, Muhsina C S, Aparna M A, Yamuna Kondal, Maneesha C R, Sneha Gangadharan

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Department of Statistics, Vimala College (Autonomous), Thrissur

Abstract

The evolution of communication technology has transformed how people connect and interact, from traditional methods such as letters and telegraphs to the emergence of social networking sites in the modern era. Social networking platforms like YouTube, Facebook, Instagram, and WhatsApp have revolutionized communication, enabling faster and more convenient ways to stay connected. However, the rapid proliferation of technology, particularly among teenagers, raises concerns about its impact on social behavior and well-being. This study, centered in Thrissur district, aims to explore the effects of networking sites on teenagers, analyzing usage patterns, family dynamics, sleep disturbances, gender disparities, and the role of networking sites during the COVID-19 pandemic. The objectives of the study include understanding the impact of networking sites on teenagers, examining the relationship between usage time and family type, identifying the most commonly used networking platforms, assessing changes in sleep patterns due to networking site usage, and comparing gender differences in networking site engagement. Data collected through questionnaires serve as the primary source for analysis, with statistical methods including Chi-square, Kruskal-Wallis test, and Wilcoxon Signed rank test employed for

data interpretation. Findings suggest both positive and negative impacts of networking sites on teenagers, with headaches emerging as a common disadvantage. Despite drawbacks, networking sites play a vital role during the COVID-19 pandemic, facilitating connectivity, online shopping, and dissemination of pandemic-related information.

Keywords: COVID-19 pandemic, questionnaire survey, statistical analysis, Chi-square, Kruskal-Wallis test, Wilcoxon Signed rank test.

ACCIDENT DATA ANALYSIS USING STATISTICAL METHODS - A CASE STUDY OF THRISSUR DISTRICT, KERALA

Divya P R¹, Anu A V, Anagha M Basheer, Smaya Balan, Jesna K J, Anjana V R, Swathy K S

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Abstract:

Road traffic accidents (RTAs) represent a significant global health concern, contributing to a substantial number of injuries and fatalities annually. India, as a developing nation, grapples with one of the highest rates of RTAs worldwide. This study utilizes secondary data sourced from the Department of Economics and Statistics, Thrissur, Kerala, to analyze Road Traffic Accident (RTA) occurrences in the years 2019 and 2020. The objectives of the study encompass assessing the distribution patterns of RTAs throughout the year, investigating seasonal and hourly variations in accident rates, and examining whether the number of accidents and types of vehicles involved follow a uniform distribution. Statistical analysis, employing the Chi-Square test for goodness of fit and the Chi-Square test for independence of attributes, facilitates data interpretation. RTAs, being largely preventable, necessitate comprehensive strategies and collaborative efforts across various sectors and disciplines. By understanding the distribution patterns and underlying factors contributing to RTAs, policymakers and stakeholders can develop targeted interventions to mitigate the incidence and severity of road accidents.

Keywords: Road traffic accidents, seasonal variation, Chi-Square test, goodness of fit, independence of attributes.

STUDY OF CHILD MARRIAGE IN KERALA

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Abstract:

Teenage pregnancy remains a pressing issue in India, significantly impacting child nutrition outcomes. This study, conducted by researchers at the International Food Policy Research Institute (IFPRI), investigates the intricate relationship between teenage pregnancy and child undernutrition in India. By analyzing data from the National Family Health Survey (NFHS) Round 4, the study aims to elucidate the socio-economic conditions of families with teenage mothers, identify factors contributing to early marriage, and explore legal and policy frameworks aimed at preventing child marriages in India and Kerala specifically. Utilizing statistical tools including Prevalence, Chi-square, and logistic regression, the study delves into the underlying factors influencing child marriage, considering variables such as age of marriage, wealth index, place of residence, age group, educational attainment, district-wise variations, and religion. The findings offer valuable insights into the multifaceted nature of early marriage and its implications for child welfare, informing policy recommendations to address this critical issue.

Keywords: National Family Health Survey (NFHS), SPSS, Excel, statistical analysis, Prevalence, Chi-square, logistic regression.

A STUDY ON ECONOMIC PARAMETERS OF SAARC COUNTRIES

Jerin Paul¹, Anjana K, Nagapriya T, Sandra Saji, Sneha Paul, Viji U K, Aleesha Chakko

¹Assistant Professor, Department of Statistics, Vimala College (Autonomous), Thrissur
Department of Statistics, Vimala College (Autonomous), Thrissur

Abstract:

The economy serves as a cornerstone for the development of nations, playing a pivotal role in fostering growth and progress. Regional organizations such as the South Asian Association for Regional Cooperation (SAARC) strive to advance the economic well-being of member countries within South Asia. This study delves into the economic dynamics of SAARC nations, focusing on real sector variables spanning the years 2004 to 2019. Through comprehensive analysis, we aim to elucidate the variations in these variables both across countries and over time. Utilizing secondary data sourced from the official SAARC website, we employ statistical methods including the Kolmogorov-Smirnov Test, Kruskal Wallis Test, Mann-Whitney U Test, Bonferroni Correction, and Growth Curve analysis to interpret the data. Our findings reveal consistent trends across the examined period, indicating minimal fluctuations in economic variables over time. However, disparities in variable contributions among countries are evident, with India emerging as the predominant contributor across all variables throughout the years.

Keywords: Economy, SAARC, statistical analysis, Kolmogorov-Smirnov Test, Kruskal Wallis Test, Mann-Whitney U Test, Growth Curve, contribution analysis.

A STUDY ON THE ONLINE CLASSES VIA VICTERS CHANNEL, THRISSUR DISTRICT

Anamiya Baby¹, Aswini Rajendran, Sreeshma P S, Roshini Robbin, Laya Joseph, Dilsha T T

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Department of Statistics, Vimala College (Autonomous), Thrissur

Abstract:

The concept of online education has a rich history spanning nearly 170 years, with various universities embracing digital platforms to offer quality education to students, especially those in remote areas. The global realization of the significance of online education was magnified in 2020, prompting governments and educational institutions worldwide to adapt swiftly to virtual learning environments. In Kerala, India, the Government initiated the First Bell program, leveraging the VICTERS channel—a dedicated educational platform—to provide virtual classes from grades 1 to 12 of the Kerala syllabus. This study aims to evaluate the effectiveness of VICTERS online lessons during the lockdown period of the 2020-21 academic session, analyze the channel's reach and acceptance within the student community, and conduct a comprehensive Strengths, Weaknesses, Opportunities, and Challenges (SWOT) analysis. Data analysis utilized statistical methods including the chi-square test, Wilcoxon signed-rank test, Mann Whitney U-test, and SWOT analysis. Findings indicate consistent acceptance of the VICTERS channel among students from both rural and urban areas. Survey results from students in grades 8 to 12 highlight time flexibility and ease of access as the primary strengths of VICTERS online classes. However, challenges such as technical issues and limited teacher-student interaction remain pertinent concerns. This study provides insights into the evolving landscape of online education, particularly

through platforms like VICTERS, shedding light on both its merits and potential areas for improvement.

Keywords: Online education, VICTERS channel, SWOT analysis, Statistical softwares

2021-2022 PROJECTS

STATISTICAL ANALYSIS OF HEALTH INDICATORS BASED ON NFHS 5

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Abstract:

This study presents a comprehensive statistical analysis of health indicators derived from the fifth round of the National Family Health Survey (NFHS-5). The dataset, collected on a national scale, serves as a robust foundation for understanding the current state of health across various demographic and socio-economic segments. Employing advanced statistical methods, we explore key health metrics such as maternal health, child nutrition, infectious diseases, and access to healthcare services. Our findings highlight significant disparities in health outcomes among different regions and demographic groups. The study employs regression analysis to identify the determinants influencing health indicators, offering valuable insights for policymakers and healthcare professionals. Additionally, time-series analysis provides a dynamic perspective on the evolution of health trends over the survey period. The implications of our research extend beyond academic curiosity, providing actionable intelligence for public health interventions and resource allocation. By merging English language expertise with statistical rigor, this study contributes to the ongoing discourse on health policy, fostering a data-driven approach towards improving healthcare systems.

Keywords: NFHS-5, health indicators, statistical analysis, maternal health, child nutrition, infectious diseases.

APPLICATION OF STATISTICAL TECHNIQUES IN MANUFACTURING OF POLYMER BAG INDUSTRY

Divya P R¹, Sruthi Krishna A S, Anagha C S, Seetha Menon, Maneesha Varghese, Honey Antony, Neeraja K N

¹Assistant Professor, Department of Statistics, Vimala College (Autonomous), Thrissur
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Abstract:

This study delves into the pivotal role of statistical techniques in enhancing the manufacturing processes within the polymer bag industry. In the dynamic landscape of modern manufacturing, statistical methodologies emerge as indispensable tools for optimizing production efficiency, minimizing defects, and ensuring consistent product quality. The research investigates the application of various statistical techniques, including design of experiments, regression analysis, and statistical process control, in the context of polymer bag production. The study explores how statistical methods contribute to the identification and mitigation of potential bottlenecks, thereby streamlining the manufacturing workflow. It also scrutinizes the impact of statistical process control on reducing variability and ensuring adherence to quality standards in polymer bag production. Additionally, the paper highlights the integration of statistical methodologies in the

design phase to enhance the overall product development lifecycle.

Keywords: Polymer bag industry, Quality standards, Product development.

A COMPARATIVE STUDY BETWEEN OFFLINE AND ONLINE CLASSES FOR THE STUDENTS AT VIMALA COLLEGE, THRISSUR

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Abstract:

This study explores the efficacy of offline and online classes in the educational landscape, focusing specifically on students at Vimala College. As the shift towards digital learning accelerates, understanding the impact on students' academic performance and overall satisfaction becomes imperative. The research employs a comparative approach, analyzing key variables such as learning outcomes, student engagement, and satisfaction levels between traditional offline and contemporary online classes. Using a mixed-methods research design, both qualitative and quantitative data are gathered to provide a comprehensive understanding of the students' experiences in both environments. Academic achievements, attendance rates, and participation levels are assessed alongside subjective measures such as student feedback and preferences. Additionally, factors influencing the effectiveness of each mode, including technology accessibility, instructor effectiveness, and peer interaction, are investigated. The findings of this study aim to inform educational institutions, particularly Vimala College, about the strengths and limitations of both offline and online learning formats, enabling informed decision-making in curriculum planning and delivery methods. This research contributes to the ongoing discourse on the evolving nature of education, offering valuable insights for institutions navigating the dynamic landscape of instructional modalities.

Keywords: Offline classes, Online classes, Academic performance, Student satisfaction, Learning outcomes.

A STUDY ON THE ROLE OF LOCKDOWN IN ELEVATING OTT PLATFORMS

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Abstract:

This study delves into the transformative impact of lockdown measures on the burgeoning landscape of Over-The-Top (OTT) platforms. With the global populace confined to their homes, the demand for online content consumption witnessed an unprecedented surge, prompting a paradigm shift in entertainment preferences. Leveraging a multifaceted approach, this research combines English language expertise with statistical analysis to illuminate the nuanced dynamics at play. Through comprehensive linguistic analyses, the study investigates how lockdown restrictions have influenced the language and narrative structures of content across various OTT platforms. Additionally, statistical models are employed to quantify the spike in user engagement, subscription rates, and content consumption patterns during lockdown periods. The findings unveil a symbiotic relationship between the confinement measures and the exponential growth of OTT platforms, highlighting the pivotal role played by lockdowns in shaping contemporary

entertainment paradigms.

Keywords: Lockdown, Over-The-Top (OTT), Entertainment Preferences, Subscription Rates.

INFLUENCE OF ADVERTISEMENT IN PURCHASE OF COSMETIC PRODUCTS

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Abstract:

This study delves into the intricate relationship between advertisements and consumer purchasing decisions within the cosmetic products industry. With the cosmetics market experiencing unprecedented growth, understanding the influence of advertisements becomes paramount for businesses and marketers. Employing a comprehensive analysis, this research investigates the psychological and emotional triggers embedded in cosmetic advertisements that shape consumers' preferences and purchasing behavior. By merging insights from both English language expertise and statistical methodologies, the study employs linguistic analysis to decipher the persuasive language and visual cues employed in cosmetic advertisements. Concurrently, statistical models are applied to quantify the correlation between exposure to advertisements and subsequent consumer actions, shedding light on the magnitude of advertisement impact. The findings offer a nuanced understanding of how advertisements serve as catalysts in shaping consumers' perceptions, attitudes, and ultimately, their decisions to purchase cosmetic products. This research contributes to the existing literature by bridging the gap between linguistic and statistical analyses, providing a holistic view of the interplay between advertising strategies and consumer behavior in the cosmetic industry.

Keywords: Advertisements, Cosmetic Products, Consumer Behavior, Statistical Modeling, Advertising Impact.

A STATISTICAL ANALYSIS OF POCSO CASES IN KERALA

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Abstract:

This research endeavors to conduct a meticulous statistical analysis of POCSO (Protection of Children from Sexual Offences) cases in the state of Kerala, aiming to provide a comprehensive understanding of the prevalence, patterns, and trends of such offenses. Utilizing a robust methodology, the study delves into the available data sets, considering variables such as age, gender, socio-economic factors, and geographic locations. The analysis employs advanced statistical tools to discern patterns and identify key factors influencing the incidence of POCSO cases. The findings of this study not only contribute to the existing literature on child sexual abuse but also offer valuable insights for policymakers, law enforcement agencies, and social workers in devising targeted intervention strategies. By examining the demographic and socio-economic characteristics of both victims and perpetrators, this research sheds light on potential risk factors and areas requiring focused attention in the prevention and mitigation of POCSO cases in Kerala.

Keywords: POCSO, child sexual abuse, intervention strategies, prevention, law enforcement.

A STUDY ON THE SIGNIFICANCE OF DIGITAL MEDIA LITERACY

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Abstract:

This study focuses into the multifaceted realm of digital media literacy, aiming to illuminate its pivotal role in contemporary society. Bridging the domains of English language expertise and statistics, our interdisciplinary analysis employs a comprehensive approach to investigate the nuanced dimensions of digital media literacy. Through a meticulous examination of current literature and empirical data, we explore the impact of digital media literacy on communication, critical thinking, and socio-cultural dynamics. The English language aspect of this study focuses on the linguistic elements within digital media, scrutinizing how language nuances shape the comprehension and dissemination of information. Concurrently, statistical methodologies are employed to quantify the extent to which digital media literacy influences public opinion, online behavior, and the accessibility of information. Our findings underscore the critical importance of fostering digital media literacy in educational curricula and public discourse.

Keywords: Digital media literacy, statistical analysis, online behavior, information accessibility.

2022-2023 PROJECTS

STATISTICAL ANALYSIS BASED ON NIRF RANKING ON COLLEGES

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Abstract

The National Institutional Ranking Framework (NIRF) has emerged as a prominent yardstick for evaluating the performance and quality of higher education institutions in India. This study delves into the realm of statistical analysis concerning NIRF rankings of colleges, aiming to uncover underlying trends, patterns, and insights within the dataset. By employing rigorous statistical methodologies, this research scrutinizes the intricacies of the ranking system, identifying factors that significantly influence the rankings and elucidating the dynamics of institutional performance. Through comprehensive data analysis, this study explores the relationships between various parameters such as academic excellence, infrastructure, faculty quality, research output, and overall ranking scores assigned by the NIRF. Utilizing advanced statistical techniques including regression analysis, correlation studies, and factor analysis, the research seeks to discern the relative importance of different factors in shaping the final rankings. Furthermore, the study examines temporal trends to discern any evolving patterns or shifts in the ranking criteria over time. Moreover, this research endeavors to highlight disparities and discrepancies in the NIRF

rankings, offering insights into potential biases or inconsistencies inherent in the evaluation process. By critically evaluating the statistical robustness of the rankings, this study aims to foster a deeper understanding of the nuances involved in assessing institutional quality and performance within the Indian higher education landscape. In summary, this study contributes to the ongoing discourse surrounding NIRF rankings by providing a comprehensive statistical analysis that sheds light on the intricacies of the ranking system, identifies key determinants of institutional performance, and offers valuable insights for policymakers, educators, and stakeholders in the realm of higher education.

Keywords: NIRF, statistical analysis, colleges, higher education, regression analysis, correlation studies, factor analysis, SPSS, R.

STATISTICAL ANALYSIS BASED ON NIRF RANKING ON UNIVERSITIES

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Abstract

The National Institutional Ranking Framework (NIRF) serves as a pivotal tool for evaluating the performance and quality of universities in India, offering insights into various facets of higher education. This study embarks on a comprehensive statistical analysis of NIRF university rankings, aiming to unravel underlying trends, discern influential determinants, and unveil the broader implications of the ranking system. By employing advanced statistical techniques, this research endeavors to elucidate the dynamics of university rankings and provide valuable insights for stakeholders within the higher education landscape. Through meticulous data analysis, this study examines the multifaceted dimensions that contribute to university rankings, including academic excellence, research productivity, faculty quality, infrastructure, and overall institutional performance. Utilizing rigorous statistical methodologies such as regression analysis, correlation studies, and factor analysis, the research seeks to identify the relative importance of these factors in shaping the final rankings. Furthermore, the study explores temporal trends and variations to discern any evolving patterns or shifts in the evaluation criteria over time. Moreover, this research endeavors to critically evaluate the statistical robustness of the NIRF rankings, shedding light on potential biases, inconsistencies, and areas for improvement within the ranking framework. By providing a nuanced understanding of the complexities involved in assessing university quality and performance, this study aims to inform policy decisions, guide institutional strategies, and enhance transparency and accountability in the higher education sector. In summary, this study contributes to the scholarly discourse surrounding NIRF university rankings by offering a comprehensive statistical analysis that illuminates key trends, determinants, and implications inherent in the ranking system. By bridging the gap between statistical analysis and educational policy, this research seeks to foster informed discussions and facilitate evidence-based reforms in the Indian higher education landscape.

Keywords: NIRF, statistical analysis regression analysis, correlation studies, factor analysis, R.

STATISTICAL ANALYSIS OF SEIZURES OF DRUGS ACROSS INDIA

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Abstract

The illicit drug trade poses significant challenges to public health and safety, with seizures serving as critical indicators of enforcement efforts and drug trafficking trends. This study undertakes a rigorous statistical analysis of drug seizures across India, aiming to unravel spatial and temporal patterns, identify emerging trends, and elucidate factors influencing the dynamics of drug enforcement activities. By leveraging diverse datasets and advanced statistical methodologies, this research offers insights into the complexities of the drug trade and informs evidence-based strategies for combating illicit drug trafficking. Through comprehensive data analysis, this study examines the spatial distribution of drug seizures across different regions and states in India, discerning hotspots and trends in drug trafficking routes. Utilizing advanced statistical techniques such as spatial autocorrelation analysis, cluster analysis, and time series modeling, the research investigates the spatial and temporal dynamics of drug seizures, highlighting variations and trends over time. Moreover, the study explores the relationship between drug seizure rates and various socio-economic factors, shedding light on underlying drivers of drug trafficking activities. Furthermore, this research endeavors to assess the effectiveness of enforcement strategies and policy interventions in curbing drug trafficking, offering insights into the impact of law enforcement initiatives on seizure rates and drug market dynamics. By critically evaluating patterns of drug seizures and enforcement outcomes, this study aims to inform evidence-based policies and interventions aimed at disrupting illicit drug networks and safeguarding public health. In summary, this study contributes to the understanding of drug trafficking dynamics in India by providing a comprehensive statistical analysis of drug seizures. By integrating statistical methodologies with insights from law enforcement and public health perspectives, this research seeks to advance knowledge and inform evidence-based strategies for combating the illicit drug trade.

Keywords: Statistical analysis, drug seizures, drug trafficking, India, spatial distribution, temporal trends, enforcement strategies, illicit drug trade, public health, spatial autocorrelation analysis, cluster analysis, time series modeling, law enforcement, policy interventions, socio-economic factors.

A STATISTICAL STUDY ON CONSUMER BEHAVIOR TOWARDS ONLINE AND OFFLINE SHOPPING

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Abstract

Consumer behavior in the retail sector is a dynamic and evolving field, influenced by a myriad of factors including technological advancements, convenience, pricing strategies, and consumer preferences. This study conducts a comprehensive statistical analysis to explore and compare consumer behavior towards online and offline shopping modalities. By employing sophisticated statistical methodologies, this research seeks to unravel underlying trends, preferences, and determinants that shape consumer choices in the retail landscape. Through rigorous data analysis, this study examines various aspects of consumer behavior, including purchasing habits, product preferences, satisfaction levels, and perceived benefits of online and offline shopping channels. Utilizing advanced statistical techniques such as regression analysis, cluster analysis, and factor analysis, the research seeks to identify key drivers and barriers influencing consumer preferences across different shopping platforms. Moreover, the study explores demographic variations and

socio-economic factors that may impact consumer behavior in online and offline settings. Furthermore, this research endeavors to assess the relative strengths and weaknesses of online and offline shopping experiences, offering insights into factors driving consumer satisfaction and loyalty towards particular retail channels. By critically evaluating consumer perceptions and preferences, this study aims to inform retail strategies, marketing campaigns, and business operations aimed at enhancing the overall shopping experience and maximizing customer satisfaction. In summary, this study contributes to the understanding of consumer behavior in the retail sector by providing a comprehensive statistical analysis of online and offline shopping preferences. By integrating quantitative methodologies with insights from consumer psychology and marketing research, this research seeks to provide valuable insights for retailers, marketers, and policymakers seeking to adapt to the evolving dynamics of consumer preferences in an increasingly digitalized retail landscape.

Keywords: Consumer behavior, online shopping, offline shopping, statistical analysis, demographic variations, socio-economic factors, regression analysis, cluster analysis, factor analysis, R.

STATISTICAL ANALYSIS OF REVENUE USING TIME SERIES

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Abstract

Revenue analysis is a critical aspect of business performance evaluation and strategic decision-making. This study employs time series statistical analysis to delve into the dynamics of revenue generation, aiming to identify patterns, trends, and forecasting insights. By leveraging time series methodologies, this research seeks to uncover underlying patterns, seasonality, and long-term trends in revenue data, offering valuable insights for business stakeholders and decision-makers. Through rigorous data analysis, this study examines historical revenue data over time, utilizing time series techniques such as decomposition, autocorrelation analysis, and forecasting models. By decomposing the revenue series into its constituent components, including trend, seasonality, and random fluctuations, the research endeavors to discern recurring patterns and identify potential causal factors influencing revenue fluctuations. Additionally, the study explores the presence of autocorrelation and seasonality effects, facilitating the development of accurate forecasting models to predict future revenue trends. Furthermore, this research aims to assess the impact of external factors such as economic indicators, market dynamics, and business cycles on revenue fluctuations, employing statistical techniques to identify significant relationships and causal linkages. By providing actionable insights into revenue trends and forecasting accuracy, this study offers decision-makers valuable tools for strategic planning, resource allocation, and performance optimization. In summary, this study contributes to the understanding of revenue dynamics by utilizing time series statistical analysis to uncover patterns, trends, and forecasting insights. By integrating quantitative methodologies with insights from business analytics and econometrics, this research aims to empower organizations with actionable intelligence for informed decision-making and sustainable growth.

Keywords: Revenue analysis, time series, statistical analysis, forecasting, trends, seasonality, autocorrelation, forecasting models, decision-making, strategic planning, revenue forecasting.

STATISTICAL STUDY ON ROAD ACCIDENTS IN KERALA DURING THE PERIOD 2019 TO 2021

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Abstract

Road accidents pose significant challenges to public safety and infrastructure development, necessitating comprehensive analysis and proactive measures to mitigate risks and enhance road safety. This study undertakes a detailed statistical examination of road accidents in Kerala from 2019 to 2021, aiming to elucidate trends, patterns, and underlying factors contributing to road accidents in the state. By leveraging robust statistical methodologies, this research seeks to inform evidence-based policies and interventions aimed at reducing road accidents and promoting safer road environments. Through meticulous data analysis, this study examines the spatiotemporal distribution of road accidents across different regions and time periods in Kerala, identifying hotspots and temporal trends in accident occurrence. Utilizing advanced statistical techniques such as regression analysis, time series modeling, and spatial mapping, the research explores factors influencing road accidents, including road infrastructure, traffic density, weather conditions, and human factors such as driver behavior and road safety compliance. Furthermore, this research endeavors to assess the effectiveness of existing road safety measures and interventions in mitigating accident risks and improving road safety outcomes. By critically evaluating patterns of road accidents and identifying high-risk areas and contributing factors, this study aims to provide valuable insights for policymakers, law enforcement agencies, and transportation authorities tasked with enhancing road safety initiatives in Kerala. In summary, this study contributes to the understanding of road safety dynamics in Kerala by providing a comprehensive statistical analysis of road accidents during the period 2019 to 2021. By integrating quantitative methodologies with insights from transportation engineering and public health perspectives, this research aims to inform evidence-based strategies and interventions aimed at reducing road accidents, saving lives, and promoting safer road environments across the state.

Keywords: Road accidents, spatiotemporal analysis, regression analysis, time series modeling, R, SPSS.

A STATISTICAL ANALYSIS OF PERSONS INCARCERATED IN INDIA

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Abstract

The incarceration of individuals is a complex societal issue with far-reaching implications for public safety, justice, and human rights. This study conducts a comprehensive statistical analysis of persons incarcerated in India, aiming to uncover trends, patterns, and demographic characteristics of the incarcerated population. By utilizing robust statistical methodologies, this research seeks to inform evidence-based policies and interventions aimed at addressing disparities, promoting rehabilitation, and enhancing the effectiveness of the criminal justice system. Through meticulous data analysis, this study examines various aspects of incarceration, including demographic profiles, offense categories, duration of sentences, and spatial distribution of incarceration facilities across different regions in India. Utilizing advanced statistical techniques

such as descriptive statistics, regression analysis, and spatial mapping, the research explores factors influencing incarceration rates and demographic disparities within the incarcerated population. Furthermore, this research endeavors to assess the impact of socio-economic factors, legal frameworks, and criminal justice policies on incarceration trends and outcomes. By critically evaluating patterns of incarceration and identifying vulnerable populations, this study aims to provide insights for policymakers, legal advocates, and social service providers working towards a more equitable and effective criminal justice system in India. In summary, this study contributes to the understanding of incarceration dynamics in India by providing a comprehensive statistical analysis of persons incarcerated. By integrating quantitative methodologies with insights from criminology, sociology, and public policy perspectives, this research aims to inform evidence-based strategies and interventions aimed at reducing incarceration rates, addressing disparities, and promoting rehabilitation and reintegration for individuals within the criminal justice system.

Keywords: Incarceration, India, statistical analysis, spatial distribution, regression analysis, R.

A STUDY ON THE SUICIDE RATES IN INDIA

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Abstract

Suicide is a multifaceted phenomenon with profound implications for public health, mental well-being, and social dynamics. This study conducts a comprehensive statistical analysis of suicide rates in India, aiming to elucidate trends, patterns, and contributing factors associated with suicide occurrences. By leveraging robust statistical methodologies, this research seeks to inform evidence-based interventions, mental health policies, and suicide prevention strategies tailored to the diverse socio-cultural landscape of India. Through meticulous data analysis, this study examines various dimensions of suicide rates, including demographic profiles, regional variations, methods of suicide, and underlying risk factors such as mental illness, socio-economic disparities, and psychosocial stressors. Utilizing advanced statistical techniques such as time series analysis, regression modeling, and spatial mapping, the research endeavors to identify temporal trends, spatial clusters, and factors influencing suicide rates across different states and demographic groups in India. Furthermore, this research aims to explore the intersections between mental health, socio-cultural norms, and systemic factors contributing to suicide vulnerability among various population segments. By critically evaluating patterns of suicide occurrences and identifying high-risk populations, this study seeks to provide insights for policymakers, healthcare professionals, and mental health advocates working towards suicide prevention and mental health promotion initiatives in India. In summary, this study contributes to the understanding of suicide dynamics in India by providing a comprehensive statistical analysis of suicide rates. By integrating quantitative methodologies with insights from psychology, sociology, and public health perspectives, this research aims to facilitate informed decision-making, destigmatize mental health issues, and promote holistic approaches to suicide prevention and mental well-being across diverse communities in India.

Keywords: Suicide rates in India, statistical study, time series analysis, regression modeling.