FETSAC 2021

PROCEEDINGS

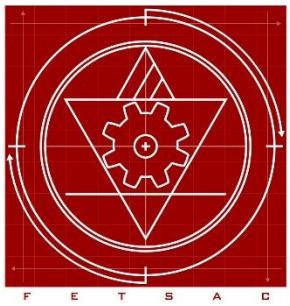
Faculty of Engineering Technology

Student Academic Conference

07th & 08th January 2022

Green World From Innovations

Faculty of Engineering Technology
The Open University of Sri Lanka



Faculty of Engineering Technology Student Academic Conference

Green World from Innovations

Proceedings of 6th Faculty of Engineering Technology Student Academic Conference

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ABSTRACTS

Faculty of Engineering Technology
The Open University of Sri Lanka

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Message of the Vice Chancellor

It is with great pleasure I write this message to the Faculty of Engineering Technology Student Academic Conference (FETSAC). FETSAC initiated its activities in 2014 with the intention of assisting to create a liaison between the final year undergraduates and the industry partners.

The event is mainly focused on the new inventions of the undergraduate engineering students and the implementation of a platform to showcase their innovations and skills to industry partners through publishing an abstract and presenting a paper in front of a learned audience.

The theme selected for this year conference is 'Green World from Innovations' is having a contemporary importance because it leads a way towards an innovative technological path to create an Eco-friendly world, so our planet and our minds become greener. Green technology encompasses energy efficiency, health and safety concerns, recycling, renewable resources, and many other things. Although it seems as a completely new concept, renewable energy has been around for thousands of years.

I extend deep gratitude to the members of in the organizing committee, Dean and Heads of Departments of the Faculty of Engineering Technology for their guidance and valuable comments given in organizing this conference.

I would like to congratulate all the final year undergraduates and wish all the very best in their future endeavours. Finally, I wish a successful student academic conference.

Professor P. M. C. Thilakerathne
Vice-Chancellor
Open University of Sri Lanka

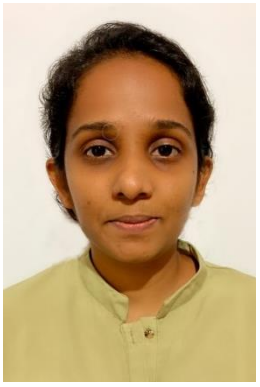
Message of the Dean - Faculty of Engineering Technology

On behalf of the Faculty of Engineering Technology, I warmly welcome you to the Faculty of Engineering Technology Student Academic Conference. FETSAC is organised to showcase industry relevant applications and the findings of research initiatives of the final year students of the Faculty of Engineering Technology. Communicating such findings and obtaining feedback from the industry representatives open up many opportunities to us.

As we all know, the industry looks for individuals with both soft skills and hard skills and this interaction helps our learners to demonstrate their abilities. A successful learner should possess the ability to showcase and share the achievements with the Engineering community. Such interactions help students to refine and to generate new ideas to serve the society better. I take this opportunity to wish you success and hope that this event would enhance our outreach.

Dr. H. G. P. A. Ratnaweera
Dean
Faculty of Engineering Technology

Message of the Chairperson - Organizing Committee (Academics)



On behalf of the Organizing Committee (Academic) it is great pleasure and honour to welcome you for the 6th Faculty of Engineering Technology Student Academic Conference, FETSAC 2021. Faculty of Engineering Technology Student Academic Conference (FETSAC) is an annual event of the Faculty of Engineering Technology which was started in 2014 with the intention of assisting to create a relationship between the final year undergraduate students and the co-operative communities through the exposing their final year projects and their creative intelligence. The Faculty of Engineering Technology is proud to conduct this annual event for the sixth time in the faculty history. Considering the calming ability of the green environment and the most important concept of innovations, fixing problems which can be answering by innovations for a stress-free life, "Green World from Innovations" is chosen as the theme for this year.

We take this opportunity to thank the authors and the academic staff of the Faculty of Engineering Technology, very particularly supervisors of the final year research projects, for encouraging students to publish abstracts in FETSAC-2021, and for reviewing their abstracts. A very special appreciation also goes to members of reviewing panels, and the keynote speaker, Mr. Heminda Jayaweera who obliged our request and support, despite their heavy work scheduled. Also, we give our special thanks to Prof. Jagath Manatunge, Professor in Environmental Engineering, Department of Civil Engineering, University of Moratuwa for conducting the workshop on "How to write abstracts" which is helpful to students in Faculty of Engineering Technology. We would like to extend our sincere appreciation to the Vice Chancellor, Prof. P.M.C. Thilakarathna, and the Dean of the Faculty of Engineering Technology, Dr. H.G.P.A. Ratnaweera, for their kind and timely advice, support, and leadership given to us. We would like to specifically thank Prof. (Mrs) B.C.L. Athapattu, Eng. (Mr) S. Perera, Eng. (Mrs) H. Pasqual, and Dr. (Mrs) A.G.B. Aruggoda for their continuous guidance towards the success of this event. We also take this opportunity to thank the staff of the OUSL press, CETME, IT division for their valuable contribution towards the success of this event despite their other commitments. We also like to give our special thanks to Mr. Wijikumar Kulasarasingam, Assistant Registrar of the Faculty of Engineering Technology and the staff to their contribution of making this event success. At last, but not least, we would like to thank to all the members of the organizing committee both the academic staff and students committee of FETSAC 2021, for their dedication, teamwork, and valuable comments. without their commitment, this event would not have been a success.

Dr. K. D. N. Kumari, Dr. W. A. L. Niwanthi
Co-Chairpersons
Organizing Committee (Academic)
FETSAC – 2021

Message of the Chairperson - Organizing Committee (Students)

The current world poses a challenge to all of us. We'd all like to be a part of something that leaves a lasting impression. For the sixth occasion, the Faculty of Engineering Technology, The Open University of Sri Lanka is hosting the Faculty of Engineering Technology Student Academic Conference (FETSAC). I am honoured to be the Chairperson of the FETSAC 2021, where I am a part of a fantastic team that strives for success and greatness.

I extend a warm welcome to all the distinguished delegates, speakers, and participants of the FETSAC, 2021 which is conducted virtually on January 07 and 08, 2022. FETSAC 2021 provides a unique opportunity for students and scholars of the Open University of Sri Lanka to disseminate their knowledge on crucial issues related to functional areas of Engineering. This conference enables undergraduates to present their successful research project to the industry and embark on further developments leading to a possible commercialization. Therefore, the worthy effort will finally become beneficial to the society at large. FETSAC creates great opportunities for students by encouraging them to take part in organizing the event thus improving their social skills and teamwork.

The theme of this year conference is “Green World from Innovations”. The key personality gracing and enriching this event is the Keynote Speaker, Mr. Heminda Jayaweera, Serial Innovator and Entrepreneur. I am much thankful to him for his valuable contribution, and I have no doubt that his presence will add a great value to FETSAC 2021.

Further, I acknowledge the invaluable guidance, encouragement and fullest support provided by Dr. K.D.N. Kumari and Dr. W.A.L. Niwanthi, Co-Chairpersons, Organizing Committee (Academic) FETSAC 2021. Moreover, I would like to take this opportunity to extend my gratitude to the Vice Chancellor of the Open University of Sri Lanka, Dean of the Faculty of Engineering Technology, the members of the Organizing Committee, all the staff of the faculty who have spent their precious time to make this event a reality and all the others who have contributed in numerous ways to make this event a success.

I hope that the conference will be a memorable, productive, and inspiring event.

Mr. S. Himanujahn
Chairperson
Organizing Committee (Student)
FETSAC – 2021

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ABSTRACTS

Abstract No: AE001

Morphological evaluation of new coconut crosses for Aceria mite tolerance

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Coconut mite (*Aceria guerreronis:*Keifer) (*Eriophydae*: Acari) is a major pest of coconuts. In a preliminary study carried out to compare the mite resistance /tolerance in local varieties, a certain degree of tolerance to CM was found in Yellow Dwarf, Gonthembili, recommended cultivar CRIC65-yellow revealing the genetic control of resistance to the pest. Five new coconut hybrids were developed in 2006 using the two local varieties showing tolerance to CM and two exotic varieties with round shaped nuts. In the current study, morphological features associated with mite infestation were studied on new coconut hybrids and compared with two recommended cultivars CRISL98 and CRIC65 green over 6 months period under wet conditions. The results revealed no difference between the new hybrids and control cultivars with respect to the mite infestation and no relationship was identified between morphological features and the mite infestation. The probable reason for lower mite infestation due to unexpected heavy rains during the period. The cross between Brazilian Green Dwarf and Gon thembili (BGD x GT) and the cross between San Ramon and Brazilian Green Dwarf (SR x BGD) were identified as the most promising new hybrids showing morphological features associated with mite tolerance. Both showed the lowest area under the perianth, and the recorded values were significantly different from the two control cultivars.

The shape of the nuts of BGD x GT were significantly different from two control cultivars with more round shape while the nuts of SR x BGD was significantly round compared to CRISL98. The distance between the perianth and nut surface was lowest in SR x BGD and significantly different compared to two control cultivars however, in BGD x GT it was significantly different only with control cultivar CRIC65. In addition, SR x BGD showed a contortion pattern of tepals arrangement of that favour's tightness of the perianth structure, providing resistance to the entry of CM The recommended cultivar CRISL98 was identified as having morphological traits that increase its susceptibility to CM infestation. These positive results should further investigate during dry period to identify the association between these morphological characters and mite infestation.

Keywords : *coconut mite (cm), coconut, pest damage, morphological traits, tolerant hybrids*
Supervisors : Dr. A. G. B. Aruggoda[1], A. Dissanayake[2] and N. Aratchige[2]
Affiliation : [1]The Open University of Sri Lanka
[2]Coconut Research Institute, Lunuwila

Abstract No: AE002

Nutritional properties and hydrolysing rates of rice grown with Biofilm Bio-fertilizer (BFBF)

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Rice (Oryza sativa L.) is the staple food for a larger proportion of the world population. Excessive use of chemical fertilizer (CF) in rice cultivation, especially urea is one of the causes of global warming and ground water pollution. Biofilm Biofertilizer (BFBF) has been developed as an environmentally friendly alternative for reducing excessive use of CF in rice cultivation. This study compared the nutritional properties and hydrolysing rates of the rice grown with BFBF and CF. Rice samples of Bg94/1 grown with six fertilizer treatments: different ratios of BFBF and CF, T_1−100% CF, T_2−80% CF, T_3−80% CF+BFBF, T_4−65% CF, T_5−65% CF+BFBF and T_6−Control: normal soil were analysed. All the analysis was carried out in triplicates, and data were analysed by using one-way ANOVA. Based on the results, moisture, ash, crude fat contents among the treatments varied from 10.2% (T_4) to 12% (T_1), 2.1% (T_1) to 5.1% (T_4), and 1.0% (T_1) to 2.7% (T_4), respectively. Protein content was in the range between 5.6% (T_2) to 7.3% (T_4). Available carbohydrate content varied between 68.3% (T_4) to 74.8% (T_1). The mineral profile of rice showed that no harmful trace elements exceeded the acceptable level. A significantly higher level of Zn was observed in T_5. Total dietary fiber (TDF) content ranged between 6.8 to 3.1 g/100 g belonging to T_2 and T_1, respectively. Moreover, when the rice samples were hydrolysed, the lowest maltose releasing rate was observed in T_4. The results of the present analysis revealed that rice grown with 65% CF+BFBF have satisfactory level of macro and micronutrient composition. Protein, TDF and zinc content in rice grown with 65% CF+BFBF treatment were significantly higher than those in the rice grown with 100% CF and the control sample. Therefore, it could be concluded that the 65% CF+BFBF is an eco-friendly and economically viable recommendation for rice farming in Sri Lanka.

Keywords : *biofilm biofertilizers, chemical fertilizers, nutritional properties, Oryza sativa, sustainable agriculture*

Supervisors : Prof. Shanthi De Silva[1], Dr. Ruvini Liyanage[2,] Shehani Maheepala[2] and Gamini Seneviratne[2]

Affiliations : [1]The Open University of Sri Lanka
[2]National Institute of Fundamental Studies, Kandy

Abstract No: AE003

Estimation and mapping soil organic carbon in paddy growing soils of Monaragala district, Sri Lanka

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Soil carbon sequestration is prominent and the most effective natural way to reduce the atmospheric concentration of CO_2 and slow down global warming. The paddy ecosystem is considered one of the most important carbon pools as it stabilizes more carbon under water-logged conditions and has a great potential in sequestering atmospheric carbon dioxide. The present study was carried out in paddy growing soils of Monaragala district, Sri Lanka, to identify the carbon sequestration capacity and the spatial distribution patterns of soil carbon concerning the different paddy growing soil types and the climatic conditions. This study adopted conditional Latin hypercube sampling (cLHS), designed to determine sampling locations and the total 35 soil samples were collected representing the paddy growing areas of the district and analyzed for the soil carbon content by using CHN elemental analyzer. The Regression kriging interpolation technique was utilized in Arc- GIS environment to predict the spatial distribution patterns of soil carbon. According to the results, soil carbon content varied from 1.2% to 2.1%, with mean value of 1.6%. The highest soil carbon content stocks (1.7% - 2.1%) were observed in south-western and western side in Monaragala district. The highest soil carbon content (1.9%- 2.1%) was observed in the Sevanagala DS division in DL1b agro ecological sub region. This agro ecological sub region is characterized by two detectable peaks in the rainfall distribution. The soil organic matter content in the soil varies with the soil types. Soil with a high organic matter content generally has a lower bulk density and increased soil organic carbon stock. Soil organic carbon stocks were calculated based on the carbon concentration of soil, the actual depth of sampling and the bulk density of soil. The mean SOC stock was varied from 15.2 Mg ha^{-1} to 55.6 Mg ha^{-1} with mean value of 31.1 Mg ha^{-1} for the topsoil layer. The major soil types of the area, Reddish Brown Earths (RBE) and Immature Brown Loam soil, Alluvial soil, Reddish Brown Earths (RBE) & Low Humic Gley soil and Miscellaneous land units were reported with 39.3 Mg ha^{-1}, 37.2 Mg ha^{-1}, 29.4 Mg ha^{-1}, and 26.7 Mg ha^{-1} SOC stock values respectively. The output generated from this study will provide the baseline information on the status of SOC stocks in paddy soils of Monargala district and it will be useful for the establishment of national carbon accounting system in Sri Lanka.

Keywords : *agro- ecological zones, paddy, soil carbon stock, soil organic carbon*
Supervisors : Prof. C. S. De Silva[1] and Prof. Renuka Ratnayake[2]
Affiliations : [1]The Open University of Sri Lanka
[2]National Institute of Fundamental Studies, Kandy

Abstract No: AE004

Downward movement of exchangeable Potassium and Magnesium after long term application of fertilizer under different placement techniques: a case study at Ranawana coconut estate, Kurunegala

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Coconut plays a major role in Sri Lankan economy. Fertilizers are the main inputs which are incorporated into soil to achieve the required yield. Fertilizers are mainly of two types those are inorganic and organic in nature. An experiment was conducted at Ranawana estate in Kurunegala which belongs to the IL1 agro ecological zone to compare fertilizer application techniques to increase the efficiency of nutrient uptake. After 7 years of continuous fertilizer application under three different placement techniques each with inorganic and (organic and inorganic) fertilizer practices soil samples were randomly collected at five depths those are 0-20, 20- 40, 40-60, 60-80 and 80-100 cm from each treatment to investigate and compare the downward movement of two exchangeable K^+ and Mg^{2+} ions. The Three different fertilizer placement techniques used were the surface application, trench application and basin application method. Totally there were 6 treatments with two types of fertilizer combinations under each fertilizer placement techniques. The experimental site soil is in sandy loam to sandy clay loam soil with some quartz, few feldspar and iron stone gravels belongs to Red Yellow Podzolic grate soil group and Kurunegala soil series of S2 (most suitable) land suitability class for coconut growing. Collected soil samples were analyzed for pH, Electrical conductivity (EC), exchangeable ions K and Mg at different depths. Data were analyzed using General Linear Model with Minitab 17 statistical software at 5% significant level and at 95% confidence level. EC data revealed that movement of ions from top to bottom layers with the significant variations while the pH changes through the depths were not significantly different. The highest K^+ concentration (0.78cmol/kg ^{a}) and highest EC value (185.82µs/cm ^{a}) were observed in first depth of inorganic & organic manure application in surface method while the highest Mg^{2+} (1.80cmol/kg ^{a}) concentration in inorganic fertilizer application in trench method. Furthermore, leaching tendency of Mg ion is comparatively higher than that of K leaching in Kurunegala series soil.

Keywords : *coconut, fertilizer, placement techniques, leaching*
Supervisors : Prof. C. S. De Silva[1], Ms. M. K. F. Nadheesha[2] and Ms. S. S. Udumann[2]
Affiliations : [1]The Open University of Sri Lanka
[2]Coconut Research Institute of Sri Lanka, Lunuwila

Abstract No: AE005

Bee keeping in rubber plantations: a case study in Kegalle district

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In rubber trees, honey is produced in extra floral nectary glands, and these glands are activated around four years after planting. Thus, the possibility of beekeeping was explored by many rubber growing countries. In Sri Lanka, beekeeping has been recommended for mature rubber plantations especially targeting the smallholder sector to increase the income of rubber growers. However, the adoption level of beekeeping is very low due to various reasons. With this background, this study was commenced to identify the status of beekeeping in rubber plantations and identify the willingness to accept of beekeeping by rubber smallholders in the Kegalle district. A semi-structured questionnaire survey was carried out for cross-sectional data collection. Since the highest number of smallholders are present, the Kegalle district was selected for the study. The sample size was 250. During the study, the data were collected on rubber cultivation, beekeeping, demographic details of the farmers and willingness to accept beekeeping. In the study sample, 82% are male, while 18% are female. The age of the farmers varies from 24 years to 80 years, whereas the average age is 55 years. The average land size of a smallholder owned is 2 acres. The average value for farming experience is 20 years. It distributed from 1 year to 60 years range. Among the rubber farmers, 55% are interested in beekeeping; however, 46% of the farmers are not aware of the possibility of beekeeping with rubber. About 10.75% of farmers practice beekeeping in their rubber lands, while 2.49% of farmers have practiced beekeeping and stopped due to various problems. The logit analysis revealed that there is a 50% probability that a rubber farmer would decide to engage in beekeeping if the income from beekeeping would be at least Rs. 20,950.00/acre/year.

Keywords : *beekeeping, rubber, smallholder, Kegalle*
Supervisors : Dr. S. Thrikawala[1] and Mrs. B. M. D. C. Balasooriya[2]
Affiliation : [1]The Open University of Sri Lanka
[2]Rubber Research Institute of Sri Lanka, Agalawatte

Abstract No: AE006

Growth, physiology, weed abundance and yield in rice (Oryza sativa L.) under diverse input systems in the dry zone of Sri Lanka

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A field trial was conducted to compare the growth, physiology, weed abundance and yield in rice under three input systems: organic, conventional, and integrated, during 2019 Yala season as the second season of a long-term cropping systems trial. The experimental design was Randomized Complete Block Design (RCBD), and there were six (6) replicates for each treatment. Three treatments were based on three input systems as T1- Conventional input system (100% Department of Agriculture (DOA) inorganic fertilizer recommendation), T2- Integrated system (50% of Department of Agriculture (DOA) inorganic fertilizer recommendation+50% of the rate of compost added to organic input system) and T3- Organic system (No inorganic fertilizers and only compost with the rate of 10000 kg ha-1). A significant difference ($p<0.05$) in rice shoot biomass among the three input systems was identified at panicle initiation and harvesting stages, and the organic system showed the lowest values compared to the other two systems. There was a significant difference ($p<0.05$) in plant height among the three input systems at panicle initiation, 50% heading and harvesting stages and the organic system showed the lowest values at all stages. The organic system had the highest weed count at all three crop stages and no significant difference between integrated and conventional systems. No difference was observed in biological yield among conventional (10.5 tons/ha) and integrated system (11.7 tons/ha), but the organic system had the lowest value (6.8 tons/ha). Overall results indicate that reducing inorganic fertilizers by 50% with the combination of organic manure as in the integrated system gives similar final grain yields as the conventional system of new improved varieties like Bg 300 in high potential areas like Anuradhapura. Also, organic systems can show low crop growth and yields due to inadequate nutrient supply through organic materials and due to high weed density during the first year of transition.

Keywords : *crop growth, physiological, weed abundance, integrated, organic, rice*
Supervisor : Prof. C. S. De Silva[1], D. M. D. Dissanayake[2] and D. A. U. D. Devasinghe[2]
Affiliation : [1]The Open University of Sri Lanka
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Abstract No: AE007

The tea research institute recommendations and the profitability of tea smallholders in Kalutara, Sri Lanka

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Tea cultivation was begun as large plantations, but tea small holders gradually increased in Sri Lanka over the decades. Majority of the smallholders concentrated in the Low country and Kaluthara is one of the major tea planting districts in Low country (WL1a). The Tea Research Institute (TRI) make recommendations for various agronomic practices. However, the extent to which the agronomic practices are adopted by the tea smallholders as per the recommendation of the TRI have not been adequately researched. This study was carried out to investigate, the level of adoption of TRI recommendations and its effect on the profitability of the tea smallholders in Meegahathenna sub office division of Kalutara district. A structured questionnaire survey was carried out to gather primary data from randomly selected 280 farmers of two Tea Inspector (TI)/extension officer ranges which includes 14 Grama Niladari divisions from each TI Range. The results show that from here onward you got to discuss the results with numbers and for each TI range

- Percentage of adoption of different practices.
- The profitability
- The correlation between level of adoption and profitability
- And if available the factors affecting the adoption of each technology/agronomic practice etc.
- Then the conclusions and recommendations

The survey conducted here identified the extent to which tea small holders have followed or have not followed the recommendations of the Sri Lanka Tea Research Institute. Accordingly, the relationship between the yield and the price of those tea small holders could be identified. From the information obtained from the ground, it was found that the tea smallholders were aware of the recommendations of the Tea Research Institute but had not followed those recommendations in practice. Therefore, it was seen that these tea smallholders did not get the required yield per unit area. It has also affected their economy. Accordingly, since the recommendations of the Tea Research Institute of Sri Lanka are passed on to tea smallholders through those tea inspector/extension officers of the Tea Small Holding Development Authority, persuading tea small holders to follow the recommendations of those services in practice is a successful solution. Tea grows well within an air temperature.

Keywords : *tea small holders, recommendation adoption, price, yield*
Supervisor : Dr. S. Thrikawala
Affiliation : The Open University of Sri Lanka

Abstract No: AE008

Production and marketing constraints faced by Betel leaf (Piper betel L) farmers in Kurunegala district

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Betel is a minor export crop which was popular among smallholder farmers in the Kurunegala district. However, many farmers have experienced production and marketing constraints which challenge the continuation of betel production for their livelihood. This research, therefore, intended to assess such constraints using a five-point Likert scale. A survey was conducted to gather primary data from 120 farmers in three DS divisions namely Kuliyapitiya west, Narammala, and Pannala in the Kurunegala District. Mostly felt constraints according to the analysis are high price fluctuations as indicated by 94.2 % of respondents, lack of government support (91.6%), absence of a new export market (87.5%) and involvement of middlemen (85.8%), all of which are marketing constraints. Non-availability of sound extension service (82.5%) High input cost (73.4%), poor access to credit facilities (70.9%), shortage of land (70%), high level of disease occurrence (68.11%) are constraints affecting Betel leaf production, while absence of a Farmer Association (45%) is an overall constraint that decrease the bargaining power of the farmers.

Marketing constraints have been given emphasis by growers in comparison to production constraints. Addressing these issues will contribute towards export earnings since 33% of growers are targeting the export market while another 52.5% produce Betel for both export and local markets. Pakistan has been the main buyer for many years and comparatively higher price fluctuation was witnessed in betel marketing due to the involvement of middlemen. Despite the economic contribution of Betel as a minor export crop, government patronage received by growers is minimal. Safeguarding the growers by controlling the high price fluctuations and involvement of middlemen by establishing a sound marketing system is, therefore, the main recommendation of this study.

Keywords : *betel, middlemen, market, constraints, price fluctuation*
Supervisor : Dr. H. M. U. N. Herath
Affiliation : The Open University of Sri Lanka

Abstract No: AE009

Tea factory firewood ash as a potential plant nutrient source for mature tea in Matara district of Sri Lanka

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Tea industry has waste products such as refuse tea coming from made tea production while ash coming from firewood. There are 705 tea factories located island wide, nearly 35,250 kg of wood ash is being produced every day as approximately 50 kg of wood ash is being produced in a tea factory for a day. Lack of information on wood ash, composition as well as the plant nutrient value of wood ash, have led the application of wood ash to tea plantation is limited. Therefore, the main objective of this study is to investigate on suitability of tea factory wood ash as a plant nutrient source for mature tea. The experiment started in the Field number 1B, Mervillian Division, Kiruwanaganga Estate at Deniyaya in Matara district. The different rates of wood ash (1000, 2000 kg ha-1 year-1) and refuse tea with or compost were compared with current fertilizer mixture, VPLC 880. Ten experimental plots were marked out for 4 treatments and controlled by current recommended mixture with 200 bushes per each plot. Two replicates for each treatment. The soil pH values measured with distilled water varied significantly among treatments. The higher pH values can be seen in the plots treated with wood ash compared with inorganic mixture applied plots. Soil available phosphorous content did not vary significantly with treatments. Soil available potassium varies significantly among treatments. The concentration of the soil potassium in wood ash applied pots with compost significantly differs with other treatments especially with inorganic mixture applied plots. Soil available Mg varies significantly among treatments. The concentrations of the soil Mg in wood ash applied pots at 1000kg/ha/yr with either compost or refuse tea significantly differ with other treatments especially with inorganic mixture applied plots. Soil available Ca varies significantly among treatments. The concentration of the soil Ca in wood ash applied pots at 1000kg/ha/yr. with either refuse tea significantly differs with other treatments especially with inorganic mixture applied plots. No significant difference in organic carbon content was observed among treatments. The CEC of the soil in wood ash applied pots at refuse tea significantly differ with other treatments especially with inorganic mixture applied plots. Significant difference in N, P and K content in the mother leaves were observed among treatments. Highest value was observed in wood ash applied pots at refuse tea at 1000kg/ha/yr. Wood ash applied plots showed comparable yield with present TRI fertilizer recommendation. The highest made tea yield was obtained in wood ash applied at 1000kg/ha/yr. with refuse tea plots. Therefore, tea plantations could use wood ash with refuse tea to produce highest yield of made tea.

Keywords : *tea, nutrient, soil, wood ash, refuse tea*
Supervisor : Prof. C. S. De. Silva
Affiliation : The Open University of Sri Lanka

Abstract No: AE010

Assessment of soil properties and yield under diverse rice-based cropping systems in Alfisols

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The typical conventional agriculture systems characterize Sri Lankan agriculture likely descends from the green revolution. Rice (Oryza sativa L.) and Maize (Zea mays L.) are major crops grown in Sri Lanka for decades. All major crops depend on chemical inputs for higher yield. Prolonged use of chemical inputs without proper control creates adverse impacts on soil health. Our main objective was to compare the final grain yield of rice and maize between conventional, reduced and organic systems with great attention to soil fertility dynamics within its' first transition year. The experiment was carried out at the Faculty of Agriculture, Rajarata University of Sri Lanka during Yala season 2019. Soil samples were analysed for chemical, biological and physical properties. The final grain yield and yield parameters of two crops were collected. The MIXED effect ANOVA model was used to distinguish treatment effects. With time stages, soil pH, ammonium nitrogen, nitrate nitrogen, available phosphorous, microbial biomass carbon, and C:N ratio fluctuation among different input systems were significant ($p<0.05$). Nitrate nitrogen and available phosphorous reveals significant increasement within organic input system from first transition year. Conventional (100% DOA) and reduced (50% DOA + 50% organic manure) input systems produced similar final yields with rice crop. The results suggest a potential to replace inorganic chemical fertilizers by 50 % under submerge conditions with organic manure without much impact on the yield and while reducing cost on commercial fertilizers. Maize did not produce expected yield with both organic and reduced input systems. Lower nutrient availability at critical growth stages of maize may have influenced the crop growth and yield in first transition year. Overall, long term investigations are crucial to confirm soil fertility dynamics and final grain yields of rice and maize crops within its' transition period.

Keywords : *grain yield, input systems, maize, rice, soil fertility*
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Abstract No: AE011

Determining response to nitrogen of promising rice line (O*ryza sativa* L.) in the low country wet zone of Sri Lanka

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A field experiment was conducted during the *Maha* season from August 2019 to May 2020 at Regional Rice Research and Development Centre, Bombuwala, Sri Lanka to investigate nitrogen response of promising rice line of Bw 12-574 compared at growth and flowering stages of that recommended rice variety (Ld 368). Growth parameters and yield components of both treatments were compared under five different nitrogen levels i.e., 0, 50, 100, 150, and 200% recommended by the Department of Agriculture. The experimental design was a Randomized Complete Block Design with three replicates. Two varieties were tested under 5 nitrogen levels. Data were analysed by analysis variance (ANOVA) and mean separation procedure by LSD using appropriate SAS procedures. Plant height, number of productive tillers, panicle length, leaf colour intensity, and chlorophyll content of leaves in both Bw 12-574 and Ld 368 showed an increasing trend against added nitrogen. The higher nitrogen dosages were influencing the increase of flowering days. The yield parameters including length of panicle and number of grains per panicle have shown significant differences (p=0.05) between the tested line and recommended variety. However, no significant difference was observed between the tested line and recommended variety with respect to filled grain percentage and grain yield. Hence, the response to nitrogen of Bw 12 – 574 was found to be like the recommended variety, Ld 368. The study concludes that the same nitrogen recommendation applied for Ld 368 would be recommended for promising rice line Bw 12-574. However, further investigations are needed to confirm the findings.

Keywords : *fertilizer, nitrogen response, parameters, paddy yield, rice*
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Abstract No: AE012

Management of Okra Mosaic virus and its vector: Okra Leaf Hoppers (*Empoasca Devastans*) through plant extracts

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Okra mosaic virus disease (OkMV) is a major biotic constraint on okra (*Abelmoschus esculentus*) cultivation in Sri Lanka. Diseased plants show characteristic symptoms of mosaic and vein yellowing on leaves and small and yellowish green fruits. Yield loss due to this virus is quite high, up to 80-94 percent is reported under heavy infection. Effective and efficient control of the pest can be done using chemicals, but it is hazardous for the environment due to their toxicity. There is a need to search for alternative approaches without toxicity problems that are eco-friendly and not capital intensive. Plant metabolites and plant-based pesticides appear to be one of the better alternatives as they are known to have minimal environmental impact and danger in contrast to the synthetic pesticides. This experiment was conducted for the management of Okra mosaic virus through the Okra leaf hoppers (*Empoasca devastans*) control. There were 5 treatments used in the experiment to study the impact of these treatments on vegetative and yield parameters of okra (variety Haritha) in the farmer's field in Mullaithivu. The treatments were synthetic insecticide (Thiamethoxam) and three different plant extracts neem (*Azadiracta indica*) seeds, garlic (*Allium sativum*) bulbs and Ginger rhizome extracts. Highest rate incidence of okra mosaic virus was found in the plots with no plant extract management. Though all the plant extracts produced better performance than the chemical, neem seeds extract treated plants had the lowest rate of incidence of this virus, with maximum plant height, fruit length, fruits diameter and highest yield. According to present findings neem seeds extract showed promising results in minimizing Okra mosaic virus.

Keywords : *okra, plant extract, mosaic virus, vector*
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Abstract No: CE001

Variation of dissolved phosphate in horizontal flow constructed wetland treatment unit

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During the operation of the laboratory wastewater horizontal flow constructed wetland treatment system with filter medias such as clay, biochar, and Calicut tile, unforeseen dissolved phosphate variation is observed in the treatment unit. Calicut tile, clay, wastewater, and biochar samples were individually checked for dissolved phosphate test and found that dissolved phosphate variation is due to the filter media of biochar. Cinnamon biochar is the by product of gasification process at 700°C is used in the treatment unit as a filter media. Even though, Feedstock type, heat treatment temperature, pH, operating temperature of treatment unit, co-existing ions are the key parameters of dissolved phosphate variation in treatment unit, pH variation with time at temperature of 29°C is considered in this study. Cinnamon biochar's dissolved phosphate variation with time was studied for 2880 minutes under acidic, alkaline, and neutral conditions. Released amount of phosphate from biochar was higher at first 240minute at acidic (pH=4.5) and neutral(pH=7) condition. But alkaline (pH=8.5) sample expresses gradual increase in release of phosphate until 2000minutes time and then constant release was observed. Having said that, this study expresses phosphate release was most intense in alkaline condition, most favourable on acidic condition and least favourable on neutral condition. This may be due to the co-existing ions presence in biochar such as Mn, Ti, Fe, K & presence of heavy metals in the wastewater. Cinnamon Biochar's X-Ray Fluorescence (XRF) elemental analysis expresses the average of 86% of K, 2.5% of Fe, 0.85% of Ti, 0.6% of Mn available in the cinnamon biochar gasified at 700°C. Form the results obtained, running the horizontal flow constructed wetland treatment system at neutral condition plays a major role in reducing the release of P from biochar and provide the effluent with less phosphate.

Keywords : *Dissolved Phosphate, Biochar, Constructed Wetland.*
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Abstract No: CE002

Investigation of properties of Ultra High-Performance concrete and development of UHPC waffle deck panels for pedestrian bridges

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As a developing country Sri Lanka is in the requirement of constructing bridges and high-rise structures under infrastructure development projects based on the country need or on behalf of structurally unstable old structures. Therefore, new technologies are useful to improve the construction efficiency while using precast items which can achieve required performance with improved durability.
Accordingly, the full depth Ultra High-Performance Concrete (UHPC) waffle panels (3m long, 2m wide and 0.2m thick) are introduced as a possible alternative to construction industry. The usage of UHPC is highly limited in Sri Lanka and UHPC waffle deck panels are not available in Sri Lanka as a precast item for bridge construction. Then this study is focusing on development of UHPC waffle deck panels using locally available materials. Accordingly, number of trials were performed to find out a suitable mix proportion for UHPC with compressive strength ≥ 150 MPa at 28 days. Therefore, cubes (75mm×75mm×75mm) were cast based on different mix designs and specimens were tested for compressive strength at 01-day, 07-day, 28 day and 56 day. Then other properties of the selected UHPC mixture were investigated through testing flexural strength, tensile strength, water absorption, permeability, thermal expansion, and drying shrinkage after completion of 28 days for cast specimens. Finally, a representative sample of the waffle deck panel was tested for panel service test and ultimate load test. As per the properties of UHPC and load test results of designed waffle deck panel, this development is recommended to pedestrian and light vehicle bridges.

Keywords : *Ultra High-Performance Concrete (UHPC)*
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Abstract No: CE003

Interaction between precipitation and recharge mechanisms, seasonal variation of water quality in Kala Oya basin, Sri Lanka

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In Sri Lanka, The Kala Oya is one of the most important river basins situated in dry zone. Because of majority of farmers and civilians depend their corps, domestic needs based on this river basin. This extensive extraction of groundwater during the dry season has resulted some of the negative effects such as groundwater depletion, drying up of wells, reduction of water in streams and lakes and deterioration of water quality. The environmental isotopes can utilize to understanding the recharge mechanisms of groundwater and evaporation effect of surface water. In this study, the water quality index was introduced to the easiest interpretation and get overall description of the quality of water bodies for different purposes. The sampling points were properly distributed to include 20 surface water, 14 shallow groundwater and 14 deep groundwater sources in the Kala Oya Basin. Sampling sessions were conducted in 2019 to cover up wet and dry seasons. From this study, there are three possible groundwater recharge mechanisms were identified.

Depleted isotopes in the upper part of the basin indicated direct recharge into deep groundwater by higher elevation precipitation experiencing in both seasons. Intermediate isotope values in the mid basin indicated the possible recharge through mixing surface water and significant direct local precipitation inputs. The enriched deep groundwater in the lower basin indicated the limited direct precipitation recharge and significant surface water recharge (evaporated water). The study highlights water quality of the basin during dry. The results were visualized using GIS maps to simplify for general public that those who do not have specific scientific knowledge. Above findings would be a help to better management of precipitation and groundwater around the Kala Oya basin.

Keywords : *Kala Oya Basin, Recharge Mechanisms, WQI, Precipitation. Isotope technology*
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Abstract No: CE004

Assess the performance of Nano clay-biochar composites for removal of hardness, fluoride and selected heavy metals from groundwater

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Removal of harmful contaminates from drinking water is of the most important for human life. In this study, potential of nano clay-biochar composite for the removal of selected contaminants were tested. The biochar was obtained from the pyrolysis of cinnamon wood. Obtained biochar sample was subjected to Carbon Hydrogen Nitrogen (CHN) to determine the elemental concentrations and X-ray Fluorescence (XRF) to identify the chemical composition. Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), Thermal Gravimetric Analysis (TGA) were performed to identify the presence of MMT in the clay sample collected from Murukkan in Mannar, and SEM was carried out to identify the morphology structure of both MMT and biochar. After verifying the presence of MMT, nano clay was extracted using combinational method of sedimentation and centrifuging. Finally, the resultant was subjected to XRD and particle size analysis to verify the presence of MMT within the nano range. After the characterization of raw materials, adsorbents were prepared considering the mixing ratios of clay-biochar as 1:1, 1:2 and 1:3 to determine the potential ratio for nano clay-biochar adsorbent. The adsorption capacity of the adsorbents was determined through the Isotherm and Kinetic studies. The Isotherm behaviour was investigated using the Langmuir, Freundlich, Temkin and Dubinin-Radushkevich models and the data of all the adsorbents were well fitted to the Temkin model. The Kinetic adsorption behaviour was investigated using Pseudo first order and Pseudo second order models and the data mostly correlated with the Pseudo first order model. Among all adsorbents, the 1:1 clay-biochar composite showed higher adsorption capacity for the selected contaminants. Therefore, the nano clay-biochar composite was prepared using 1:1 ratio and then removal efficiency was determined. The removal percentage was 56% for fluoride, 24.82% for hardness, 44.17% for arsenic and 55% for cadmium onto nano clay-biochar composite. Thus, 1:1 nano clay-biochar composite could be used as effective adsorbent to remove contaminants from groundwater.

Keywords : *montmorillonite clay, biochar, clay-biochar composite, adsorption, nano clay-biochar composite*
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Abstract No: CE005

Conceptualization of water quality based on hydro geochemistry and surface water– groundwater interaction in deep confined aquifer at Wanathawilluwa, Sri Lanka

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The current study is about hydro geochemistry and the interaction of surface water – groundwater in identified area on deep confined aquifer in North-western province. Communities in this area use both groundwater and the surface water for domestic purposes and irrigation. But they tend to rely specially on groundwater during the dry periods as the surface water bodies in the area fails to fulfil their water requirement due to highly affected drought conditions. Hence the available quality and the availability of water in deep confined aquifer are crucial for people. The measurements of physicochemical parameters such as pH, electric conductivity, salinity, total dissolved solids, chemical oxygen demand, dissolved oxygen, turbidity, nitrate nitrogen, phosphate, and stable isotopes ($\delta^{2}H$ and $\delta^{18}O$) measured at twenty-one different locations along the Wanathawilluwa deep confined aquifer for pre monsoon and the post monsoon of the year 2019. Isotope technique was used to identify the origin of groundwater and the interrelations between surface water and groundwater of this aquifer. It showed that the extreme evaporation conditions during the mid of pre-monsoon in August and during the North-eastern monsoon, surface water immediately recharged with precipitation and from the results, the deep confined aquifer at Wanathawilluwa can be recharged by higher elevation source during the North-eastern monsoon. Water quality is directly related to the physical, chemical, biological and radioactive properties of water. The properties of this water are affected by the pollution of water due to various human activities. It is therefore essential to assess the quality of groundwater. Therefore, an attempt has been made to develop water quality index (WQI), using seven water quality parameters for the weighted arithmetic method. From the calculated WQI values, it has showed that the groundwater in Wanathawilluwa area is suitable to use than the surface water in the area.

Keywords : *deep confined aquifer, groundwater, surface water, WQI, stable isotopes*
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Abstract No: CE006

Study the workability and compressive strength behaviour of G35A concrete based on the impact of fines content variation of M-Sand

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In Sri Lanka, G35A concrete is being used for most of the water retaining structures and as the other construction work, the use of Manufacture sand has been one significant solution to the scarcity of river sand. Where in most cases alternative solution would deliver either equal or lesser performance based on the original.

Availability of the fines, their percentage based on weight is one significant area where engineers need to focus on selecting an alternative source for fine aggregate and deciding the replacement percentage. This study investigates the impact of fines percentage variation on the Workability and compressive strength of G35A concrete. The Collected samples have been tested for their properties to identify the variations in supplies. Then the Workability and Compressive Strength of concrete have been tested by varying the percentage of the fine based on the size of particles and the replacement percentage based on mass. It has been identified that the Workability and Compressive Strength of concrete reduced with the increase in fineness percentage.

The fine aggregate content was replaced by Manufacture sand with 30%, 40%, 50%, and 70%. For each partial replacement percentage, another five trials were prepared by varying the 150µm passing percentage from 5-25% with 5% intervals. Workability was tested using the slump test and Compressive strength was tested for 7, 14, and 28 days. The results were compared with the Waterboard requirement for G35A concrete performance and guidance was prepared concerning the fine content variation.

The results showed that the compressive strength always satisfied the Grade 35 requirements for all the variations in Manufacture sand. But to maintain the workability within the requirements, it is recommended to control the fine content variations related to 150µm passing percentage to a maximum of 15%. Especially in the case of a higher degree of partial replacement as 70%.

Keywords : *manufacture sand, concrete, fines percentage, G35A, workability, compressive strength*
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Abstract No: ECE001

Investigation of wind power penetration potential for Sri Lanka power system

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During the last few decades, the world has focused on harnessing renewable energy, owing to the increased fossil fuel consumption and the depletion rate of conventional energy reserves. When compared with other renewable energy sources, wind energy is relatively cheap due to its availability and free accessibility. In Sri Lanka, the island consists of abundant wind power potential in some clusters, though they are not being used in a prospective manner in electricity generation. The wind plants are lacking the characteristics of synchronous machines owing to wind intermittency, and less or even no inertia. As such, wind intermittency has become a governing factor in power system control and frequency stability. Therefore, it is necessary to find the maximum wind penetration level that can be absorbed by a power system, not only for smooth operation but also for future planning and issuance of licenses for the potential investors in this field. In this research paper, a novel method is presented to determine maximum wind penetration level using wind ramp to assure a reliable power supply. In here, modelling of the wind ramp representing its intermittency is the key factor. To determine the appropriate wind penetration level, frequency stability along with related transient stability studies are carried out to ascertain stable operation of the Sri Lanka power system. Prior to the determination of wind penetration levels, the system model of the central power system is validated to ensure the reliability of results. All the required power system simulations are carried out using the PSS®E software assuming 5% spinning reserve and 9MW per minute wind ramp. The study revealed that the wind power penetration levels for Sri Lanka power system are 300MW and 540MW at base load level, 540MW and660MW at night peak load level in 2021 and 2025 respectively.

Keywords : *wind power penetration, wind ramp*
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Abstract No: ECE002

Improved passive Auto-Focusing using focus value patterns

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Autofocusing is an essential feature in modern imaging devices such as digital single-lens reflex cameras (DSLRs), telescopes, and microscopes, where gradient analysis-based passive autofocusing is very popular due to its simplicity and efficiency trade-off. However, the existing colour information-based gradient analysis techniques do not harness all the available information in an image over multiple colour domains and multiple interpixel distance values considered in gradient calculation. This research proposed a high precision, fast autofocus (AF) algorithm that encompasses three improvements to harness this additional information. Also, this auto-focus algorithm presents an efficient real-time search procedure that combines a gradient curve-based prediction model and a Gaussian type equation-based curve fitting method to find the best-focused lens position. The most important feature is that this proposed AF algorithm can be used to obtain focused images in good lighting conditions as well as in low light conditions. I have proposed a pre-processing step based on image enhancement before calculating the focus value (FV) to overcome the shortcomings of auto-focusing under low light conditions. Here, a new methodology has been developed based on the three basic colour information. First, the image is enhanced locally, and the output is again processed by the global enhancement method, giving a properly enhanced image without losing image brightness in this process. Next, a process was performed that combined the two popular methods of histogram equalization and contrast-stretching. The proposed algorithm proved to be more effective when tested under low light conditions. Finally, the auto-focus algorithm improved under this research was simulated by MATLAB. Furthermore, the results obtained from MATLAB verify the accuracy and speed of the algorithm. Experimental results obtained using an actual digital camera were used to verify the effectiveness of the proposed algorithm.

Keywords : *auto-focus, gradient curve, gaussian, low light conditions*
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Abstract No: ECE003

Optimum solution for connecting Broadlands's power plant to the national grid

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This report represents the outcome of the optimum solution for connecting Broadlands's hydropower plant to the national grid of Sri Lanka. The Broadlands power station will be the last large-scale hydropower development in the Laxapana complex cascade and as of now, most of its civil works are completed and electro-mechanical and hydro-mechanical works are approaching peak schedules. Generated power and energy at Broadlands required connecting to the national grid with high reliability in timely manner. At the beginning, a comprehensive literature review was carried out. The report identified seven suitable alternations for connecting the power plant to the national grid and at the end designated the foremost appropriate alternation among those options. This has been decided based on key parameters of a technical analysis, a comprehensive financial analysis, and a general environmental impact analysis. Finally, a suitable protection system for the selected alternation has been proposed. The data presented in the report mainly collected from referring the correspondence of the project, relevant branches of CEB, and consulting similar research studies. All the required power system simulations were carried out using the PSS®E software. The study unconcealed that the foremost appropriate affiliation methodology out of the seven alternatives is the connection of Broadland power plant to the existing Maliboda-Seethawaka 132kV overhead transmission line with an in-and-out arrangement.

Keywords : *Hydro power, Optimum system integration, Transmission network, Transmission interconnections*
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Abstract No: ECE004

Reviewing the excitation transformer protection scheme and generator bus bar arrangement of Lak Vijaya power station

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Lak Vijaya power station is the largest power plant in Sri Lanka which is very important to the reliability of power system. Any catastrophic damage due to design errors or protection malfunction cannot be allowed in this power plant associated with critical equipment under any circumstances. Owing to high MVA rating of the machine and to avoid installing a synchronizing breaker with ultra-high current capacity, there is no 20 kV circuit breaker installed in the generator side and unit transformer and therefore 220 kV main breaker connecting the grid is utilized for synchronizing and for all downstream protection. This design feature requests very high protection coordination and correct equipment sizing. Recently, one equipment sizing based problem caused damages to the excitation transformer. However, the cost of break down time exceeded the equipment cost. There was a short circuit fault occurred in the bus bar within the excitation transformer and AVR panel and flashing over occurred for considerable time. This research study is focused to find a solution to protect the generator and associated equipment's from such a fault. By analysing the fault, the fault current was calculated and confirmed that the actual fault has been occurred in the busbar region within the excitation transformer and AVR panel. The fault was simulated using Power System Computer Aided Design (PSCAD) workspace and validated with the Digital Fault Recorder graphs. Thereafter, to improve the de-excitation system of the generator, a nonlinear resistor characteristic was analysed. During the simulation study, the existing field discharging resistor value was calculated and increased subjected to the necessary technical constraints and limitations so that the field discharging time is reduced. Further it was checked whether the generator get saturated by considering the generator characteristics while increasing the discharging resistor value and verified that the dynamic inductance is within the linear region. Finally, the result was validated with the PSCAD model. Then the energy dissipation of the fault occurred region was plotted and compared for the existing condition and after the improvement.

Keywords : *catastrophic, de-excitation, discharging resistor, excitation, flashing over, synchronizing, nonlinear*
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Abstract No: ECE005

Blood Flow Stimulator and Foot Neuropathy Analyzer in Smart Shoe for Diabetic Patients

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Foot Neuropathy is a serious medical disorder and can be prevented by early detection of abnormal pressure patterns under the foot. By sending imperceptible vibration through the feet of Diabetic neuropathy (DN) patients, it can significantly improve the damaged nerves and stimulates blood flow. The methods used to diagnose diabetic neuropathy in clinics are based on performing physical examinations. The goal of this project is to design and build a low-cost foot pressure analyser and blood flow stimulator system, embedded within a smart footwear that a patient can wear at any place. Through this, the patient can monitor the foot pressure distribution and diagnose Foot Neuropathy by himself or herself as early as possible. To improve the blood flow, the smart footwear has a set of miniature vibrating motors that stimulate the blood flow which can be operated automatically or manually by the user. A prototype was developed using a set of four flexi force sensors distributed on a shoe and a PPG sensor placed at one end of the finger. Here, an Atmega328p microcontroller is used to measure the flexi force sensor outputs and transmit the information through a Bluetooth Module to a mobile application for future reference or for an analysis by a physician or a doctor. The developed prototype was tested with a sample of 50 patients in an age group of 55- 75 years with their Fasting Blood Sugar (FBS) levels. Results show that patients with high FBS values have been affected with a high foot pressure distribution. This wearable device will be beneficial to the diabetic patients for early detection of Foot Neuropathy conditions without spending costly medical investigations.

Keywords : *Diabetic Neuropathy, Flexi force sensors, Vibrating motors.*
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Abstract No: ECE006

Design a multi- protective single relay unit for induction motors

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Three-phase induction motors are widely used as electromechanical energy conversion devices. Although induction machines are considered relatively reliable and robust due to their simple design and well-developed manufacturing technologies, failures do occur and may severely disrupt industrial processes and even lead to disastrous accidents. To prevent this failure, happen, many techniques have been developed for early condition monitoring. The computer-based protection methods are costlier. The old classical methods are complex. Hence to protect an Induction motor easily, a microcontroller-based fault detection and protection of Induction motor is proposed. Aim of this project is to propose a microcontroller based multi protection relay unit against over voltage, over current, over frequency and under voltage, current and frequency of induction motor. The performance of proposed relay is investigated through CSS, MultiSim and Egal Cad software and implementation of prototype was done using DSP processor. The relay unit trips at abnormal condition of Current, voltage and frequency of induction motor. Also, fast furrier transform (FFT) based algorithm was to develop to measure electrical parameters such as frequency, voltage and current accurately.

Keywords : *multi protection relay, Fast Fourier transform, digital signal processing*
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Abstract No: ECE007

Renewable energy based micro-grid model for existing distribution network

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Over the past few decades, the global electricity demand has expeditiously increased, resulting in enormously high demand during the peak hours. Continuous growth in peak power demand raises the marginal cost of supply and lower the power system reliability. High-cost thermal power plants are conventionally used to cater the peak energy demand and as result, the electricity generation cost at peak hours is far beyond the average selling price. Consequently, the utilities tend to reduce the peak demand by shaping the demand curve and peak clipping can be identified as the widely used demand reduction technique. This research proposes a renewable energy-based grid connected micro-grid model combined with an energy storage device which is selected based on reducing marginal cost of supply from utility aspect. Mainly this research is to design an economical storage device charging and discharging algorithm for the micro-grid model by proposing a practical approach to calculate the optimal capacity of energy storage and thereby achieving the optimum benefit while shaping the demand curve. The implementation of this design was conducted by extracting the available renewable potential of selected portion in the distribution network, estimating the optimal storage device characteristics, developing the micro-grid model and an economical storage device charging and discharging algorithm. Then the proposed model was developed and validated through MATLAB Simulink platform. Through the simulation it was demonstrated that the release of stored energy in battery bank during the most peak of the demand curve to the selected portion of the distribution network can reduce the energy charge and hence be beneficial in utility perspective.

Keywords : *micro-grid, renewable energy, peak clipping, demand optimization, energy conservation, solar prominence*
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Abstract No: ECE008

Intelligent venue allocation for academic activities of Faculty of Engineering Technology of The Open University of Sri Lanka

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Venue allocation for academic activities in a university is considered a combinatorial optimization problem. Traditional exact methods are incapable of efficiently resolving the venue allocation problem. This problem has grown with many branches rather than being limited to a narrow spectrum. Capacity, various types of facilities, demand, time, and distances, when combined with diverse dynamics and real-world problems, have made venue allocation a much more complex problem. However, a university like the Open University of Sri Lanka which has many study centers throughout the country is doing this task manually regardless of its complexity. The main objectives of this study are to automate the manual process to minimize human intervention and maximize the efficiency, quality, and accuracy of the results. I identified and analyzed the factors' impact on the issue and developed a solution model. Then genetic algorithm was applied to optimize the arrangement of venue scheduling. The experimental results have obtained by the MATLAB simulation tool, and it proved that the genetic algorithm could generate feasible solutions out of a larger set of solutions and optimize the venue allocation. In addition, an internal web application called "IVAS" is developed to automate venue allocation tasks. It consists of creating timetables, requesting modifications and changes to academic activity schedules, and publishing news and notices. Furthermore, some interfaces for a proposed mobile application are designed and implemented in Android Studio.

Keywords : *combinatorial optimization problem, genetic algorithm, venue allocation, venue optimization, IVAS*
Supervisor : Mr. N. R. Premathilake
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Abstract No: ECE009

Online temporary residential facility reservation system

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We called "Open and Distance Learning (ODL)" when learning opportunities are provided to anyone, anywhere, and any time with open and flexible access. In the ODL method physical presence of students at the university every time is not essential as in a conventional university. However, for specific activities such as laboratory works, practical sessions, design classes, or examinations students must participate in person at the main campus. Therefore, the hostel facility provided in an ODL university is complicated when compared with a conventional university, because the data is volatile. Though there is a number of research conducted on developing hostel management systems no one has focused to satisfy the requirement persist in ODL method students. Therefore, we developed an "Online Temporary Residential Facility Reservation System (OTRFRS)," to manage the activities carried out in a hostel in a ODL university. The OTRFRS application was designed to reserve available rooms online directly by the students. We develop personas in requirement gathering for identified roles after studying the manual system and conducting face-to-face interviews with the hostel administration unit in a ODL university. The application was developed in PHP/MySQL coupled with HTML and JavaScript. PHP was used to connect the reservation web pages and the reservation database. The linear life cycle model (i.e., waterfall model) was used for project execution. We improved the product with the suggestions received after the User Acceptance Testing (UAT), which was conducted with the help of the hostel warden and administrative staff at ODL University. Replacement of the new system helps to reduce abandoned work done by the hostel warden, avoid redundancy, and improve student service.

Keywords : *online temporary facility reservation system, online hostel management system, distance learning, student management system, information system*

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Abstract No: ECE010

Design and implementation of governor unit for an off-grid micro hydro power plant

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At the mean time power systems with few generators and number of loads limited in a small area of a region is becoming popular. Commonly, these micro systems utilize renewable sources as the source of energy. At present electrification of the country is around 99%, but there are locations in the country the access to the grid is not economical. In such areas isolated systems are functioning to provide the required power. Usually, these are small villages with domestic loads such as lighting loads. Micro hydro generators are used to generate electricity in number of places where the availability of water is at the satisfactory level. Micro hydro generators do not have mechanism to control the frequency. This is one of the problems faced by these systems, The load variation affects the frequency. Frequency variation badly effect electrical equipment and the quality of power. The micro hydro generators do not come with governor control because of the economical constrains. Therefore, the purpose of this project is to design low-cost governor control for an existing micro hydro power plant. Several works have been already carried out to fabricate governor control for micro hydro power plants. Under this project a new governor based micro hydro power generation will be proposed to address rural electrification challenges. The project is carried out with specific reference to existing micro hydro power plant at Kithulgala.

Keywords : *Governor Control, Micro hydro power, frequency control*
Supervisors : Eng. K. M. G. Y. Sewwandi and Dr. K. A. C. Udayakumar
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Abstract No: ME001

Design and development of a tire changing machine for heavy vehicles

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At present, nearly 500,000 lorries, trucks and buses are registered in Sri Lanka. Trucks are widely used for transportation of goods around Sri Lanka. The tires in these vehicles must be removed during a service, repair or for a tire replacement. Removal and installation of the truck tires are mostly done by human effort. High force and awkward postures from manually lifting, lowering, and handling of tires in many instances are linked to Musculoskeletal Disorders in humans. These injuries can occur suddenly or gradually over time.

In this research a survey has been conducted to identify the problems faced and current methods used in changing a truck tire. It was found that, the workers face difficulties when loosening lug nuts and mounting the tire onto the wheel studs. The most affected part in the human body due to a tire changing process, is the lower back. 60% of the responders faced problems when using the current methods, in changing a tire. Levering is the most widely used method to align truck tires onto the wheel studs. To loosen and tighten the lug nuts, lug wrenches, impact guns and torque multipliers are being used. These methods have its own advantages and disadvantages.

A mechanical lifting system is designed to mount and demount a tire onto and off the wheel studs, with minimum effort. A gear system is designed to loosen the lugs nuts, without applying much effort. The system helps to overcome the awkward postures and heavy lifting involved when mounting and demounting a truck tire onto and off wheel studs. Also, the time consumed when unscrewing and screwing lugs nuts is reduced. The system is to be portable, so the drivers and mechanics will be able to change tires when they come across tire failures on the road.

Keywords : *musculoskeletal disorders, lower back, levering, mechanical lifting*
Supervisor : Mr. D. C. Wijewardena
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Abstract No: ME002

Automated protection system for houses close to HEC areas from elephants

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Human-elephant conflict (HEC) is a major growing concern in Sri Lanka in villages around rural areas. This expresses a complex interaction between humans and elephants representing a detrimental impact on both species have on each other. The Government of Sri Lanka has developed and practiced a variety of elephant management strategies at different scales for mitigating and preventing HEC with the help of DWC (Department of Wildlife Conservation), yet HEC keeps expanding as the elephant management solutions are only valid for a short period of time due to the changing of site-specific factors where these strategies are being used.

Property damages are the highest among HEC incidents. Elephants tend to damage or destroy houses in search of food mostly at night when people inside the house are asleep. The aim of this research is to provide an effective solution for the safety of humans from elephants entering their property within the HEC zone in Sri Lanka and to minimize property damage. To achieve a solution, the current situation, and solutions for HEC in Sri Lanka were identified. Effective strategies which are being used to chase away elephants were verified. The drawbacks and weaknesses of current elephant detection systems in Sri Lanka were identified.

As a solution, an automated protection system was designed and manufactured to detect the elephant presence in real-time, at the selected safety boundary (around the house) and to chase away or hold the elephants entering the safety area of the property while warning the people inside the house automatically.

Keywords : *HEC, DWC, electric fence*
Supervisor : Mr. D. C. Wijewardana
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Abstract No: ME003

Analysis of hand motion dynamics for designing a head massage soft robot

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The head massage is a deep style massage that focuses on the head, neck, and shoulders. A head massage applies a range of techniques to help reduce stress and release tension in the upper body. Massaging the scalp can help stimulate nerves and blood vessels around the area and begin to calm muscle tension around the head. A head massage can be both relaxing and an invigorating experience. Head massage gain variety of benefits to human well-being and head massage is a social need. Many head massagers available in the market, but many of them having poor structure and functions compering with professional human head massager. Also, those are not flexible according to the different users. All of them made with hard materials. We are developing a soft robotics base head massaging system to realize the dexterity of human hand according to the head massage. In order to develop such a system, it is necessary to understand the motion dynamics during head massaging using both hands. This study presents the development of a hand dynamics capture system using three orthogonally mounted cameras and FSR sensors hand glove record and analysis hand movements and pressure point of the head massager. Also construct data glove with 9-axis inertial measurement units (IMUs) to obtain static and dynamic parameters during head massage, record, and analysis hand movements. Differentiate both systems. Using above data & PPG wave, record the client stress level while doing head massage.

Keywords : *head massage, soft robotics, motion capture, FSR, IMU, PPG*
Supervisors : Prof. S. A. M. A. N. S. Senanayake and Eng. H. R. Jayetileke
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Abstract No: ME004

Conduit path inspection and mapping robot

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Blocking the conduit path due to the leakage of grout in electrical wiring constructions is a huge problem in building construction industry. It is hard to find the electrical wire drawing path after concreting work is finished. Currently there are several manually operated methods but, time consuming, high cost and in-accurate to find the path. Hence after the concrete was mixed into the slab, there is no proper method for conduit path mapping. This project aimed to introduce a new low cost, effective and accurate semi-automated system, with a robot to identify blocked areas of electrical conduits and mapping the conduit path.

It was developed a small robot moving inside a tube and mapped their path and recorded the blocked area in the map. It was designed using umbrella mechanism. Robot is moving forward inside the conduit and when arrived at a blocked area or a junction box it stops. Then the draw wire attached to the back of the robot is used to draw the robot back. After studying the possible solutions for the problem, it was prepared a final design of the robot to address those problems and sensors were included so that the data from the sensors can be used to map the conduit path using the robot navigation. The system was tested on 4-inch PVC pipe with 60-degree bend. The corresponding map generated on the software was highly accurate. Also, the system was tested by inserting an obstacle inside the PVC pipe and the system was able to identify the object position accurately. The map generated on the robot path was highly accurate on the tested conditions.

In this robotic process, pass the input data, which was taken from the sensors to client computer through the Node MCU to draw the map by using software. According to the results, it marks the moving path by data, which was taken from the input in mapping interface. Further, Robot can be identified the obstacles as well as how far it locates from the junction box. Finally, this project can be promoted for limiting the wastage of time and manpower in electrical conduit at building construction industries.

Keyword : *conduit, electrical, mapping, PVC pipe, robot*
Supervisor : Eng. J. H. S. K. Jayamaha
Affiliation : The Open University of Sri Lanka

Abstract No: ME005

Development of a methodology for the reduction of the vibration of radial gates

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Radial gates are used to control the upstream and downstream water flow in water canals and in spills of reservoirs. The designs are carried out using conventional design codes and with the relevant engineer's experience. But when the requirement goes beyond these limits, the usefulness of these codes is very little, hence there is no proper method to reduce or avoid the vibrational conditions when the gates are in operation.

The main task of this project is to reduce the vibration condition of radial gates which are in operational conditions. This project was carried out based on the dimensions of the Daduruoya radial gates. A simulation model and a physical scaled down model of 1:25 scale was created based on these dimensions. Initially a simulation model was built, and the static conditions of the radial gates were analysed. After that a scaled down physical model of the radial gates were constructed and immersed as a gate for an open flow channel to find the vibrations at each height level with known flow conditions.

This study proposes a method for mitigating the flow-induced vibration of a radial gate to ensure operational safety and long-term stability. The effect on the vibration reduction is investigated by using a fluid–structure interaction (FSI) analysis. The gate was modelled using a Finite-element method (FEM) and was partially submerged in water. Then the model was validated by comparing numerical responses of the gate with experimental results under the conditions of steady-state discharge. The results of this study can be used to inform the design and development of radial gates, as well as maintenance plans for their economical operation.

Keywords : *radial gates, flow-induced, fluid–structure interaction, finite-element method*
Supervisor : Eng. J.H.S.K. Jayamaha
Affiliation : The Open University of Sri Lanka

Abstract No: ME006

Semi-Automated loading machine for sausage packaging process at the Pussalla sausage factory

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The Pussalla sausage factory is one of the leading sausage producers in Sri Lanka. They wanted to implement an affordable customized automation process to reduce labour involvement for their sausage packaging process. The factory produces around 6 tons of sausages per day, but they cannot afford readily available automated machinery in the market which fit larger scale productions like100 tons per day. The objective of this project was to minimize the involvement of labour and improve the overall product quality and efficiency of the packaging process at Pussalla sausage factory. Initially a survey was carried out related to the labour working efficiency and carefully studied the factory monthly production records to identify monthly average production and labour hours of each type of sausage product. A literature review was carried out to find the importance of addressing the problem and to collect the required data for the calculations. A feed conveyor was designed to collect peeled sausage from the peeler machine and feed it to the main conveyor of the system. The main conveyor is a bucket type conveyor which is conveyed separately to the sausage pusher. The sausage pusher is an arm which is used to load sausage into the package. In this design, food-grade type 304 stainless steel was selected for all the structural design and other metal parts to be fabricated. Food-grade polyurethane has been selected as the material for conveyor belts. In implementation of the design, scaled prototype machine was designed. The machine was able to achieve target time per one cycle. It was taken average 06 second to complete one cycle since the 8.72 second was the calculated target time.

Keywords : *sausage, automation, packaging, conveyor*
Supervisor : Eng. J. H. S. K. Jayamaha
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Abstract No: ME007

Mechanizing an existing scissor jack to lift automobile vehicles

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Side road emergencies such as tire punchers, is a problem commonly observed in Automobile vehicles. Conventional vehicle jacks have mechanical advantages to allow a human to lift a vehicle by manual force. Scissor jacks available at the market have some disadvantages such as requiring more energy to operate, not convenient for women. It also cannot be used on uneven surfaces. After mechanization of the current scissor jack, it was able used to lift a vehicle by using an electrical DC motor to make load lifting easier for emergency use with the help of a vehicle battery of 12 Volt. This mechanized scissor jack can be operated by remote. This remote makes an android phone application. The significance of this work is to modify the existing scissor jack to make the operation easier, safer and more reliable in order to save energy. It also reduces health risks especially back pain problems associated with doing work in a bent or squatting position for a long period of time. After mechanizing the car jack, it was tested on cars. This naval design will solve problems associated with ergonomics. It was designed to lift and support under 1.5ton load, for typical use in four wheelers.

Keywords : *mechanization, scissor- jack, android, vehicle*
Supervisor : Eng. J. H. S. K. Jayamaha
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Abstract No: ME008

Design and implementation of a mechanism to improve the Jingwei cardboard cutter plotting process

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Pattern designing is one of the key operations in the garment industry. Pattern designer is the very first person who gets details and requirements from the customer. According to the customer instructions and measurements designer prepare the patterns using CAD designing software. Then the designer wants to get a hard copy of those patterns for fabric cutting check measurements and pre preparation meetings. In Sri Lanka most of the sample rooms are using Jingwei EDO 1873 cardboard cutting machines.
It has few major problems which are directly affected by the user efficiency. First one is its interface can install in only one PC as it has given only one license key. Due to that, from time-to-time users come to the interface PC for plotting their patterns. Second problem was that there is no pattern piece collecting mechanism. Due to this, the designer needs to wait at the machine until the plotting process is over. The third problem is that there is no cardboard advancing mechanism. Due to that designer should advance the cardboard up to its origin point before plot patterns by hand. To overcome above difficulties, it was implemented a remote plotting method which has tower light indicator by using Ardiuno Uno and Bluetooth module. Then cardboard advancing and piece collecting mechanisms were designed which has cardboard roll stand, DC warm and gear motor, drive and driven wheels for rewinding shaft and a limit switch. The Proteus software was used to simulate, while solid works software was used to design mechanical parts of the machine.

Keywords : *pattern, interface, plotting, cardboard*
Supervisor : Eng. J. H. S. K. Jayamaha
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Abstract No: TE001

Derma-Safe Bohemian casual wear collection for 2021/22 Spring & Summer

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"Bohemianism" is a lifestyle which stands with free spirits that away from conventional lifestyle and totally engaged with freestyle living contrast to the life that disguising feelings and personality that fit into the present living. Therefore, this project is focused to design a women's casual wear fashion collection with the concept of "Derma-Safe Bohemian" inspired by Eucalyptus Tree bark", set into the spring and summer fashion trend in 2021/22. Working women in the Colombo, Sri Lanka, around 25 to 40 years were selected as the target market. The customer requirement was analysed using online survey done via google forms shared around the emails and the social media. The sample size of the survey is limited up to near 100. Whereas the survey signified that the most women were uneasy at showing their skin problems in public due to unmatching fabric materials with the climate and they are more likely to buy organic products. Consequently, providing a skin comfort clothing can reduce the skin issues that are caused by the toxic environment. Bohemian style emphasizes finding the clothing that makes harmony with the nature and that idea practiced throughout the collection. Based on the customer requirement, this fashion collection was focused on providing a non-toxic, non-itchy and comfortable clothing which covers the affected body parts of the people who are with skin issues. This collection is used G.O.T.S 100% pure organic cotton fabrics and herbal dyes. Fabric manipulation techniques, Boro embroidery and herbal dyeing techniques are used to enhance the fashion collection in detail.

Since the organic and nature loving becoming a trend in the world newly designed casual wear collection shows highlights in comfortability, non-toxic, simplicity and elegant looking that achieving practical requirements of the niche market.

Keywords : *boho, casual wear, organic, GOTS cotton, herbal dyeing, natural dyeing process*
Supervisors : Ms. M. A. H. S. Hansadhi and D. S. Wijerathne
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Abstract No: TE002

High – Tech active wear collection for adventure travellers

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The "Active Sportswear" is used for clothing that specifically worn for sports activities. The theme of the fashion collection is “Stylish comfy active for hiking women” that to be launched to the US market to hikers in age between 25-29, that set into the fashion trend 2019/20. Since there was no proper existing active wear fashion collection for ladies in hiking purpose in USA fashion market considering the real customer requirement, this new collection was designed to cater majority of customer requirement through analysing the customer survey. Specially this collection focus to give support for hiking activities, adventure travelling with self-generating energy through setting removable solar power panels that able to charge electronic devices such as smartphones or tablets. The testing’s were proved that the applied set of energy storage devices for this fashion collection were able to charge a smartphone approximately up to 50%.

The conceptual approach for this collection is “Abrupt Curious” and the inspiration is the “Hiking shoes” designed by Stella McCartney under the Adidas brand for USA market in 2019. Customer requirements for fashion design purposes were achieved by using the strappy cutting, laser cutting, bonding, and printing techniques. Heat transferring methods and PAD printing techniques also used to enhance the collection with considering designing and practical aspects. Solar power technology was incorporated with the design and has used the separate and removable panel method to enhance the customer comfortability.

Accordingly, active wear women fashion collection is come out with comfortable, multifunctional purposes that enriched with unique design features to achieve high fashion market in active wear fashion category in USA.

Keywords : *hiking wear, self-generating energy, reflective, solar power system, multifunctional, sportswear*
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Abstract No: TE003

Spontaneous Soul – A modest fashion collection to navigate dire circumstances in a positive light and feel the power of optimism

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Despite abundant supply of fashion garments there is an essential need to cater the growing, relatively untapped Muslim fashion market that is sought after even by women of other cultures who believe fashion is not all about revealing skin while using fashion as a tool to address barred health issues faced by women. Even in modern society, many are reluctant to discuss about breast cancer attributable to its generally known fatal nature. Therefore, to approach the issue by means of fashion, a Modest Luxury Resort Wear collection inspired by Breast cancer cells for the UK fashion market targeting young female Gulf tourists of age 20 to 30 years is designed. Based on the research, Gulf tourists to the UK during summer is selected as the niche market. The fashion collection is focused to cater the expanding modest fashion market and to see the silver lining. The customer survey is done using secondary data analysis by the Chalhoub Group, Dubai. The customer segment is identified as Travel Gazelle, with highlighted features of unquenched interest for impeccable quality fashion products and using luxury fashion as a form of self-expression. Strong conceptual approach is built considering emotional needs of breast cancer victims while emphasizing the need of retaining positive view when feeling hopeless. Moreover, to meet the quintessential exclusivity expected by the customer group, intricate manual embellishment, and hand painting techniques along with creative 3-dimentional fabric manipulation are used to resemble enthralling appearance and invasive nature of breast cancer cells. Furthermore, all components of this Modest Luxury Resort Wear collection are designed to act the part of a strapping web so that the consumer is emotionally aligned with attire that carries within itself a promise of an immediate contribution to the sustainable fashion.

Keywords : *classic silhouettes, luxury resort wear, breast cancer, emotional bond, intricate embellishment, creative surface designing*
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Abstract No: TE004

Convertible resort wear collection for female travellers in USA

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Most travellers' visits for resorts are having major obstacles with over packing and they need more spaces in luggage to wear while travel, to visit locations. Most of resorts in USA organizing evening parties, festivals at their resorts to attract consumers and to increase the number of stay customers. So, they require additional set of clothing for several events apart from clothing for traveling purposes.

Most of female traveller's request clothing to be comfortable and stylish. As such, while the journey they must hassle with many cloth pieces. Since it's difficult to bring heavy luggage to the resorts, light packing of clothing is required that serves multiple purposes. With the concept of "Alchemize" which depicts the meaning of change from appearance or use, is bearing the ideation of one piece can be worn on several occasions in several looks within few seconds. With the techniques of convertible patterns, draping and hand lace technique this project is focused to design a convertible resort wear collection for female travellers within USA set into the fashion trend of convertible stylish resort wear fashion trend in spring and summer 2020/21.

Customer segment requirement are analysis through the world wide web and selected brand analysis "Laura Siegel" which is a designer label for luxury resort travel collections in USA. That brand is mostly ideal for youth sustainable fashion which mix with most of countries' traditional artisan craftsmanship'. The inspiration is for the fashion collection is "Transformer owl "under the species *Ptilopsis leucotis*. As the main feature, it shows ability to adapt to outer background by transforming the body and colours. Body transferring, shifting moments, feather folding and expanding moments are inspired to develop the collection in detail.

As this collection most full fill the practical aspects, the one garment can be worn in several different ways by changing the silhouette shapes and colours. They can pack one piece instead of two, three or many more. As per the applied concept of "Sustainability" which minimize the fabric wastage while serving eco-friendly duty with nature friendly light weight fabrics.

Keywords : *sustainability, fabric wastage, transformation, convertibility, draping, hand lace resort wear, travellers*
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Abstract No: TE005

Multi-functional casual travel wear collection for Non-traditional Islamic female travellers

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Fashion design is an art of the design application in an aesthetic manner to satisfy our true beauty. In the fashion world every new style or a trend begins with an idea. Cultural, Religious and Social latitudes are influenced by silhouettes, colours, and patterns in design aspects. Based on the cultural and religious latitudes in the society, Designer travel wear is like a dream for non-traditional Islamic female travellers who wish to gain authentic travel experience from exploring different destinations and cultures. age group between 25 – 35. Here is going to design a multifunctional casual wear collection for Non-traditional Islamic Female people who live around the world especially in western countries.

Customer analysis was done as a questionnaire/ online survey to identify their problems and desires. They do not have many clothing categories, but they are willing to dress fashionably as others in a modest way within their faith. They are rich Islamic females who live around the world. Introduced a fashionable travel wear collection creating a new path to explore their fashionable desires which are not dreams anymore. The conceptual approach for collection is to convert one clothing into several designs in pattern construction like one garment carrying several designs. The fashion collection was inspired by the Mosaic arts of Al Aqsa Mosque, Jerusalem and the selected customer range was non-traditional Islamic female travellers aged between 25 -35. The fashion collection was designed to meet customer requirements to reduce their luggage weight. New settings of pattern construction techniques added unique value to achieve convertible wear which gave different fresh looks in one. Through the designing process of the collection, designs are inspired by every angle, shape, colour, details and lines of the Mosaic art. The collection is enhanced by hand embroidery and detailing with machine prints. Specially, prints are created by hand illustrations. Fabric collage technique also added extra attention to the collection. This collection will be multi-functional because one garment can be converted and worn as several looks.

Keywords : *multifunctional, modesty, convertible, travel wear, pattern, mosaic prints*
Supervisors : Ms. M. A. H. S. Hansadhi and D. S. Wijerathne
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Abstract No: TE006

Minimax occasional wear collection for High-End Sri Lankan fashion market

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Women just after the twenties, experience transformations in their lives including clothing, but still concern about beauty and the body shapes, with aging & the maturity. Here is designed an occasional wear collection for Sri Lankan ladies in age 30 and above that set into the fashion trend "Minimax". The customer requirements analyzed through consumer research done with Google Survey among 100 customers through online. The conceptual approach for the collection is "Fashion product as a comfortable minimal wear with elegancy for special occasions and as setting relation to the concept Symbiosis Relationship, & Lichen is selected as the inspiration to get creative approach for the collection. The theme of the collection is "Minimax" as given sense of Minimize the maximalism an appropriate trend as it was notified as "Timeless Minimalism.''

As based on the analysis of the market research, most of the customers denoted that they do not like to expose their body shapes, also not satisfied with their body shapes due to various reasons, or believe they are out of the shape. They clearly said that there is a high gap between the available collections and real requirements. As per the information, most of the available occasion wear collections come out with similar silhouettes, material and colors as a norm but set with their satisfaction.

To achieve the target market requirements, this occasional wear collection was designed for Sri Lanka ladies in high end fashion market. Different shapes & silhouettes development techniques & embellishment techniques were used to enrich the fashion collection to give unique and elegant look to the fashion collection. Final achievements are fully matching with target market requirements in several aspects.

Keywords : *minimalism, body shape, comfortability, ageing, maximalism, occasional wear*
Supervisor : Ms. M. A. H. S. Hansadhi
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Abstract No: TE007

Live with inner peace

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According to the latest survey research, which conducted on Italy in year 2018 was proved that the young adults in age between 25-34 are most stressed-out due to their job problems, achieving expectations, and maintain the balance life. According to the research, some 40% of Italian workers say that they are so stressed by their job. While 44.8% of those between 25 and 34 would like to leave their current positions for less stressful jobs, this percentage falls to 25% for those over 55. This research is focused on to develop "Chic Street wear fashion collection" for young urban women in Italy, age between 25-30 that set into the fashion trend in 2020/21 spring and summer, inspired on "Contour line" done by Kris Trappeniers.
As based on the customer survey, the conceptual approach for the fashion collection is defined as "Relaxing meditation" and it is used to give a nourishment to their complicated minds to release their fatigue, both mentally and physically with contour line practices in the collection. Contour drawing is an artistic technique that used in the artistic sketches that is essentially work as an outline. The theme of the fashion collection is ''Chic Street wear collection" under the brand "Prada" to address the problem their daily life stress in Italy of selected customer segmentation. Designer label of Prada, appreciation for intellectualism in design and a desire to wear it in an artful fashion look. The aesthetic look of the fashion collection was highlighted with applied techniques in thread works, hand brush painting and dye techniques.

Keywords : *young adult, life balance, chic street wear, contour line, relaxing meditation, artistic sketches*
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Abstract No: TE008

"Summer Soul" women's urban street wear collection for S/S 19/20

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The story of minimize the industrial pre-consumer textile waste came up with the concept of "Summer Soul" to develop this fashion collection. With the expansion of the fashion industry the quantity of industrial pre-consumer textile waste has increased. As a design-based waste solution, "Up cycled fashion production" uses textile waste to create products with a higher retail value than traditionally recycled goods. Based on this concept, this research was focus to design "Urban Street wear fashion collection for US ladies in age between 25-35 set into the fashion trend spring and summer 2019/20 inspired on paintings of "Portrait of Emilie Floge" (1902) and "The Maiden" (1913) by the famous Austrian symbolist painter Gastav Klimt. Customer segment analysis is analysed under the 'VIKTOR & ROLF' fashion brand surveys though online. Based on that, it was proved, that fashion brand hasn't street wear line targeting Young urban women. So, that was able to consider doing the street wear collection for target costumes and these ideas I plaid in my collection as incorporating them into women Upcycling luxury urban street wear line to 'VIKTOR & ROLF' brand. As to enhance the aesthetic appeal of the fashion collection, Japanese traditional 'Boro' patchwork and 'Sashiko' hand embroidery works were studied and applied. These techniques point out the comparative uselessness of some other forms of art we admire. It also reuses materials that may otherwise end up in the landfill in creative and innovative ways.

Keywords : *pre consumer, textile waste, upcycling, Japanese artwork, urban street wear, textile industry, urban women, US premium market*
Supervisor : Miss. M. A. H. S Hansadhi
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FETSAC

Faculty of Engineering Technology Student Academic Conference (FETSAC) is an annual event organized by the Faculty of Engineering Technology of The Open University of Sri Lanka (OUSL). FETSAC first started in 2014 with the intension of assisting to create relationships between the final year undergraduate students and the co-operative communities through exposing their final project and creative intelligence.

The event mainly focuses on presenting new inventions of the undergraduate engineering students and implementing a platform to voice their skills and innovation to the industry through publishing and presenting their innovations, ideas to a sensitive audience.

Green innovation refers to any sort of innovation that contributes to the development of key products, services, or processes that help to reduce environmental harm, impact, and deterioration while also maximizing the use of natural resources. This form of innovation is becoming increasingly important in today's world. Since it directs the proper use of natural resources to increase human well-being. Furthermore, the invention and adoption of improvements in products and industrial processes may help to long-term sustainability.

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