Faculty of Engineering Technology
Student Academic Conference

Ingenious Vision. Innovative Minds.

Proceedings of 5th Faculty of Engineering Technology
Student Academic Conference

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ABSTRACTS

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Faculty of Engineering Technology Student Academic Conference 2018

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Message of the Vice Chancellor

It is with great pleasure that I convey this message of felicitation to the FETSAC – 2018, the Student Symposium of the Faculty of Engineering Technology of the Open University of Sri Lanka. Undergraduate research has been a distinctive feature of the OUSL engineering curriculum from its inception where students are required to do faculty-guided independent study. The student symposium which was launched a few years ago has now become an important calendar date of the Faculty with the students given the opportunity to present the work done by them to fellow students and the industry personnel.

An important purpose of making a presentation to an audience is to share findings and insights that result from inquiry. It allows the students to talk about the work they have done with others with similar, related and/or completely different areas of study, thus making the person more confident about the work he or she does. It also allows the presenter to get newer perspectives, as questions asked at these fora and the feedbacks received from people who have never seen the work before, would make one to think about the project from a different point of view.

Further, as this symposium is organized and conducted entirely by the student community with able guidance from a few academics, it enables the students to learn valuable co-curricular skills in organizing events, teamwork, communication skills etc. which will be of immense value in their professional career.

I take this opportunity to express my appreciation to the Organizing Committee of the Student Symposium 2018 and the staff who have contributed their time and effort to make this event a success.

I am confident that the Student Symposium 2018 would be an enriching and rewarding experience for all the presenters and participants.

Prof. S. A. Ariadurai
Vice Chancellor

Message of the Dean-Faculty of Engineering Technology

I am writing this message to the Faculty of Engineering Technology Student Academic Conference (FETSAC) 2018 with great pleasure. This event commenced in the year 2014 with the objective of improving the skills of the OUSL undergraduates that are required to make them more industry relevant, under the Quality and Innovation Grant (QIG) of the Higher Education for Twenty First Centaury (HETC) project administrated by the University Grants Commission. Due to the increased participation of a large number of students the event became a success which encouraged the Faculty to declare this an annual event.

Through this conference the Faculty has been able to proudly showcase the research projects of undergraduates to the industry. We envisage to inform the industry about the research carried out by our students under the guidance of the committed academic staff. This will strengthen the bridge spanning the University and the industry, fulfilling our long-term goal of being connected with the industry, and thereby enabling submission of real life problems to the University and solving them through our graduates. The relationship between the University and the Industry is highly important and it allows us to update the curricula and laboratories.

It is a proud moment to acknowledge that this event is fully organised by the students under the careful supervision of our academic staff. The skills developed through planning and executing an event of this scale is highly beneficial to the future careers of our undergraduates.

On behalf of the Faculty of Engineering Technology I also take this opportunity to express my gratitude to our Vice Chancellor who encouraged and gave fullest support to the conduct this event successfully. My special thanks go to the members of the Organizing Committee who provided valuable advises and guidance needed in organizing the FETSAC-2018.

I wish all the best for FETSAC-2018.

Prof.D.A.R.Dolage
Dean,
Faculty of Engineering Technology

Message of the Chairman-Organizing Committee (Academic)

It is my great pleasure to deliver this message to the proceedings of the Faculty of Engineering Technology Student Academic Conference (FETSAC) 2018 of The Open University of Sri Lanka. The theme of this year is "Ingenious Vision. Innovative Minds". This conference provides a golden opportunity for undergraduate students to present their research to academics as well as the industrial community.

I take this opportunity to extend my sincere gratitude to all the authors who submitted their abstracts to the conference and their supervisors and department coordinators for their valuable contribution.

This event is organized by the students of the Faculty of Engineering Technology. I would like to place on record that their dedication and teamwork contributed to the success of the conference. On behalf of the organizing committee of the Faculty, I would like to extend my sincere gratitude to theVice chancellor,Prof.S.A.Ariadurai, Deputy Vice chancellor,Dr. A.P Madurapperumaand Dean Faculty of Engineering Technology,Prof. D.A.R Dolage for their valuable advices, support and leadership given to us. I would also like to thank Prof. S.A.M.A.N.S. Senanayake, for conducting theworkshop for the students about writing of abstracts, and Prof. (Mrs.) B.C.L. Atapattu and Dr. M.S.T Priyadarshana for the help given to us.

We also take this opportunity to thank the staff of the OUSL press, CETMe,IT division for their valuable contribution. I would also like to thank S.M. JanakaRanjan Assistant Registrar of the Faculty of Engineering Technology and their staff for organizing this event.

Further, I would like to thank all the members of the organizing committee, both the academic staff and students for their dedication and commitment to making this event success.

L.S.A.Perera
Chairman,
Organizing Committee (Staff),
FETSAC 2018

Message of the Chairman -Organizing Committee (Students)

Contents

Abstract No: AE501

POTENTIAL OF USING RAINWATER AS A SOURCE OF DRINKING WATER IN THE ANURADHAPURA DISTRICT OF SRI LANKA

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ABSTRACT

Despite the fact that the drinking water coverage in Sri Lanka is 94%, the rest of the 6% is mostly concentrated in the rural areas. Some people in such areas consume water by purchasing it from vendors who transport water in very unsanitary plastic containers, by walking more than two km, or from rivers, streams or unprotected wells. The bimodal rainfall pattern invites the population to store water if possible, at times of rain. Rainwater harvesting in that sense is not new to Sri Lankan rural communities. However, the rainwater harvesting has been a practice of convenience rather than a system of continuous supply. The possibility of using harvested rainwater water as a source of drinking water has not been adequately studied. Thus, the aim of the study was to investigate the potential use of harvested rain water as a source of drinking water in *Anuradhapura* district. The study selected two *GramaNiladari*divisions; Madawachiya and *Kabithigollawa*, where the water scarcity causes a heavier burden among the community. The study analysed the water quality (chemical and biological) parameters such as pH, electrical conductivity, turbidity, total dissolve solids, E-coli and coliform in 10 samples from each two selected study areas. Then a survey was conducted to collect primary data to investigate the preference towards the rainwater harvesting and using rainwater as a drinking water source with 50 randomly selected households from each division. The results show rain water samples collected from both areas meet required WHO standards of chemical and biological properties of drinking water. Survey results revealed that people in both areas preferred to have rainwater harvesting system for drinking water. The people in the areas equally prefer either to boil or filter harvested rainwater before drinking. This study shows that rainwater harvesting has a good potential to overcome the drinking water scarcity problem in rural areas at least for a certain extent.

Key words: Rain Water, Water Scarcity, Drinking Water, Sensory

Supervisors
1. *Dr. S. Thrikawala.*
2. *G.V.N. Aiome*

Abstract No:AE502

YIELD RESPONSE OF RICE (*Oryzasativa L.*) TO ADDED PHOSPHOROUS AND POTASSIUM FERTILIZER IN THE DRY ZONE OF SRI LANKA

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ABSTRACT

Continuous application of Phosphorous (P) & Potassium (K) fertilizer expecting high yields may lead to accumulation of them in the soil.Continuous application of such fertilizers when rice (*Oryzasativa L.*) is not responding to them may be a waste in rice cultivation that leads to increase cost of cultivation and environmental pollution. Thus, a field experiment was carried out in the Dry Zone under irrigation conditions to study the yield response of rice to added P and K fertilizers. Two simple experiments, one with and without P fertilizer treatments for three consecutive seasons and the other, with and without K fertilizer treatments only were conducted for two consecutive seasons. Randomized Complete Block Design (RCBD) was used for both experiments but with three replications for P fertilizer trial and with two replications for P fertilizer trial. Grain yield data for P and K fertilizer trials were available over three and two consecutive seasons, respectively including that of *Yala* 2018. Data on yield components and milling quality were also recorded only in *Yala*2018. Data were analyzed separately for P and K fertilizer trials using T test for yield components and milling quality analyses and ANOVA for grain yield analysis. Grain yield significantly varied among seasons in both trials showing that the growing season has a big influence on grain yield of rice in the Dry Zone. Grain yield, yield components and milling quality did not respond to added P fertilizer so that adding P fertilizer to rice appeared to be not cost effective. Response of grain yield in rice to added K fertilizer was dependent on the grain yield level (Season). When the grain yield level was low (around 4t/ha) no yield response was observed while a significant response was observed when the grain yield level was high (around 7t/ha) to added K fertilizer. The reason maybe that the K fertilizer is needed to increase the number of spikelets / panicle at high yield levels. Thus, application of K fertilizer appeared cost effective only when the grain yield level of rice was high.

Key words: Rice (*Oryzasativa L*), Phosphorous (P) fertilizer, Potassium (K) fertilizer, Yield response, Yield components, Milling quality, Cost effectiveness

Supervisors
1. *Dr. S. Thrikawala*
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Abstract No: AE503

PROBLEMS FACED BY FARMERS WHEN ADOPTING RECOMMENDED CROP MANAGEMENT PRACTICES IN PADDY FARMING, WITH SPECIAL REFERENCE TO POLONNARUWA DISTRICT

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ABSTRACT

Polonnaruwa district is one of the largest suppliers of rice in Sri Lanka. Hundreds of farmers cultivate thousands of acres of paddy twice a year, named as Yala and Maha seasons. The government constantly try educating and training farmers on crop management practices that are beneficial for the farmers as well as for the country. The current study was aimed at identifying the social and economic characteristics that affect such farmers in adopting recommended crop management practices, and the problems faced by them in the process.

A random sample of 210 farmers covering the 7 divisional secretariats of Polonnaruwa are interviewed and given pre tested questionnaires to fill. The data gathered are analysed using SPSS. Descriptive statistics and Binomial logistic regression are used to analyse the data.

The results from Binomial regression analysis reveal that education level of farmer, obtaining credit, and the membership in farmer organizations have statistically significant relationship with adoption of HYV. Obtaining credit by farmers has a statistically significant relationship with adoption of recommended chemical fertilizer practices. The explanatory variable that has a statistically significant relationship with adoption of Soil fertility management practices is the irrigation method used. There are no explanatory variables that have a statistically significant relationship with adoption of recommended weed management practices is the annual income of farmer. The explanatory variable that has a statistically significant positive relationship with adoption of pest management practices is the satisfaction in extension services received.

Problems in obtaining credit for cultivation, lack of participation for training programs and demonstrations, problems in cultivation (pest and diseases, soil problems), lack of interest of younger generation for agriculture, high cost of agrochemicals and chemical fertilizer, the low income compared to expenses, and lack of extension officers among other problems farmers had. Several measures including credit facilities given for agricultural inputs and farm machineries, update of extension officer's practical knowledge, formal and good training for fertilizer dealers and other chemical pesticides dealers, and encouraging and training farmers for value added product to increase their income have been suggested by the author to solve such issues and improve the overall adoptions rate.

Keywords: **extension, regression, adoption, recommended, relationship, characteristics**

Supervisors
1. *Dr. S. Thrikawala*
2. *Mr.W.T.U.Perera*

Abstract No: AE504

APPLICATION OF AN ELECTRIC POTENTIAL TORETAIN SOIL NUTRIENTS AROUND THE ROOTZONE IN RICE (ORYZA SATIVA L.)USING CARBON ELECTRODES

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ABSTRACT

Nutrient leaching affects the crop production: especially in rice cultivation. It can also cause environmental pollution and affect human health. Rice is a major food crop for people around the world in general and Asians in particular. Nearly 90% of the world's rice is produced and consumed in Asian region. Rice cultivation is greatly affected by nutrient leaching as retention of plants nutrients in waterlogged rice cultivation is a challenging task. According to the studies nutrient leaching is greater when soils are fully saturated with water. Inthis study, the effect of applying an electric potential was evaluated aiming to retain soil nutrients around the root zone. For that, effect of electric potential on soil properties, growth and yield of rice were investigated in a lowland rice soil with a rice variety (BG250). Prior to the pot trial, a leaching column study was carried out to understand and compare the ion retaining ability in the presence of an electric field using the different electric potentials 2V, 5V and 8V with time combinations of 4h,8h and 12h. In leach column study, nutrient content and the properties of the leachate were assessed. All cumulative concentrations of cations (K^+, Na^+) and anions (NO_3^-, PO_4^{3-}) in the leachates of the columns supplied with the electric potential were lower than that of the control treatment. The result revealed that the nutrients were retained in the upper part of the leaching column where the electrodes were positioned. In the pot trial with the 2V/8h and 5V/8h combination, the soil analysis suggested that applying 2V electric potential was the best among treatments in retaining of nutrients around the root zone and when assessed the NP uptake by plants highest was in 5V. All growth parameters and yields were positively influencedby the integrated application of an electric potential with fertilizers compared with sole application of fertilizers. The increase in the rice yield percentages in the 2V and 5V, were 24%, and 5% respectively compared to the yield in control. Therefore, application of an electric potential supplemented with chemical fertilizers could be recommended to reduce leaching of nutrient and improve soil fertility and crop productivity.

Keywords: **Nutrient leaching, Electric potential, Cations, Anions**

Supervisors
1. *J.A.S. Chathurika*
2. *N.Rathuwadu,*
3. *M.Gunawardena,*
4. *Prof. C.S.De Silva*

Abstract No: AE505

USE OF CULTURAL PRACTICES TO CONTROL WEEDY RICE (*ORYZA SATIVA F. SPONTANEA*) POPULATION ON DIRECT SEEDED RICE (*ORYZA SATIVA)* CULTIVATION IN MALWATHE REGION OF AMPARA DISTRICT IN SRI LANKA

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ABSTRACT

Weedy rice (WR) was first reported in 1990 and it is occurring with varying population densities in all agro-ecological zones in Sri Lanka. Location field trial was conducted on rice field in Malwathe area during the 2018 *Yala* season. Samples were collected from Seven rice farmers having one rice field per farmer, F1, F2, F3, F4, F5, F6, F7 and from 7 different sampling sites. The sites were selected on the basis of previous observation of the infestation of weedy rice. It was understood that those farmers followed different cultural practices from land preparation until harvesting. Information on the cultural practices followed by the farmers was recorded on regular basis by individual contact. Samples were observed and collected from 7 rice fields at least 300m distance between plot and at least 50m between from each sample collection point in each location. Location of the samples collected point noted as S1,S2, S3. Samples were collected in 3 different stages as Seedling stage, flowering stage and maturity stage. Samples were randomly taken by using 1 x $1M^2$ quadratic frame by thrown randomly in the selected field. Different type of samples collected in different stages found within the frame have carefully counted and uprooted from each throw. Labelled samples put into a bag to bring to laboratory to evaluate the population, plant height, number of tillers, number of panicles, panicles height, number of spikelet per panicle, number of grain within 1 sq.ft and yield within 1 sq.ft. The collected data were analyzed statistically and mean differences among the yield and different farmers under different growing stage were adjudged as per Duncan's Multiple Range Test (DMRT) at 5% level of significance. The result of this survey shows that, source of seed paddy and cultural practices applied by the farmers in different stages have impact on weedy rice population and this lead to impact on yield of direct seeded rice in the selected area.This experiment revealed that the effective control of weedy rice cannot be based on one single practice, but should rely on complex management programme based on an appropriate combination of preventative, cultural, mechanical, chemical and genetic means.

Key words: Weedy rice, cultural practices, farmer information

Supervisor
1. *Prof. C.S. De Silva*

Abstract No: AE506

AN ASSESSMENT OF TEA – PEPPER MIX CROPPING FARMING SYSTEM OF TEA SMALL HOLDERS IN BALANGODA REGION

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ABSTRACT

The tea industry initiated by the British has been the biggest provider of employment, export earnings and government revenue for more than one and half centuries for Sri Lanka. Even though tea cultivation was begun as large plantations, the number of tea small holders gradually increased in the country. Majority of the smallholders concentrated in the Low Country of the Island and Balangoda is one of the major tea planting districts in the Low country where most of the tea smallholders adopted to tea-pepper intercropping system. However, the agronomy, cultivation practices, technology adoption and the profitability of this intercropping system have not been studied in detail. This study was carried out to investigate the farmer's perception on tea-pepper intercropping system, constraints faced by them, level of technology adoption, factors affecting technology adoption and profitability of the cropping systems being practiced. A structured questionnaire survey was carried out to gather primary data from randomly selected 126 farmers of three *GramaNiladhari* divisions of the district. According to the results there are five tea-pepper intercropping patterns being practiced by tea smallholders depending on spacing of shade trees and the presence of pepper wines on shade trees. The farmers only adhere to some of the cultivation practices recommended by the TRI in tea such as length of plucking round, selecting of cultivar and selecting type of fertilizers. In contrast, farmers only select the recommended varieties in pepper. The results revealed that farmers adopt tea-pepper intercropping systems to obtaining additional income. Tea-pepper intercropping is more profitable than tea mono cropping and introducing pepper after five years of tea establishment gives the highest return. Labour shortage and higher labour costs are the major labour management problems they faced, while frequent price fluctuations of pepper and lack of correct market information are the major marketing problems. Lack of attention on pepper, increasing severity of Blister Blight incidence and lack of knowledge on the intercropping system are the management problems faced by the farmers. This study recommends that there should be a good advisory programme for farmers who adopt tea-pepper intercropping system.

Keywords: **Tea, Pepper, Intercropping, Smallholder, Profitability, Technology adoption**

Supervisors
1. *Dr. S. Thrikawala*
2. *Mr. K. G. J. P. Mahindapala*

Abstract No: AE507

A RAPID IN VITRO MULTIPLICATION SYSTEM FOR LARGE SCALE PRODUCTION OF KEHIPITHTHAN (*Cycleapeltata* (Burm. f.)) BY MICRO PROPAGATION

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ABSTRACT

The present study was conducted to introduce a rapid method for large scale production of *Cycleapeltata* (Burm. f.) through high rate of shoot multiplication from nodal cutting explants. Since *Cycleapeltata* is poor in seed setting and germination, conventional methods of propagation are less successful. Therefore, applying tissue culture would be beneficial to produce active ingredients in large quantities. The purpose of this research was to develop an effective protocol for micro propagation of *Cycleapeltata*. Specifically, to detect the most favourable combination of Sodium hypochlorite (NaOCl) concentration and time duration required for successful surface sterilization of explant and to determine the best hormone combination required for shoot multiplication. The nodal cuttings of *Cycleapeltata* were surface sterilized with three different concentrations of NaOCl for three different time durations and cultured on Murashige and Skoog (MS) basal medium. Among different treatment combinations tested, no contamination was recorded from the treatment combinations, dipping explant in 5% NaOCl for 15 minutes, 10% NaOCl for 5 minutes and 10% NaOCl for 10 minutes, respectively. After two weeks, the nodal cuttings were transferred to MS media supplemented with different combinations of growth regulators, Thidiazuron (TDZ), Benzyl amino purine (BAP) and Indole-3- acetic acid (IAA). This was repeated for three sub culture cycles. The highest number of shoots (4.25) and leaves (15.50) was recorded from the treatment combination 2.0 mg/l BAP + 3.0 mg/l TDZ + 0.5 mg/l IAA. The highest shoot length (1.0525 cm) was obtained from the treatment combination 2.0 mg/l BAP + 4.0 mg/l TDZ + 0.5 mg/l IAA. The treatment combination 2.0 mg/l BAP + 3.0 mg/l TDZ + 0.5 mg/l IAA can be considered as the best treatment combination for obtaining highest number of shoots and leaves. 2.0 mg/l BAP + 4.0 mg/l TDZ + 0.5 mg/l IAA can be considered as the best treatment combination for obtaining highest length of shoots.

Keywords: *Cycleapeltata*, shoot multiplication, BAP, TDZ, IAA

Supervisors
1. *Dr. A.G.B. Aruggoda*
2. *Dr. S.A.J. Wijayabandara*
3. *Ms. M.A.N. De Silva*

Abstract No: AE508

SELECTION OF SUITABLE MEDIA AND TYPE OF STEM CUTTING FOR PROPAGATE ARALIYA (*Plumeriarubra*) IN WL_3 ZONE (GAMPAHA DISTRICT) IN SRI LANKA

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ABSTRACT

Plumeriarubra (Araliya) is a deciduous plant belongs to family Apocynaceae. The plant is mainly native to Mexico, Central America, Colombia and Venezuela. It has been widely cultivated in Sri Lanka as a popular garden and park plant. In this study, *Plumeriarubra* has been selected because of its easy of availability, and suitability as a horticultural and ornamental flowering plant, therapeutic value and degree of research work which is not done. There is no any recommended media as well as a cutting type for the vegetative propagation of Araliya. Therefore, there isn't enough knowledge on suitable media, cutting types and method of planting *Plumeria* for growers in Sri Lanka. It's a challenge to start growing *Plumeria* for both small scale and large scale floriculture industries in Sri Lanka. Araliya was Propagated using two types of stem cuttings as soft wood cuttings and semi hard wood cuttings in three types of potting media as sand only, coir dust only and sand: coir dust 1:1 media to selection of suitable media and cutting type for propagate *Plumeriarubra* (Araliya) in WL3 zone (Gampaha district), Sri Lanka. 30cm long cuttings were selected as soft cuttings and semi hard cuttings. All cuttings were allowed to dry for one week before planting. Sand and coir dust samples were sterilized for half and one hours. Each cutting was established as one cutting in one type of potting media filled pot. Experiment was arranged in two factors factorial completely randomized design (CRD) with six of treatment combinations. Statistical analysis was performed using SAS software. Two weeks after planting, all observations of 180 experimental units were reported as length of stem, number of leaves and number of sprouts. Significantly a higher results were observed in soft wood cutting with coir dust only media compared to all other treatments.

Keywords: **lactiferous, ornamental, propagated, sterilized, sprouts**

Supervisors
1. *Mr.P.K.J.de Mel*
2. *Mrs.A.N.Nanayakakara*

Abstract No: AE509

IDENTIFICATION OF SUITABLE POTTING MEDIA FOR *Petunia hybrida*

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ABSTRACT

Petunia hybrida is a worldwide most popular annual bedding ornamental plants and economically profitable potted plants. Potting media is most important factor which plays a key role of root growth, vegetative growth and quality production dependent on a relatively small volume of the medium. Hence present study was conducted to identify the most suitable potting media for *Petunia hybrida*. The experiment was conducted at the plant house located at Henarathgoda botanical garden, Gampaha by using *Petunia* plants, i.e. Variety of *Petunia fi multi. fenice.*. The experiment was laid out in a Completely Randomized Design (CRD) with seven treatments randomized in three replicates. Treatments were the seven different potting mixtures, i.e. river sand: coir dust 1:1(control) ,river sand: compost 1:1, river sand: coir dust:compost1:1:1, river sand: coir dust:compost:top soil 1:1:1:1, river sand: coir dust:compost:cow dung 1:1:1:1, river sand: or dust:compost:leaf manure 1:1:1:1 and river sand: coir dust:compost:half burned paddy husk 1:1:1:1 were used to check the best suitable medium for *Petunia* plants. Weekly measurements were taken on height of plants, number of leaves, number of flowers, diameter of flowers and average number of days were evaluated to first flower emergence, shelf life of flower and as well as mortality percentage during the study period. Physical and chemical characteristics of potting media, i.e. pH, EC, macro nutrients content (N, P, K) and moisture percentage were analyzed. The data were obtained tabulated and analyzed subjected to the Analysis of variance (ANOVA) procedure of Stastical Analysis System (SAS). Duncan's New Multiple Range Test (DNMRT) was performed to compare the differences among treatment means at P=0.05. Height of plant (cm) had significant differences ($p<0.05$) among different treatments tested. The highest plant height was reordered from T1, i.e. river sand: coir dust 1:1 and the lowest from T2, i.e. river sand: compost 1:1. Stem height was not significantly different ($p<0.05$) among T5, T6 and T7 treatments. Furthermore the best floral attributes was recorded from T3, i.e. River sand: coir dust: compost 1:1:1. The overall results showed that the T3 media prepared from River sand: Coir dust: Compost 1:1:1 was the most effective medium to enhance the growth and flowering performance of *Petunia hybrida*.

Key words:*Petuniahybrida,* Potting media, vegetative growth, floral attributes, shelf life

Supervisors
1. *Dr. H.K.L.K.Gunasekara*
2. *Mrs. M.C.Wickramasinghe*

Abstract No: AE510

EFFECT OF WATER REQUIREMENT OF TRUE CINNAMON (*Cinnamomumzeylanicum*Blume.) ON GROWTH PERFORMANCE AT NURSERY STAGE AND PEELABILITY OF STEMS AFTER HARVESTING

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ABSTRACT

True cinnamon (*Cinnamomumzeylanicum*Blume.) is one of the most economically important export agricultural crop in Sri Lanka. However, water requirement of true cinnamon is still not estimated. The study planned to identify the suitable water requirement influencing growth performance at nursery stage, acclimatization stage and peelability of vegetative propagated higher variety true cinnamon stems. A nursery experiment was conducted to determine crop water requirement and crop coefficient (KC) of vegetative propagated Sri Gemunu and Sri Wijaya cultivars and seedlings of true cinnamon under different water supplement levels, during June - December, 2018. Complete randomized design of five treatments were determined, i.e., 180 ml (fresh water at field capacity) as the control treatment (T1) and other four fresh water treatments for T2, T3, T4 and T5 (100, 150, 200 and 250 ml) with five replications at nursery and acclimatization stages. The results revealed that the water consumed by plants during the different crop growth stages follows the order of T5>T4>T1>T3>T2 water supplement levels. A field experiment was conducted for determination of crop water requirement (ET crop), crop coefficient (KC) and peelability for vegetative propagated true cinnamon crop under different water supplement levels, during June - December, 2018. Complete randomized design of five treatments were determined, i.e., 00 liters (fresh water) as a control treatment (T1) and other four fresh water treatments for T2, T3, T4 and T5 (05, 10, 15 and 20 liters) with five replications. The results revealed that the water consumed by plants and peelability during the mature stage follows the order of T5>T4>T3>T2>T1 water supplement levels. According to the obtained results, the shoot root parameters and peelability of stems were significantly differed on treatment effects, variety & water variety interaction and indicated that water had a remarkable effect on improvement of growth and peelability of true cinnamon and the water requirement was significantly differed at nursery, acclimatization and mature stages of vegetative propagated true cinnamon crop. Overall, it was found that the differences are attributed primarily to specific variety, the changes in local climatic conditions and seasonal differences in crop growth patterns. Thus, further studies are essential to determine the irrigation requirement and efficiency values under different variables, different areas of agro climatological zones to make the best management practice (BMP) in Sri Lankan Agriculture.

Keywords: true cinnamon, reference evapotranspiration, crop coefficient, water requirement, peelability

Supervisors
1. *Prof. C.S.De Silva*
2. *S.N. Weerasuriya*

Abstract No: AE511

INVESTIGATION OF *Datura stramonium*L. PLANT LEAVESEXTRACTIONUSE ASBIO-PESTICIDE IN CONTROLLING THRIPS ON*Anthuriumandraeanum*

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ABSTRACT

*Anthuriumandreanum*is a major cut flower species in the floriculture industry in Sri Lanka. Thrips attacks are highly affected for poor quality production of Anthurium in commercial cultivations. In the light of this situation, the aim of this study was to investigate the effect of different concentrations of *Datura stramonium*plant leaves, ethanol and aqueous extract on Thrips in Anthurium cultivation. A laboratory experiment as well as a field experiment were conducted at Botanical Garden, Gampaha. Both *In vitro* and *In vivo* experiments were conducted with ten treatments which were replicated four times. The treatments were 4%, 3%, 2% and 1% different concentrations of Ethanol and aqueous extraction of *Datura stramonium*. In laboratory experiment, the Filter paper method was used to calculate the mortality percentage of thrips. The greenhouse experiment was arranged in a Completely Randomized Design (CRD). Data assessment consisted of counting healthy leaves, attacked leaves and estimated damages caused on leaves. Among different treatments tested, the commercial chemical insecticide and the 4% concentration of *Datura stramonium*ethanol extraction were recorded the best results. Furthermore, it was noted that all the tested insecticides significantly ($p = 0.05$) reduced the thrips population and the Datura extraction was contributed to sustainable reduction of thrips damages on Anthurium plant leaves compared to the control treatment. Among different treatments tested, 4% concentration of ethanol extraction was identified as the best treatment to control about 90% of thrips attack in Anthuriumcultivation. Therefore*Daturastramonium*leaves extraction could be considered as a potential natural insecticide in the management on thrips population on Anthurium instead of inorganic pesticides. This eco-friendly approach will help as an alternative solution to reduce the usage of synthetic insecticides infuture.

Keywords: ***Datura stramonium*, *Anthuriumandreanum*, thrips, ethanol, aqueous, extraction**

Supervisors
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Abstract No: AE512

DEVELOPING MOSQUITO REPELLENT HERBAL INCENSE STICK

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ABSTRACT

Plant-based repellents have been used for generations in traditional practice as a personal protection measure against host-seeking mosquitoes. Knowledge of traditional repellent plants like Neem, Marigold, Tulsi obtained through ethnobotanical studies is a valuable resource for the development of new natural products. Recently, commercial repellent products containing plant-based ingredients have gained increasing popularity among consumers, as these are commonly perceived as "safe" in comparison to long-established synthetic repellents although this is sometimes a misconception. The *Aedesaegypti* mosquito which spreads Dengue fever. In Sri Lanka, large cyclical Dengue epidemics have occurred at regular intervals and in 2014, over 47,000 cases were reported. Therefore, the control of mosquitoes is an important public health concern around the world. The objective is this research to develop a harmless mosquito repellent incense stick using herbal ingredients. All the air-dried plant materials were grounded into powder and well mixed with normal incense mixture. This mixture was wrapped around bamboo sticks and the end product was obtained. This mixture was used for Incense stick preparatory machine. The screen cage method concluded the maximum rate of plant combination Neem, Marigold and Maduruthala. The field method concluded three combinations of plant materials content incense stick. Surveying method gives different results of incense stick quality, price, health effectiveness, and other products of repelled mosquitoes. Thus, it can be concluded that the blended powder has the potential to be used as a repellent against mosquitoes very well. These medicinal plants can also be used for the preparation of many medicines and will have scope for other value-added products both for the Sri Lankan market and the International market.

Keywords: Mosquitoes, Repellent, Plants, Product, Incense stick

Supervisors
1. *Dr. H.M.U.N.Herath*
2. *Mrs. S.Sugathadasa*
3. *Mrs. G.S. Disanayaka*

Abstract No: AE513

EFFICACY OF *Ricinuscommunis*(CASTOR) LEAVES EXTRACTION AS ECO-FRIENDLY FUNGICIDE FOR DENDROBIUM (PURPLE)

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ABSTRACT

Ricinuscommunis(Castor) produced potential source of safer and more effective substitutes for synthetically produced antimicrobial agents where can be used as bio fungicide. Therefore, the aim of this study was to evaluate the effect of *Ricinuscommunis*against fungal diseases of Dendrobium. The present study was carried out at the Henarathgoda Botanical Garden, Gampaha. The field experiment was conducted in Completely Randomized Design (CRD) with six treatments randomized in five replicates. *In Vitro* and *In Vivo* experiments were consisted of six different treatments and tested against isolated *Colletotrichumsp.*Among different treatments tested the Mancozeb (0.2%) showed minimum mycelial growth (0 mm) followed by plant extract at 0.4% (T4) concentration (1.41 mm). Leaf extract 0.1% (45%), 0.2% (67%), 0.3% (76%) were found the least effective in inhibiting mycelial growth over 0.4% (97%) and Mancozeb 0.2% (100%). The maximum concentration of leaf extract (0.4%) was found significantly superior over 0.3%, 0.2% and 0.1% concentrations. Similarly,*In Vivo* studies, consisted of six treatments among different treatments tested 0.1% (61.20%), 0.2%(56.40%),0.3% (47.80%) were found least effective in inhibiting disease over 0.4% (23.60%) and Mancozeb 0.2% (20.40%). The maximum concentration of 0.4% was found significantly superior over 0.3%, 0.2% and 0.1% concentrations. The most effective fungicidal concentration was recorded in the ethanol extract (0.4%) when compared to other concentrations. Ethanolic leaf extract of *Ricinuscommunis*(0.4%) was identified as the most effective and eco- friendly fungal disease management for Dendrobium. In the present study the extract of *Ricinuscommunis*leaf effectively and significantly inhibited the growth of *Colletotrichum*sp. under *In Vitro* and *In Vivo* condition but none of the form absolutely inhibited the growth of the respective fungi even at the concentration of 0.4%. Therefore, higher concentration of different forms of *Ricinuscommunis*leaf extract should be tested under *In Vitro* and *In Vivo* condition and the effective one may also be tested in the field as an alternative to the chemical for the eco-friendly management of thedisease.

Keywords: **Antifungal activity, *Colletotrichumsp., Dendrobium*, Mycelial growth,*Ricinuscommunis***

Supervisors
1. *Dr. H.K.L.K.Gunasekara*
2. *Mrs. A.N.Nanayakkara*

Abstract No: CE501

EVALUATION OF THE IMPACT FROM INDUSTRIAL WASTE MATERIALS AS FILLER IN PERFORMANCE OF SELF-COMPACTING CONCRETE

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ABSTRACT

Sri Lanka is currently facing a severe problem on solid waste management as it generates tons of waste per day. The currently adopted predominant method is open dumping mainly due to low cost and less processing involved. Therefore, it was intended in this study to examine the feasibility of using waste materials in self-compacting concrete to reduce their negative impacts on the environment. As such, the aim of this research was to evaluate the impact on the fresh state properties of self-compacting concrete by partially replacing the fine aggregate content with selected waste materials (rice husk ash, glass powder and asphalt dust waste) and to obtain an optimum percentage of mix without loss in strength from each waste material.

An optimum mix proportion was obtained by conducting performance-based tests such as slump flow test, T500 test, V funnel test, U box test and compressive strength test on the conventional self- compacting concrete mixes. Next, physical properties of rice husk ash, glass powder and asphalt dust waste were tested and compared with the properties obtained for the M-sand. Using the mix proportion obtained from the selected trial mix designs, fine aggregate content was replaced with selected industrial waste materials (rice husk ash, asphalt dust waste and glass powder) separately in percentages of 0-25% with 5% intervals. Fresh state properties were checked for each RHA-SCC, GP-SCC and ADW-SCC mix using slump flow test, t500 test, V funnel test and U box test separately. Hardened state properties too were checked for each mix using compressive strength tests conducted for 1 day, 7 day and 28 days. Next, the results were compared with controlled SCC mix and optimum mix was obtained from each RHA-SCC, ADW-SCC and GP-SCC mixes.

The results demonstrated that 5% replacement of RHA, 15% replacement of GP and 15% replacement of ADW can be effectively use in SCC mixes which in turn satisfy and improves both fresh and hardened state properties of a self-compacting concrete. According to the cost analysis the use of industrial waste materials (RHA, GP and ADW) as a filler in the production of self-compacting exhibit a marginal profit.

Therefore, the conclusion of the study is that RHA, GP and ADW are suitable as a filler in Self-compacting concrete as it improves the fresh state properties considerably without loss in strength.

Keywords: Self-Compacting concrete, Fillers, Rice Husk Ash, Glass Powder, AsphaltDust Waste

Supervisor
1. *Dr. T. Priyadarshana*

Abstract No: CE502

OPTIMIZATION OF THE PRODUCTION COST OF COMPRESSED STABILIZED EARTH BLOCKS BY PARTIALLY REPLACING CEMENT WITH FLY ASH AND DETERMINATION OF REQUIRED CURING TIME

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ABSTRACT

Clay that used in burnt clay bricks is expensive because of the scarcity of clay soil, and this resource is scarce in many areas of Sri Lanka. On the other hand, there is a high production cost of cement blocks due to the high material cost. Therefore, people tried to find substitutes for the former materials and consequently Compressed Stabilized Earth Blocks was commenced. Suitable soil types for the production of Compressed Stabilized Earth Blocks can be found in many areas of Sri Lanka. The main advantage of this CSE block is unnecessity of plaster.

Compressed Stabilized Earth Blocks are produced in Sri Lanka as a building material. Cement is used as the binding material and its production costs are high. Thus, present study was designed to reduce the production cost of CSE by partial replacement of cement by using cheap material of fly ash.

Produced blocks need to be cured for a certain duration to satisfy the specified strength criteria. SLS 1382: part 3 recommends to cure the produced blocks for 28 days. However, the production cost will be less if the required curing period is shorter.

In order to achieve these objectives, blocks were made using different cement fly ash mix proportions and the most suitable mix proportion was evaluated. Then, the prepared blocks were tested at different time periods to determine the optimum curing period required to achieve the criteria specified by the SLS 1382 applicable to CSEB. Prepared blocks were tested for dry density, total water absorption, dimensions, dry/wet compressive strength, bending strength, erosion resistance and linear expansion of block upon saturation with water. Next the samples which satisfied above mentioned properties were selected. Then the material costs for those blocks were calculated separately. The material cost of the block with 6 % of bonding agent and used only cement is Rs.21/= for 28 curing time. Also, total material and curing cost is Rs.24.33.

Finally, the most economical samples for each curing times were selected. The sample with 6% bonding agent replaced by 35% of cement with fly ash is the most suitable for 28 days.
When above mentioned mixture is used, the material cost is Rs.18.64. Total material and curing cost is Rs.21.97 after 28 curing days and the profit is Rs.2.36.

The sample with 6% bonding agent replaced by 30% of cement with fly ash is the most suitable sample for 21 days. When above mixture is used, the material cost is Rs.18.98. Total material and curing cost is Rs.21.47 after 21 curing days and the profit is Rs.2.86.

The sample with 6% bonding agent replaced by 20% of cement with fly ash is most suitable for 14 curing days. When above mixture is used, the material cost is Rs.19.65. Total material and curing cost is Rs.21.31 after 14 days and the profit is Rs.3.02.

The sample with 6% bonding agent replaced by 15% of cement with fly ash is the most suitable sample for 7 days curing period. When above mixture is used, the material cost is Rs.19.90. Total material and curing cost is Rs.20.73 and the profit is Rs.3.60.

Furthermore, fly ash is one of the waste materials which is becoming a threat to the modern world. When fly ash is used as a raw material, the environmental damage could be reduced extensively.

Key words: CSEB, soil

Supervisor
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Abstract No: *CE503*

OUSL-COLOMBO REGIONAL CENTRE AND MAIN UNIVERSITY NAWALA - ORIGIN PATTERN STUDY

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ABSTRACT

This study focuses to identify inflow pattern of users of OUSL Colombo Regional Center and Main University Nawala with their origin destination and study their travel mode patterns.

This study followed road side interview methodology which was selected by a literature review. A pilot survey was conducted on a midweek day and on a weekend day to identify the number of walkers and motorists entering at four gates of the university by conducting a count at 15 minutes intervals in order to plan the subsequent survey.

The origin pattern survey was carried out on Saturday 8th September 2018 and Wednesday 12th September 2018, from 8:00 am to 6:00pm covering 10 hours survey period. More than 1000 respondents including employers and motorists entering into OUSL through all four gates were interviewed using a questionnaire. This survey was able to capture 57.7 % and 56.5 % arrivals during the week day and weekend respectively.

A total of 51 % of the population entered via Nugegoda while, majority of them are from Kotte DS division (zone no 7). According to the responses, the main purpose of their arrival was education 82 % on weekend and 6 % on midweek. Approximately similar percentage of males and females entered to the OUSL during the weekend (51% males and 49% females) and during the midweek (54 % males and 46 % females) while majority of them used public transportation i.e. more than 74 % used buses and more than 9% used trains.

According to the origin and destination distributions observed in the survey, we propose a shuttle bus service from several zones which have considerable gathering of university community. Through the study it was found that no adequate number of passengers use trains. Hence proposing an additional carriage is not necessary.

Supervisor
1. *Prof K. S. Weerasekera*

Abstract No: CE504

FEASIBILITY OF M-SAND USE FOR BUILDINGS IN SRI LANKA AS A PARTIAL REPLACEMENT

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ABSTRACT

The shortage of Natural Sand due to depletion of resources and limitations due to environmental consideration become an alarming issue in construction industry in Sri Lanka. Under such circumstances, introducing a suitable alternative to natural river sand is vital for the construction industry.

The present work was initiated to determine the strength properties of concrete and cost feasibility analysis of partial replacement of natural River Sand with Manufactured Sand in G30, G40, G50 and G30 BSR analysis (Building Schedule of Rate) concrete. During the experimental analyzing; comparison of particle size distribution, fine content, particle shape and shape factor, workability, compressive strength and cost analysis of G30, G40, G50 and G30 BSR analysis (Building Schedule of Rate) of concrete with river sand and 30%, 60% & 100% replacement of manufactured sand were performed. G50 concrete with 0%, 30%, 60% & 100% replacement levels were casted by adding superplasticizers as admixtures for workability retention.

The results indicate that both sand samples are complying with overall standard particle size grading limits. From the experimental work, the results proved that all concrete samples achieved the target compressive strength. Hence, it can be concluded that the Manufactured Sand can be used as a partial replacement for river sand in concrete up to 100 % replacement. Further, it is found that around 30 % replacement of fine aggregate (River Sand) using Manufactured Sand gave the highest compressive strength. Present finding revealed that former replacement gained eleven (11%) to fifteen (15%) percent cost saving compared to River Sand.

Keywords: Natural Sand, Manufactured sand, Fine aggregate, Compressive Strength, Superplasticizer.

Supervisor
1. Dr. T.L Pradeep

Abstract No: CE505

EFFECT OF SEQUENTIAL LOADING IN FATIGUE LIFE ESTIMATION OF RAILWAY BRIDGES (CASE STUDY: KELANI BRIDGE)

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ABSTRACT

Fatigue is one of the main causes of damage in many structures. A good knowledge in several fields including structural analysis, material mechanics and modeling of loads and load effects on structures is required to design structures with reference to fatigue since the process of fatigue damage is rather complicated. Therefore, fatigue analysis is often needed in design work and this applies both to the design of new bridges as well as the analysis of the remaining service life of existing bridges.

The problem of the assessment of bridge endurance for railway bridges, has intensified significantly in recent years and the rail authorities all over the world are paying attention to extend the service lives of railway bridges. Each of the types of railway bridges used nowadays has some sort of damage that causes a significant reduction in or limitation of its endurance. This damage causes gradual loss of stiffness of the structural components which leads to a reduction in the endurance of the entire civil structure. Therefore, a fatigue assessment approach to predict the remaining fatigue life of ageing Railway Bridge is essential.

The Miner's rule is generally accepted as the simplest and the most commonly used fatigue criteria for the life estimation of railway bridges. The life calculation is considered to be simple and reliable when the detailed loading history is unknown. However, in the case of existing railway bridges where the detailed loading history is known, Miner's rule might provide incorrect results because of its omission of load sequence effect. In this study, a new damage indicator (damage stress model) based sequential law has been proposed to capture the load sequence effect more precisely than Miner's rule. The major objective of this study was to estimate the remaining fatigue life of a railway bridge using the sequential law, and to introduce a new approach to estimate the remaining fatigue life of existing railway bridges. Finally, significance and validity of the method is confirmed by comparing the predicted fatigue lives with previous estimations. The obtained results indicate the effectiveness of the proposed model over commonly used Miner's rule-based life prediction of steel bridges.

Keywords: Railway Bridges, Fatigue life, Miner's rule, Sequential law, Damage stress model

Supervisor
1. Dr P A K Karunananda

Abstract No: CE506

EFFECT OF CONTRACTOR'S PROFIT PERCENTAGE ON PRICE FLUCTUATION CALCULATED USING CIDA PRICE FLUCTUATION FORMULA

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ABSTRACT

The price fluctuation is inevitable due to multiform reasons such as the price of oil, alteration in the technology and increments in inflation in all over the world. When it comes to the construction industry, the fluctuations of the prices of the construction inputs i.e. materials, labour and plant and equipment should be peculiarly concerned since they are biasing to the contract sum in millions, billions range in major projects. The Price Adjustment (PA) technique for price fluctuations introduced by the Institute of Construction Training and Development (ICTAD) known as the "ICTAD formula method for adjustment to contract price due to fluctuation in prices" has a constant of 0.966 which has derived by a fixed contractor's overhead and profit percentage of 15%. But the contractor's overhead and profit margin is ranges generally in a huge extent and neither be fixed for all projects nor for each and every contractor. Generally it can be vary according to the type of the construction project and according to the contractor. Hence, the price escalations rendering from the ICTAD formula are not the true fluctuation for a particular project or a contractor. Therefore, present research was planned to study the degree of accuracy of the ICTAD price fluctuation formula method with compared to conventional method. The data analyses emphasized the ICTAD price adjustment rendering through the current CIDA formula is higher for the contractors with higher overhead and profit margins than the true price escalation that need to claim. Therefore the current CIDA formula is more advantageous to contractors with higher overhead and profit margins. But the contractors with lower overhead and profit margins are paid by a lower amount of price escalation than the true price escalation which needs to be compensate. Usage of the current CIDA formula is disadvantageous to the minor contractors with lower overhead and profit margins. The results have plotted with the variance of price fluctuations for the selected construction project calculated by the ICTAD Formula and the adjusted ICTAD Formula. The formula has adjusted by substituting different overhead and profit factors, K from 0% to 35%. Since the overhead and profit margin of the Bill of Quantities is changing from 0% to 35%, there are 35 projects in the sample with 9 project interim bills of each project. As interpreted by the study, it shows the true escalation to a high end contractor should be lower than the current escalation calculated by the CIDA formula for a particular project whereas low end contractor should be paid more than the current amount coming from the CIDA Formula. Therefore, the current CIDA formula is not giving the true price escalation in point of view from the contractor's profit percentage.

Keywords: Cost Adjustment Factor, Fixed Coefficient, ICTAD Price Formula, Input Percentage, Price Escalation

Supervisor
1. Mr. L. S. Wijewardena

Abstract No: CE507

IMPACT OF GROUND RICE HUSK ASHIN CONCRETE

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ABSTRACT

To minimize the production cost of concrete structures, researchers are being searching alternative ingredients of concrete, which do not compromise the strength. Cement is the primary raw material of concrete mixture. Many countries face an array of issues in conventional cement production such as scarcity of raw material and higher CO_2 emission. Therefore, considerable efforts have been made to utilize indigenous materials and waste materials as a partial supplement for cement worldwide in order to reduce the production cost of concrete. Among different materials, rice husk is one of the possible supplements, which can use to partially replace cement in concrete production.

Rice Husk Ash (RHA) is a Pozzolanic material which, contained silica and it could be a possible cement supplement in concrete production. Thus, present study was designed to determine the chemical and physical properties of RHA in relation to their particle size, and to investigate the optimum percentage replacement of cement with Ground Rice Husk Ash (GRHA).

In this research, RHA samples were collected after the full burning in the selected brick kilns at Anuradhapura District. To increase the fineness of RHA, a ball mill was used while the fineness of GRHA was detected using Blaine air permeability test. Concrete mixtures were prepared supplementing cement with GRHA in different proportions, i.e. 15%, 20%, 25% 30%, 35%, 40%, 45% & 50% by weight. The water binder ratio was maintained as 0.55 and, 57 cubes were casted to detect the compressive strengths at 7, 28 and 56 days. Based on compressive strength values, tensile strength, corrosion test, water absorption test and heat of hydration test were also performed.

According to BS Code 5328, the minimum compressive strength for Grade 25 (ST5) concrete is 25kN/mm^2. Comprehensive strength of cubes consists of 35% GRHA at 07 days, 28 days and 56 days were higher than that of standard value of 25 kN.mm^2. Besides to former test value, tensile strength, corrosion, water absorption and heat of hydration of same product were also within the acceptable level.

Supervisors
1. *Prof.D.A.R.Dolage*
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Abstract No: CE508

RECYCLED CONCRETE AGGREGATES FOR RAILWAY BALLASTING

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ABSTRACT

Ballast is the main structural part of railroad where the sleepers are laid. The main function of ballast is to transfer the loads transmitted from the super structure to the sub grade without failure, and to maintain proper drainage.

Although various types of materials including granite, slag and gravel are being used as ballast in rail track constructions, granite stone aggregates is the common ballast in Sri Lankan rail tracks. But in Sri Lanka we can see mainly granite stone aggregates. Aggregate with the following properties are considered as a good ballast material.

The ballast should be clean and graded aggregate with hard, dense, angular particle structure providing sharp corners and cubical fragments with a minimum of flat and elongated pieces. These properties will provide for proper drainage of the ballast layer and the angular property will provide interlocking qualities which will give the sleepers firmly to prevent movement. Ballast must have high wear and abrasive qualities with stand the impact of the traffic loads without excessive degradation. Excessive abrasion loss of an aggregate will result in reduction of particle size, fouling of the ballast section, reduction of drainage and loss of the supporting strength of ballast section. The ballast particles should have high internal shearing strength to have high stability and the material should possess sufficient unit weight to provide a stable ballast section to provide support and alignment stability to the track structure. Also ballast material should have less absorption of water. Absorption can result in rapid deterioration during alternate weathering and drying cycles.

Usage of Recycled Concrete Aggregate (RCA) as ballast in rail track construction is an environmentally friendly application as it minimizes the natural granite resource depletion. Further, former application reduces the environmental pressure of associated demolished concrete land filling. Therefore, the aim of this research was to investigate the possibility of demolished concrete as a ballast material in railway track construction and maintenance.

The main objectives of this research were (i) to determine the properties of demolished concrete aggregates, (ii)to compare the former material with the commonly used ballast materials, and (iii)to assess whether demolished concrete aggregates confirm with the local authority requirement (Department of Sri Lanka Railway) as a ballast material.

The concrete cubes of grades C15, C20, C25 and C30 were casted and crushed after 28 days to evaluate the relevant grades. The crushed concrete was broken into required sizes and it was graded by sieve analysis. Graded demolished concreates were tested for shear strength, particle sizes, impact resistance, abrasion, weathering and water absorption. RCA was compared with commonly used ballast materials by performing Los Angeles Abrasion, Aggregate Impact Value, Water absorption, Soundness of Aggregates by use of Magnesium Sulfate and Medium Scale Direct Shear Test.

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Initially 100% of RCA (C15, C20, C25, C30) were used for the experiments and change the mixed proportion 25% of RCA with 75% of current ballast material accordingly to satisfy the required limits.

Keywords: Ballast, Recycled Concrete Aggregate, Concrete Grade, Abrasion, Shear strength

Supervisors

1. *Dr.P.A.K. Karunananda*
2. *Dr.(Mrs) L.A. Udamulla*

Abstract No: CE509

STUDY OF THE FEASIBILITY OF THE CONSTRUCTION OF CELLULAR LIGHTWEIGHT CEMENT BLOCKS USING SLUDGE COLLECTED FROM WATER TREATMENT PLANT

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ABSTRACT

Surface water Treatment for potable supplies typically involves coagulation, flocculation, sedimentation, and filtration processes for removing colloidal as well as suspended solids in raw water. All water treatment plants (WTPs) produce waste/residue known as water treatment Plant sludge (WTPS) during the purification of raw water. This paper summarizes the research work carried out to determine the suitability of WTPS to partially replace fly ash percentage in manufacturing Aerated light weight cement masonry blocks. In this research, mixtures have been prepared in combinations of fly ash, cement, Aluminum powder, lime and WTPS. In order to select WTPS samples, dewatering process and chemicals that use for flocculation were studied in Several WTP's located in the Western and Southern province. Selected samples were analyzed for particle size distribution and chemical composition. Test samples were prepared by varying Fly ash and WTPS in to different ratios .150 cubes were casted and tested for their compressive strength at 14 and 28 days. According to the results, compressive strength values show more than 2.00 N/mm^2 for different variations of Fly ash and WTPS combinations. Since densities were more important, it also calculated in addition to Compressive strength for these blocks. Densities were varied in between 750 – 9000 Kg/m3.

Water absorption is a useful index to determine the permeability of the block masonry walls. It is not a physical requirement as specified in the SLS 855: Part 1. The water absorption test was carried out in this study to calculate the water absorption of harden auto calved cured AAC blocks in accordance with BS 1881 – 122.

Sludge added samples were shown higher percentage values and it was varied in between 12 % to 37 %. Since former results not comply to the stranded for water absorption, further studies are recommended to improve the results to comply with stranded.

Key words: Water Treatment Plant sludge, Fly ash, Auto Aerated Cement block, Compressive strength, Density

Supervisors
1. Prof. D.A.K. Dolage

Abstract No: CE510

STUDY ON AGU WEWA IN THE TRADITIONAL CASCADE SYSTEM

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ABSTRACT

Sri Lankan traditional irrigation system is called Tank Cascade Systems (TCS) were major part of Sri Lankans glories heritage. Cascaded tank systems are a series of inter-connected tanks organized within the micro-catchments of the dry zone landscape within a hydrological boundary. These manmade tanks are in natural landscapes and provides maximum benefits. In this system water re-used several times before discharged from the system and they serve multiple functions including irrigation, domestic supply and water for livestock and prevent siltation of major tank. In upper catchment of major tank has a small tank to prevent siltation of major tank, called Aguwewa. Agu mean entry passage to the traditional home and this passage prevent carry over dust particle by foot. The functionality of these tanks is similar in nature and since then term "Aguwewa" was designated. The major tank is fed by function of seepage or spilling of Aguwewa. Nowadays Aguwewa not represent its actual function. People use it as water for paddy cultivation, built their houses on the tank bed and cultivate paddy on the tank bed. With the climatic change often high intensity rain falls occur and deforestation in the catchment cause high velocity run off and soil erosion cause siltation of tank. Due to siltation, storage capacities of water in tank has been reduced. Shallow water depths over large area cause high evaporation. Therefore, insufficient of water storage for paddy cultivation becoming a critical problem in dry zone of Sri Lanka.

This research attempts to closely examine the Aguwewa in cascade system and whether it fulfils the purpose and to develop hydrological models to understand the siltation of Aguwewa. Further, economic value of the silted materials in the construction industry was evaluated. Comprehensive literature review, field visit, tank bed survey, extruded soil column from tank bed and Arial photography, Remote Sensing and Global Information System data were used to investigate the siltation of Aguwewa and variation of shape and size of Aguwewa in Minneriya and ParakramaSamudraya reservoir basins. Tank bed core samples were collected to the 0.5- 2.5 m depth and particle size distribution was carried-out using X-Ray distraction method. Tank bed soil was further investigated for heavy metals. Water quality parameters such as Total Suspended Solids (TSS), turbidity, pH, and conductivity of influent water to the Aguwewa were tested to estimate the siltation potential. HEC-HMS modelling was employed to determine the inflow rate of the tank, while the loss method was SCS curve number and unit hydrograph were used as transport method. HEC-RAS software was used to estimate sedimentation. Particle size distribution curves of soil columns obtained from the tank bed of Aguwewa differ from a well graded soil in natural ground. This study reveals that heavy metal concentrations of tank bed sediments are insignificant. To improve the functionality of Aguwewa de-siltation to be carried out and de-silted material is recommended for making bricks to give economic value to silted material. Restoration of this concept will help to save revenue which losses due to de-siltation of large reservoirs and reduction of reservoir capacities.

Key words: Aguwewa, Tank Cascade System, Siltation, Minneriya and ParakramaSamudraya reservoir basins

Supervisors
1. *Eng.(Dr.) B.C.L. Athapattu*
2. *Eng.(Dr.)G. N.*Paranavithana

Abstract No: CE511

DESIGNING A MAJOR FLOOD PROTECTION STRUCTURE AT KAHATAPITIYA, COLOMBO DISTRICT, SRI LANKA

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ABSTRACT

Kahatapitiya village, located in the Kelani River Basin, Kaluaggala, in the Western province. As per the literature, part of the village is frequently flooded causing significant impact on human settlements, daily activities, agriculture and other social activities. These impacts are severe at KahataPitiya village which is close to the place at which Heenela a tributary joint with the Kelani River.

During rainy seasons, excess water tends to flow through Kahatapitiya village via HeenEla stream. During the minor flood events river water directly enters the village through overtopping its river bunds. Thus, a proper mechanism to avoid the impacts associated with these floods are yet to be developed. Therefore, the aim of this project is, to provide a solution to avoids impacts associated with frequent minor floods and occasional major floods at Kahatapitiya by achieving two main objectives, (i) designing a flood controlling structure along the Kelani river bund to protect Kahatapitiya from minor and major floods, and (ii) to investigate the financial feasibility of the proposed design.

At first, a literature survey was conducted to collect data on flood levels, existing ground levels, and the level of impacts on the village etc. Then catchment area of the stream was identified to obtain peak discharge of the stream and topographical and geological information of the area were also collected. Then a gated control structure was designed for the stream to avoid impacts of flood even at its peak discharge w. Elevation of the Breast wall of the structure was increased up to the major flood level to control river water intrusion. After that, stability of the structure was analyzed against typical failure modes with reinforcement designs.

As existing river bund does not protect the village against major floods, an elevated floodwall was introduced and designed along the river bund with a higher elevation in order to protect during major flood level. Then stability checking & design was done as per the requirement.

Removal of excess water accumulated behind the floodwall during major flood was considered at the next step, and this task was completed introducing an innovative structure of inflatable rubber dams. Two rubber dam segments were planned to establish at either end of the abutment walls closely, to drain out the stagnant water. Rubber dams consist of self-controlling inflation and deflation mechanisms through a control panel attached to the system. Design parameters of the rubber dam were calculated relative to the project problem and those readings were sent to worldwide contractors.After the designing part, an economic analysis was performed to evaluate the feasibility of the project. For the analysis, financial benefit as compensation and other benefits by introducing the structure was separately evaluated. Finally, project was concluded as feasible design with 14 years recover period of project capital under current inflation rate of Sri Lankan

rupee.

Abstract No: CE512

CLASSIFICATION OF COMMENLY USED LOCAL TIMBER SPECIES ACCORDING TO BS 5268

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ABSTRACT

Timber is one of the most popular and perhaps the earliest building materials in the history of world civilization. The unique characteristics of wood together with their abundance made it a natural material for homes. The strength parameters of timber are not being used wildly during the designing stage of timber structures In construction, various factors directly affect the quality of timber such as density, strength (bending, tension, compression, flexural, shear), moisture content, and durability Despite, there is an array of considerations, consumers select timber according to their requirement, demand and appearance and they use timber without any quality control. Further, structural designers are facing the challenge of timber selection for their structures. However, quality of timber varies with the growth rate, structural properties and degree of durability. This prevailing issue is possible to minimize introducing a standard or mechanism for timber classification. To fill the above research gap, present study was designed to apply both qualitative and quantitative analysis to evaluate the availability, cost effectiveness, durability, workability and general usage selecting fourteen selected Non-class timber.

Data gathered from the State Timber Corporation Sri Lanka have been the main anatomical data source for classification of commonly used local timber species according to BS 5268. On the basis of the already outlined trends, the research designed the methodology for the first (qualitative) phase of the survey. For specifying the common use timber in Sri Lanka, which to be measured later with quantitative methods, series of different types of qualitative surveys were conducted focus groups with in-depth interviews by using survey questionnaire. Then strength parameters were investigated for the bending, compression and tension. All the tests were done according to BS 373: 1957 and moisture content was kept close to 12%. Out of 14 species, the highest bending strength was detected for Tamarind, while the highest compression value parallel to grain and perpendicular to grain was found in Palu. The highest tension strength parallel to grain was obtained in Micro The qualitative analysis and strength values of timber, the demand is not varied according to the strength characteristics. The reason for this is, when strength of timber is very high, the density may be high, and it is very unfavourable to work. Therefore, carpenters always tend to use with higher workability timber. Average dry density of selected timber materials lies between 500-1100 kg/m^3. Strength parameters at serviceability limit, mainly compressive strength at parallel to grains varies from 4 MPa to 13 MPa and compressive strength perpendicular to grains varies from 3 MPa to 9 MPa in most of non-class timber species. Compressive strength of timber materials is decreased with increment of water absorption. At the end of this research, selected Non-class timber are classified according to strength classes to propose appropriate structural element.

Supervisors
1. *Dr. G.Parasnavithana*
2. *Dr. K.C.P. De Silva*

Keywords: Non-class timber; Strength classes; BS 5268, Qualitative analysis

Abstract No: CE513

INVESTIGETE THE USE OF SLUDGE FROM A WASTE WATER TREATMENT PLANT TO PRODUCE FINE AGGREGATES AS AN ALTERNATIVE TO SAND IN CONCRETE

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ABSTRACT

Wastewater treatment sludge (WWTS) of Katunayake Export Processing Zone (KEPZ) disperse directly into the natural environment causing an array of environmental issues. Thus, present study was design to evaluate the possible reuse of wastewater treatment sludge (WWTS) in concrete production in the construction industry. The WWTS was tested for its physiochemical properties such as moisture content, organic matter & inorganic matter content, pH values, heavy metals and chloride concentration. Average moisture content, organic matter content and pH range of WWTS were 10.64 %, 49.18 and 7-8 respectively. Despite, WWTS consists of different elements such as Cr, Ni, Mg, Cu, Zn and Ca, none of the metal were at hazardous levels. For the production of Sludge Sand (SS), WWTS was dried in sunlight to reduce its moisture content & then it was ignited at 2000C for one hour to partially remove organic matters. The remaining materials used in concreate production partially replacing sand content as 5%, 15%, 25%, 35% & 50%. Conformity test for grading of the fine aggregates of partially replaced sand using SS always laid within the limits and comply with normal fine aggregates. Grade 20, medium workability concrete test cubes were produced using above mentioned partial replacements and those cubes were tested for their characteristic strength as per the specification -BS 1881: Part 116-1983. Further, their workability was evaluated using the slump test as per specification-BS 1881: Part 02–1983. It revealed that the optimum replacement percentage of SS with sand was in between 25% - 35%, which was the effective achievement than the previous studies. Since the WWTS contains few heavy metals, manufactured concrete was tested for the leachability and discovered that the heavy metals concentrations were not in a detectable level.

According to the results, SS can successfully use to partially replace (Approximately 30%) sand in the production of Grade 20 concrete with required strength. Even the production cost of SS is higher than that of the river sand, overall impact SS based concrete production is an environmentally friendly method as this process reduce the associated impacts of WWTS landfilling.

Supervisor
Dr. P. A. K. Karunananda

Keywords: Waste water treatment sludge (WWTS), Sludge Sand, Concrete, fine aggregate

Abstract No: CE514

EVALUATION OF THE USE OF RECYCLED CONSTRUCTION AND DEMOLISHED WASTE IN ROAD CONSTRUCTION IN SRI LANKA

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ABSTRACT

There is a rapid expansion in Sri Lankan construction industry, and consequently old buildings are being demolished. Thus, a massive load of debris materials are stockpiled annually. On the other hand rapid highway constructions make significant depletion of natural resources specifically gravel. Under this context searching alternative for gravel has paramount validity. Thus, this research was designed to test recycled construction waste (RCW) and demolished waste (DW) as an alternative for gravel in road constructions.

The gravel was selected from an excavation site at Galagedara which was within the specified limits for particle size distribution in ICTAD (Institute of Construction Training and Development). Demolished Concrete and Crushed Brick samples were prepared by mixing the sorted particles in different sizes to satisfy the ICTAD limits of gradation.

A mixture of above two waste was prepared mixing RCW and DW in 1:1 ratio. Then sieve analysis test was performed for the control sample and samples blended with 35%, 40%, 45% and 50% the above mixture. All the samples were within the range specified in the standards for sub base material and shoulder material. Samples are possible to use in cement stabilized sub base in Sri Lanka but not for stabilized road bases.

According to the Atterberg limit test results, for all the samples when *construction and demolition (*C&D*)*waste content gets higher, the Liquid Limit and the Plasticity Index Values decreases while Plasticity Limit Increases. These Values does not meet the Atterberg limits specified for Upper Subbase in Rigid Pavements but show suitability to be used in rest of road structure elements.Both Modified Proctor Compaction test and four day soaked Modified CBR test revealed that, these samples are suitable to be used in road construction in Sri Lanka since addition of C&D waste increases in stockpiles. UCS test results for control sample, samples blended with 35%, 40%, 45% and 50% of demolished concrete, samples blended with 35%, 40%, 45% and 50% of crushed bricks and samples blended with 35%, 40%, 45% and 50% of demolished concrete + crushed bricks mixed in 1:1 proportion treated with cement in 5%, 6% and 7% revealed that Crushed Brick samples comparing with the Control Sample does not give a significant increase in unconfined compressive strength but with the increasing percentage of Crushed Bricks in the specimen, there is a slight increase in its unconfined compressive strength. But there is a much increase in the UCS value with the addition of demolished concrete to the blend.

Keywords - Demolished Concrete, Crushed Brick, Waste, Unconfined compressive strength

Supervisor
1. *Eng. (Mrs.) M. N. Tantirimudalige*

Supervisor
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Abstract No:CE515

DEVELOP AN OPTIMUM PRIMARY SUPPORT SYSTEM FOR TUNNEL EXCAVATION BASED ON AHP TECHNIQUE CASE STUDY – MORAGAHAKANDA-KALUGANGA PROJECT

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ABSTRACT

Sri Lanka as a developing country undergoes many infrastructure developments including underground tunnels such as Umaoya and Upper Kothmale. The underground excavation is very critical construction event. The wedges may have encountered during the excavation of tunnel which critically effect worker safety and sustainability of tunnel while construction and after construction have been completed. Multi million rupees have been spent for the construction of underground tunnels and it could make a significant burden to the national economy of the country. Therefore, detection of cost-effective methods for underground tunnel construction is crucial for a developing country such as Sri Lanka.

The selection of the most appropriate supporting system for tunnel construction is a complex process. In this research, the most appropriate support system was developed based on Q system, original RMR and their adjusted values combining with the Analytical Hierarchy process (AHP). The tunnel trace was divided into four rock classes based on rock mass classification values, i.e. very good rock (RMR 81-100), good rock (RMR 61-80), fair rock (RMR 41-60) and poor rock (RMR 21-40). When the very good rock encountered during the excavation support systems are requirement is zero while different type of primary support systems such as Rock Bolt, Shot Crete and Steel Ribs were constructed for different type of rock conditions.

Although different parameters such as uniaxial compressive strength of intact rock material, drill core quality (RQD), spacing of discontinuities, conditions of discontinuities and ground water condition, orientation of discontinuities were considered during the rock mass classification, developing a primary support system solely based on RMR is not perfect. Hence, we used another popular support residing method like Q system in which many other factors such as joint set number, joint rough number, joint alteration number, joint water reduction factor and stress reduction factor are considered. Rock wedge analysed performed to evaluate the rock wedges.

The ten criteria such as Surrounding rock mass condition, Rock slope stability, Tunnel overburden, Tunnel geometry, ground water table, Construction Safety, Sustainability, Socio/environmental impact, Cost of Construction and Construction duration are evaluated through the questionnaires survey which is directly related to the AHP parameters. The expert judgments were obtained through the questionnaires survey. The AHP calculations were done based on the result of the questionnaires survey. After analysing all the results, the most appropriate support system was developed respected to the different rock classes throughout the tunnel trace.

Keywords: Analytical Hierarchy Process, Rock mass rating systems, Q System, Rock Wedge analysis

Supervisor
1. *Eng. M.N.C. Samarawickrama*

Abstract No: CE516

STRUCTURAL UPGRADING OF EXISTING RAILWAY TURNING TABLES IN SRILANKA

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ABSTRACT

The Railway turntable structure is basically a large bridge equipped with rails that can revolves in a full circle in order to change the direction of the rail engines at the terminal stations, engine yards. Nowadays trains and railroads are becoming essential part of the society and their mobilization. In Sri Lanka, most of the railway turning tables are more than 100 years old. Although these old tables were designed for 45 tons steam engines, still these manually operated tables (55 – 60 feet in length) are being used for diesel engines of 135 tons.

The existing railway turn table structure allows more deflection than earlier steam engines end deflection value. This deflection leads bearing wheels forcedly tough the rotating circular track situated in masonry ground pit, and consequently make difficulties in rotating railway turn table structure leading to structural failure in future. Currently, Railway Department of Sri Lanka is facing the problem of rotating railway turn tables. Therefore, present study of using modified steel structural design for the continuous girder in railway turning table to reduce deflections in both end edges may be the one of the solutions of the problem. When reducing the edge deflection and concentrated central loading enable -free rotation without any obstacles. The present analysis work deals with the comparative study of existing railway turn table versus upgraded railway turn table in Sri Lanka. The analysis was performed using numerical tool of SAP 2000 according to British Standard code of practice and the practical observations. Using engine loads for calculations like, M2, M4, M6, M8, and M10 engines. For each loading conditions 55ft and 60ft models were prepared. Also, the comparative study was carried out from critical bending moments, shear forces, axial forces and end deflection results. The upgrading study consider on the economics, performance, and constructability of the structure. Site visits together with interviews with railway engineers were conducted to check the feasibility of construction and of modification of structure.

The structure of railway turning table was strengthened by employing using two options, (i) adding 'C' sections to internal 'I' section of main girder and, (ii)increment of top flange thickness. Our findings revealed that the end deflections reduce when the main girder made stiffer by above options. Proposed adding 'C' sections to main girder for structural strengthening or creating stiffer than existing elements which is economic and effective.

Supervisor
1. *Dr.P.A.K.Karunananda*

Abstract No: *CE517*

FEASIBILITY STUDY FOR LATERAL STABILITY OF MASONRY BUILDING WITHOUT REINFORCED COLUMNS

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ABSTRACT

Masonry construction is very common in the housing industry all over the world. It has many advantages such as a single element fulfilling several functions including structure, fire protection, thermal and sound insulations, weather protection and sub-division of space while having high durability that allows long years of service.

Burnt clay bricks are commonly using for non-loadbearing walls in Sri Lanka. Due to their low strength characteristics and poor quality controlling in production, most of structural designers do not recommend the clay bricks for load bearing walls constructions specially for multi-story buildings.
Also current cement blocks production mainly focusing on non-load bearing construction. Hence can use only with reinforced structures for multi-story buildings. For low income communities in Sri Lanka, have no option other than go with reinforced structures to construct their multi story dream house. This is quite expensive option because of construction material and skill labour expenses. Hence most of housing dreams never come true and remain as a dream ever.

Introduction of masonry building with high strength cement blocks will give a solution for multi-story residential building construction. This system eliminates the reinforced columns from building structure. This will be an economical and fast construction method which can manage with less skill labour strength. It was calculated that, comparing to similar reinforced concrete building, masonry building with high strength block will save 25% (Approximately) from super structure construction cost.

Non load bearing Cement block production is currently very popular self-employed production method in Sri Lanka. Hence required high strength cement block production capacity can easily increase as per market needs. Also this will create new job opportunities all around the country. Only requirement is to maintain correct guide lines with practical quality controlling systems.

Major challenge which effect for masonry multi-story building is lateral stability. In Sri Lanka major source that can effect to lateral stability is wind force. With selected arbitrary building design in wind zone 03 for normal structures wind speed, it was proven that laterally stabilized masonry building can construct up to four (04) story height without reinforced columns.

Supervisor
1. Dr. T. L. Pradeep

Abstract No: CE518

THE SIGMA PURLIN IS RELIABLE

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ABSTRACT

Purlins are beams provide over trusses to support the roofing between the adjacent trusses these are placed in a tilted position over the principal rafters of the trusses. Channel and angle sections are commonly used purlins. Cold formed steel purlins are the widely used structural elements in Sri Lanka.

This study mainly focuses to analyze and design the cold formed steel purlins those are carried heavy roofing loads and wind loads. Most of the industrial buildings are made by structural steel in Sri Lanka. In concern with roofing materials it has a more density than Zn/ Al or other corrugated type metal roofing materials. In the recent decades, many type of cement braced roofing material has come to the industry. As we all know, timber is more expensive than structural steel and strength parameters are much less than steel. Hence Purlin is important structural member in a roof structure for industrial building / ware house of factories.

Therefore, the main aim of the project is proposed a new type of structural steel Purlin to support wind loads and roof covering loads with enhanced cross sectional properties.

The aim of structural design is to produce a safe and economical structure that fulfils its required purpose. Theoretical knowledge of structural analysis must be combined with knowledge of design principles and theory and the constraints given in the standard to give a safe design. A thorough knowledge of properties of materials, method of fabrication and erection is essential for experienced designer.

British Standards are drawn up by panels of experts from the professional institutions, and include engineers from educational and research institutions, consulting engineers, government authorities and fabrication and construction industries. The standard gives the design methods, factors of safety, design loads, design strength, deflection limits and safe construction practices.

In this study, limit state design has been used to take account of all conditions that can make the structure become unfit for use. The design is based on the actual behaviour of materials and structures in use and is in accordance with BS 5950: The Structural use of Steel work in Building; Part 1 – Code of Practice for Design- Rolled and Welded Sections.

The wind loads are calculated based on CP3 – Ch V: Part 2:1972 and EN 1991-1-4. According to that wind speed for the zone 3 of Sri Lanka has been taken into accounts.
Finite Element Method was used to analyse both structures against stresses due to wind forces. There are many computer programs like STAAD Pro, ANSYS and SAP2000 etc. to develop a combined roof-structure finite element computer model. Here it was used SAP2000 (version 14) software to model and analyse both Lip C Purlin and Sigma Purlin type.

Supervisor
1. *Eng .D.I.Fernando*

Abstract No: *CE519*

A FEASIBILITY STUDY ON SEPTIC TANK EFFLUENT DISCHARGE IN THE COLOMBO REGIONAL CENTER AREA DURING WET AND DRY WEATHER

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ABSTRACT

Traditional tools for the evaluation of septic tank site suitability have been found to be inadequate for assessing the potential pollution of underlying groundwater in permeable soils. The Colombo Regional Center has recently had to deal with a large number of buildings built on permeable outwash terrace deposits along the Kirullapana Canal. The Colombo Regional Centre (CRC) area has several septic tank-soakage pit units installed during various periods of its development. These units installed in the CRC area are few decades old and it is suspected that they leak untreated effluent to the ground water table. Further, there may be some connections where gray water is also diverted to the septic tank.

A number of septic tanks and manholes in the CRC area overflow to the surface during extended rainy periods, where a significant rise in ground water table is observed. Pounding of untreated effluent causes a nasty odor and a health hazard.

It is reasonable to think that the groundwater table level resonates with canal water levels. Such a study enables the determination of groundwater contours and gradients during wet and dry weather periods. This study intends to obtain effluent water samples to carry out the following laboratory tests during wet and dry-weather periods.

The above observations are useful in designing new septic-tank soakage pit units for the CRC area. The results may indicate the viability of designing such units, or the need to propose a suitable sewer collection and treatment system with direct discharge of effluents to the canal.

The results of the study indicated that while OSDS were impacting groundwater in their immediate vicinity, they were not impacting canal water quality significantly at the time of this study because of the self-dilution.

The groundwater quality parameters like BOD, COD, DO, EC, Fecal Coliforms, Nitrogen compounds and turbidity were above the maximum permissible limit prescribed by Central Environmental Authority (1981). According to this study, the groundwater in CRC is contaminated in most of the areas. To restore the groundwater quality, conventional treatment methods are available but these methods may prove to be very costly giving consideration to economics of CRC area. Precautionary measures will be a good step to improve the quality of groundwater in CRC area. In which sewerage system up to the whole limits of CRC must be provided and centralized sewage treatment system is provided to the CRC area. Wherever inevitable, the groundwater must be treated to desired standards prior to its intended use.

Key words: Ground water table, OSDS, Ground water quality, Centralized sewage treatment system

Supervisor
1. Dr. H.C.B.A. Ratnaweera

Abstract No: *CE520*

DEVELOPMENT OF SAND COLUMN TO ENRICH THE GROUND WATER TABLE AND TO CONTROL FLOOD RISK IN NORTH CENTRAL PROVINCE

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ABSTRACT

Flood and water scarcity are the biggest limitations to life in the North Central Province in Sri Lanka. It faces to flood in rainy season with a little more rainfall and as soon as it faces water scarcity in the area. If the aquifer in the area has filled with water and flooded during the rainy period how it faces water scarcity as soon as end of the rainy period. To cope with those problems, it's required to study the reason for those problems and a solution. The reason which obstructs the water percolation was identified as the soil type of lying in the North Central Province by investigating soil profiles. It's required to study an artificial recharge method to enrich the ground water table in the North Central Province within the rainy season to overcome the problem. Placing a sand column which increases the hydraulic conductivity on a flooding area to increase the percolation of rain water to the underground aquifer was selected as an artificial recharge method to reduce the flooding and water scarcity.

This was a laboratory experiment research which included the making of two models of soil profile in Anuradhapura district with and without sand column to have a comparison study and clogging test apparatus. The model was prepared with the soil collected from Anuradhapura district and the ground conditions were prepared as per the collected borehole details. The objectives of the research were investigating the soil profile in Anuradhapura district which was selected from North Central Province with regards to the research and through the model tests, the most suitable sand type and composition for the sand column and the suitable diameter for the sand column were investigated.

The primary data results from the model without sand column was used to model the sand column in the other model and the clogging was the biggest problem in the model and it's a real natural case. So the clogging test apparatus was prepared and used for the clogging tests and selected the most suitable sand type for the sand column. Based on all those results, the optimum diameter size of sand column which gives the highest infiltration rate for the runoff rain water was selected.

Keywords: Low infiltration Artificialrecharge,Sandcolumn, Clogging

Supervisors
1. *Dr. GanilaParanavithana*
2. *Eng. SamanWijewardhana*

Abstract No: *CE521*

FEASIBILITY STUDY OF JACKETING TO STRENGTHEN DETERIORATED REINFORCED CONCRETE COLUMNS

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ABSTRACT

In many cities, we come across some buildings needing major repairs or in a dilapidated condition and unfit for occupation. So, it is necessary to take a decision whether to demolish a distressed structure or to restore the same for effective load carrying system. For that we have to find out the suitable and economical strengthening method application to ensure that the cost of strengthening does not exceed the cost of raising a new building' This research was performed to review and analyses the Feasibility Study of reinforced concrete jacketing to strengthen Deteriorated Reinforced concrete columns instead of Fiber Reinforced Polymer method and demolishing the whole concrete structure and rebuild. Therefore, in this study, a real life three Storied Building in KibulapitiyaMedhanankaraVidyalaya, Negombo was selected.First it was identified all defects by visual inspection and it was quantified the rate of corrosion and deterioration of existing column structure through experimental methods of Rebound hammer test, Cover meters test and depth of carbonation test and it was identified the critical situation of the columns. We were used the analytical method to find out the existing and required strength of the existing column. After analyzing our results summary, it was identified that actually this building is not a load failure building according to the evaluation of existing structure. It was jacketed for the purpose of use the building 20 years more in the future. Our tests results were shown that balance cover depth will be carbonate within nearly 6 years and it will deteriorate reinforcement also. So, it should be find most economical, safe and suitable strengthen method through the above three methods. Reinforced concrete jacketing and Fiber Reinforced Polymer jacketing through the experimental and analytical results were designed.And Finally, A direct real cost of the strengthening materials were considered and prepared a cost for reinforced concrete jacketing, cost for Fiber Reinforced Polymer method, cost for demolishing the whole concrete structure and rebuild. According to these results, the best method was recommended considering which is more economical for our selected site. So, by comparing those three methods the most suitable and the most economical retrofitting method to strengthen the deteriorated RC columns of our selected site was RC jacketing. When considering and comparing other jacketing methods with RC jacketing this is not a more strengthen method and not suitable for all retrofitting conditions. Generally, for under water construction, more floor space required construction, current conditions of the construction and etc. In our case study it was begun to deteriorate. Cracks and exposing reinforcement bars were the major harmful factors to fail a building. But still load carrying capacity was enough. Despite the disadvantages, concrete jacketing is a practical option for the buildings where columns are highly deficient in flexure or shear as compared to the required performance.

Supervisor
1. Eng. D.I.Fernando

Abstract No: *CE522*

INVESTIGATION OF FEASIBILITY OF USING RECYCLED PLASTIC WASTES AS A PARTIAL SUBSTITUTION FOR SAND BY PRODUCING CONCRETE

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ABSTRACT

In present days, the rapid industrial development causes serious problems all over the world and it mainly effect to the depletion of natural things and creates large amount of waste materials to the environment. The usages of polymer waste also have been increased in recent years due to industrialization and because of their advantages as they are easy to use, durable and low prize. But disposing them because many problems to the environment because plastic is a non-degradable material even after a long period.

In Sri Lanka, most of polymer wastes are abandoned and there are no any proper ways to dispose. This situation seriously causes the environmental pollution. Except recycling, there is another way to reduce this problem is to utilize waste materials in production of construction applications. Uses of these waste materials will helps in reducing the cost of concrete manufacturing and also give the solution for the depletion of natural resources.

This research was done to check the feasibility of using recycled plastic waste of High-Density Polyethylene (HDPE), as a partial substitution for sand by testing particle size distribution, compressive strength and slump test for a concrete mixture. This was checked for Grade 25 and Grade15 along a time interval of 7 to 28 days using plastic waste in 5% to 25% with 5% of intervals from fine aggregates. This was compared with control sample (0%) of added amount of waste plastic to fine aggregates.

Finally, the possibility of using HDPE plastic waste in concrete mixture was obtained as 15% of waste in grade 15 concrete. It was completed the main target of this research. Also increasing of waste HDPE plastic increases the workability of concrete mixture.

When considering grade 25 concrete mixture, it was hard to cover the target of strength as it only covers the 5% used waste plastic sample. It cannot be taken as a considerable amount of waste plastic. But in grade 15 concrete, 15% can be considering as a larger amount than that. As this research was done to minimize the environment pollution and minimize the usage of sand, the depleting material, it is better to have a larger amount of waste plastic in the concrete mixture.

Finally, by considering the obtained results, using HDPE plastic waste according to the grade 15 concrete mixtures can be used as non-load bearing concrete structures as paving blocks, garden furniture, and decorative sculptures and decorative purposes.

Supervisor
1.Eng. (Mrs.) M.N Tanthirimudalige

Abstract No: EE501

SOIL RESISTIVITY ANALYSISAND EARTH ELECTORDE RESISTANCE DETERMINATION

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ABSTRACT

A good grounding system is very important not only for safety reasons but also for preventing damages to industrial plants and equipment. At present a standard size of earth electrode has been used in all domestic installations. However, this may not comply with the maximum allowable earth resistance for the TT systems. Earth resistance depends on the earth resistivity, value of which depends on the soil structure at a location. Intend of this work is to investigate the actual resistance of the standard earth electrode's resistance at a location. Determination of soil resistivity is one of the key areas of this work the earth has been considered as homogeneous, two layer model and multilayer model. For each of these models the earth resistivity has been determined. Measurement has been carried out to determine the soil resistivity under different conditions. A software has been used to determine resistivity of multilayer soil model. Voltage distribution on the surface of the earth has also been presented in the research. The actual values, values taken from analytical expressions has been compared with the standard value of the earth electrodes resistance. Recommendation to minimize the earth electrode resistance has also been presented at the end of this work.

Keywords: **TT System, Earth Electrode, Earth Resistance, Soil Resistivity**

Supervisors
1. *Dr. K.A.C.Udayakumar*
2. *Mrs. D.Y.T. Babarawanage*

Abstract No: EE502

TRASH BURNING POWER GENERATION IN HILL COUNTRY

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ABSTRACT

Use of bio mass for electrical energy generation becomes more popular in number of countries. Bio energy generation provides certain amount of electrical energy but it solve the environmental issues such as disposal of garbage. This project proposes utilization of plastic waste to generate electricity. The project is part of the solutions for the plastic waste in the hill country. Data collection has been carried out to estimate the amount of plastic waste for generation of electricity. The project proposed to produce gas with the help of gasifier. The parameters of the gasifier have been determined based on the available data. Parameters of the sterling engine also determined in this project. The amount of energy that can be produced with the proposed design has been presented. Based on the design data a bio gas plant has been fabricated.

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Supervisors
1. *Dr. K.A.C. Udayakumar*
2. *Mrs. R.H.G. Shashikala*

Abstract No: EE503

FEASIBILITY STUDY ON HARNESSING SEA WAVE ENERGY FOR POWER GENERATION IN SRI LANKA

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ABSTRACT

Utilization of renewable sources for electricity generation is one of the solutions for the energy crisis in the country. Other than solar and wind there are renewable sources that can be utilized for energy generation. Feasibility study on sea wave energy for electricity generation is carried out in this work. This report contains comprehensive theoretical study and literature review on sea wave energy. With the available data the best location for the sea wave plants have been identified. A suitable model to convert sea wave energy to electrical energy has been proposed in this work. The amount of electrical energy that can be produced at the identified locations with the proposed model has been presented as an outcome of the project.

Keywords: **Renewable Energy Sources, Sea wave energy**

Supervisors
1. Dr K.A.C. Udayakumar
2. Eng. Gamini.D.Nanayakkara

Abstract No: EE504

PRE-FEASIBILITY STUDY ON NILWALA RIVER HYDRO POWER PROJECT

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ABSTRACT

This project proposed to carry out a feasibility study to find capability of generating electricity by hydro power from Nilwalariver while controlling flood. Literature survey has been done to find out technologies used in Sri Lanka as well as worldwide and previous proposals about the Nilwala hydro power project as first step of this study. Two locations which are suitable for reservoirs and power plants are proposed in this study. Two power plants were proposed to generate electricity. They have been proposed after careful study of topographical, geological, technological, economic, social and environmental factors. As the third step site condition of the selected location such as topography, geology, rainfall and runoff of the streams are investigated. As the final step basic plants design have been carried out. This design includes plants capacity, heads, flow rates, turbine type, turbine speed, specific speeds and main component dimensions.

Keywords:**Nilwala River, Hydro Power, Plant Capacity, Heads, Flow Rates**

Supervisors
1. *Dr. K.A.C. Udayakumar*
2. *Eng. L.A Samaliarachchi*

Abstract No: EE505

USE OF BATTERY ENERGY STORAGE DEVICES FOR DISTRIBUTION SYSTEMS

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ABSTRACT

This work investigates financial benefit of use of battery energy storage system (BESS) in distribution systems. The work is mainly focused on reduction of peak power of the distribution system by using batteries. A comprehensive literature review on use of BESS has been carried out at the beginning of the project. Criteria to determine the BESS capacity has been proposed in this work. This work also proposed to use of BESS as emergency power supplier during the outages. The criteria have been tested with one of the semi urban distribution systems and results were presented at the end of the project.

Keywords: battery energy storage system, distribution system, capacity, charging, discharging, load curve, cost, peak power, emergency power

Supervisors
1. Dr K.A.C. Udayakumar
2. Eng. Dinesh Dissanayaka

Abstract No: EE506

PRE-FEASIBILITY ANALYSIS OF GENERATING ELECTRICITY USING CONCENTRATED SOLAR THERMAL ENERGY IN SRI LANKA

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ABSTRACT

This study presents the outcome of the research on utilization of Concentrated Solar Power to generate electricity in Sri Lanka. Direct Normal Irradiance (DNI) values of all the districts of the country have been collected to assess the suitability of CSP. The districts that are suitable for constructing commercial CSP plants have been identified in thisstudy. Number of parameters have been identified to select most suitable areas of the country. Analytical Hierarchical Process has been used as a tool to identify most suitable locations in each district. The report also includes the suitable areas identified using GIS. The energy potential of each district and areas available for constructing plants has been presented in this work.

Supervisor
1. Dr K.A.C. Udayakumar

Abstract No: EE507

OUSL ROUTE GUIDANCE NAVIGATION MOBILE APP

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ABSTRACT

The Open University of Sri Lanka is the premiere open and distance learning institution in Sri Lanka. In the Open and distance learning methodology students do not need to visit the university very frequently. Every day the Colombo Regional Centre (CRC) publishes the activities and the locations where these activities are held on notice boards. Inability of prior knowing the location of the activity before coming to the university makes it a tedious task in finding the location and the task becomes crucial if the student is late for the activity.

As a solution for the above statedproblem this study presents asystem that will handle schedules and provide navigation instructions inside theuniversity premises. The system consists of two main components a mobile app and a web application. Both the components use a MySQL centralized database. The mobile application is developed using android technology and uses GPS technology with Google maps to guide students to class rooms. Some additional features such as checking their upcoming schedules, all schedules and notices of updated activities etc.

The web application is used to update schedules and classroom locations and developed using web development technologies of PHP, MysqlandLaravel framework and web frontend uses the HTML, CSS and Javascript. The resource allocation for activities are done by the CRC staff members. The total solution will enable the students to know the locations of their activities before coming to the university and will provide navigation instructions to find the places easily.

Keywords: **Navigation, Android, GPS Technology,Web technology**

Supervisor
1. *Dr.D.D.M. Ranasinghe*

Abstract No: EE508

AUTOMATED EMERGENCY WEATHER AND FLOOD REPORT SYSTEM

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ABSTRACT

Flooding is one of the most common natural disasters worldwide that happens without prior warning. The loss of human lives and damage to property is unaccountable due to flooding. Hence an automated emergency weather and flood report is important for protecting lives, livelihoods and properties of human begins. Automated emergency weather and flood report system is an android web based system using IOT devices with live time data. The system operates through the messages received by the system through the gages fixed at different identified points in the usual flooding areas as well as the data received from the meteorological department and from registered users. The gages fixed at different points of the river will give the exact figures of the water level as well as the registered users will provide information about the rainfall and flood levels at nearby areas. The system will process all these data in a neural network to predict possible flooding.

The system has two modules for information dissemination and for receiving information. The websites show the data of past years and current weather and flood situations. When the water level reaches the flooding level, warnings can be send via SMS through GSM network or via an e-mail. The responsive website uses BOOTSTRAP and it will be more flexible for all users with devices such as computer tabs, smart TVs and mobile phones. Website shows previous news, current weather conditions, Flood alerts, affected areas, suggestions and warning services. Since the system is capable of giving early warning signs to people who are in the vicinity of flooding areas we believe that this system will help in saving human lives and property in large with a time lag for evacuation.

Keywords: **Automated, Weather and Flood, Android App, IOT, Responsive,BOOTSTRAP**

Supervisors
1. *Dr. D.D.M. Ranasinghe*
2. *Mr. N.A.R. Priyanka*

Abstract No: EE509

EARLY DETECTION OF DIABETES USING IMAGE PROCESSING WITH THE AID OF IRIDOLOGY

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ABSTRACT

Diabetes has become one of the main health issues that people are facing due to changing life styles, eating habits and level of stress encountered each day. According to the year 2016, statistics of the World Health Organization 8.5% of the adult population of the world are suffering from Diabetes. Percentage for Sri Lanka is also the sameas per year 2015International Diabetes Federation reports and these numbers are on the rise.

Iridology is a technique conceived decades back which focuses on study of iris patterns like colour, texture, shape & structure for diagnosis of various diseases.

This paper explores a medical imaging method with computer vision for the identification of Diabetes by analysing the iris of the human eye related to the pancreas, spleen and kidney of the human body and tries to produce a low cost, efficient & hazard free diabetes detection system making use of image processing.The proposed method transforms an image of the iris into a new representation using image processing algorithms and analyses changes in patterns like color pattern changes and broken tissues in the regions of the iris corresponding to the pancreas, spleen and kidney. The obtained results are then compared with the iridology chart and can make a diagnosis as to whether a patient has diabetes or not.

Various filters have used to remove noises. Localization of the boundaries of the iris has been done by Daughman's operator. Normalization has been done to transform the iris region into fixed dimensions. The center of the pupil has considered as the reference point. Region of interest has identified according to iridology chart. Feature extraction acts a vital role in assessment of the individual to be diabetic or not. The classification has done with the Convolutional Neural Network with back propagation. The methodology has been tested with free iris databases for validation.

Keywords: **Diabetes, Iris, Localization, Normalization, Convolutional Neural Network, Computer Vision, Image processing, Iridology**

Supervisor
1. Dr. D.D.M. Ranasinghe

Abstract No: EE510

COMPREHENSIVE DESING OF AN EARTHING SYSTEM FOR POWER HOUSE SWITCHYARD OF BROADLANDS HYDROPOWER PROJECT

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ABSTRACT

Broadlands Hydropower Project (BHP) harnesses the last hydropower potential of Kehelgamu-MaskeliOya (KM) complex located near Kitulgala area with an installed capacity of 35 MW and 126 GWh annual energy generation. Excavation of the powerhouse switchyard site exposed to a bedrock formation with highly weathered granitic gneiss beneath a thin layer of scum soil top resulting irregular high soil resistivity profile. The main purpose of this research is to design safe and effective grounding system for the generator switchyard of BHP which can carry fault current into the ground without exceeding tolerable ground potential rise ensuring the desired operation of protective & control devices so that not to endanger human and equipment. Owing to the nature of non-uniform high soil resistivity and limited land space for extension, this becomes a great challenge. Research used two approaches; guidelines of conventional IEEE 80-2000 standards & Numerical Analysis Method (NAM). Initially resistivity measurement survey was conducted covering the entire area of concern. A soil model is prepared using orthodox horizontally stratified two-layer soil model using Sunde's graphical technique based on measured data. Then, the grounding grid design is prepared adhering to IEEE algorithm and observed high overall grid resistance eventually exceeding the tolerable step and touch potential levels. Then discrete soil model is prepared based on NAM which facilitates plot of accurate and smooth surface voltage distribution over the entire switchyard area. Applying fault current to these desecrate finite elements and based the first principle of Kirchhoff's current distribution balance, the localized voltage distribution has been developed for the entire area and plotted using a self-developed MATLAB computer program. NAM model can trace the points where the touch and step potentials exceed safe limits in two-dimensional stratified grid, estimation of voltage gradients at boundary areas, which all are unable to track using conventional IEEE method and in some expensive commercial software even. Accuracy of the model can further be increased by reducing the size of the soil element. Finally, several sensitivity studies were conducted so as to optimize the BHP switchyard grid design ensuring safe grid operation.

Keywords: **Broadlands Hydropower Project, IEEE standard, NAM, Step voltage, Touch voltage, mesh size, grid resistance, satellite electrode**

Supervisors
1. *Eng. L. A. Samaliarachchi*
2. *Eng. AnuradhaMudannayake*

Abstract No: EE511

CAPACITY ENHANCEMENT STUDY OF 33 kV GRID CONNECTED SOLAR POWER AT HAMBANTHOTA 132/33 kV SUBSTATION

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ABSTRACT

Hambantota, situated in southern part of Sri Lanka has become a rapid developing zone. With the operation of Hambantota harbor and Mattala international airport, electricity demand increase in this area is inevitable. Currently a large share of electricity is generated in the country by fossil fuels. However, owing to the limitations and environmental impacts of fossil fuel related energy generation, the whole world is moving towards the renewable energy sources in the production of electricity. With the development of the technology and continues reduction of the unit cost of Photovoltaic (PV) systems, the solar power generation has become more popular in many countries.

This research study is focused to Hambantota 132/33 kV substation, since it can be identified as one of the most suitable area in the island to establish more grid connected PV solar power plants. However, the integration of PV system shall be done only after a thorough technical study since the PV penetration level at distribution often limited by the violation of voltage variation caused by large intermittent solar power generation. In addition, less reactive power contribution of PV systems also a considerable impact to limit the PV penetration level on the utility network. The main objective of this study is to determine the maximum possible PV penetration level at Hambantota 132/33 kV substation while maintaining the 33 kV bus bar voltage stability within the acceptable limits. In order to determine these penetration levels, 33 kV grid connected PV system is modelled at Hambantota 132/33 kV substation using Power System Computer Aided Design (PSCAD) workspace and thereafter monitoring the voltage variation on 33 kV bus by executing a three-phase load flow analysis. This analysis was done under different load levels on 33 kV bus as well as different solar irradiation levels.

Finally, PV penetration levels at Hamabntota 132/33 kV substation are selected according to the load levels connected at grid side using 33 kV bus bar voltage variation during the simulation run of the modeled grid connected solar system.

Keywords: Photovoltaic solar plant, PV penetration level

Supervisors
1. *Eng. L. A. Samaliarachchi*
2. *Eng. G. Sashikala*

Abstract No: EE512

OPTIMAL UTILIZATION OF RENEWABLE ENERGY RESOURCES AVAILABLE AT HAMBANTHOTA NLDB FARM TO MEET ITS OWN DEMAND

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ABSTRACT

The largest in the South Asian region providing fifteen million liters of fresh milk to the Sri Lankans per year is none other than Ridiyagam NLDB dairy farm. In this farm, 2000 acres of high nutrition grasses for cattle feed are grown. More than 2500 reputed type of Australian cows; Jersey and Jersey-Cross are in mate in this farm in order to achieve sustainable dairy farming, especially to accomplish fresh milk & curd production. Dairy farms consume more energy than any other agricultural industry and today face challenges owing to rapidly increasing energy prizes and environmental impacts. In NLDB farm too, the energy is extensively consumed in milking, cooling, storing, water heating, lighting and ventilation etc. If one can determine and explore the best energy efficient and management opportunities in this farm, it would not only reduce the wastage of energy in the existing processes but also enhance the environmental quality in and around. Therefore, the objective of this research study would be to ascertain and harness the available renewable energy resources in the farm by applying their associated technologies and meet the energy requirement of the NLDB farm optimally. Screening and detailed energy audit carried out at the beginning of the study gathered, the required energy data and process details of the farm. It has been found that the farm can easily save about one Million LKR annually by shifting the existing billing system to I2 tariff system. Thereafter, the energy optimization and conservation opportunities such as replacement of florescent lamps by LEDs, introduction of VFDs for vacuum pumps and off-peak water pumping system etc. are introduced. To cater to the optimized farm load, Renewable Energy Hybrid Systems (REHSs) which combines the renewable-energy sources such as sheer wind catcher (Involex), solar collectors for water heating, photovoltaic systems & biogas generator with conventional grid connected energy systems are then considered. Optimal sizing and designing of REHS is not a trivial task and therefore, the study considered a detailed simulation of demand/supply analysis with an appropriate mathematical model for the proposed system. Basic model is developed and a simulation for optimal sizing of Wind/PV/Biogas/Grid different combination are carried out. The required number of type/units, ensuring that the Life Cycle Cost is totally minimized subjected to the constraints that the load/energy requirements are optimally met are then figured out. Finally, the amount of excess energy that can be sold to the national grid with the maximum reduction of CO2 emission to the environment is reasonably computed and presented.

Keywords: **Renewable energies, solar photovoltaic power, biogas generator, Solar Thermal, Sheer wind catcher, Genetic Algorithm.**

Supervisor
1. *Eng. L. A. Samaliarachchi*

Abstract No: EE513

OPTIMAL ROUTINE MAINTENANCE SCHEDULE FOR MV TOWER LINES

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ABSTRACT

Electricity distribution system is found to be the most important infrastructure of an electric utility and has a great impact on system performance and reliability. Therefore, reliability improvement of Medium Voltage (MV) distribution network has become an important aspect in power systems. MV tower line distribution systems are physically very large exposed entries with little redundancy. It contains a multiplicity of feeders with varying configuration, maintainability and has very long service life. Tower line maintenance schedule of MV distribution system is a timely action plan with a purpose to extend life cycle and to reduce overall operation and maintenance costs of MV lines. If maintenance actions are performed rarely, it can cause large number of faults and outages, while done too often, costs will be greatly increased. Therefore, it is necessary to make an appropriate balance between maintenance cost and outage duration cost.

This research study initially investigates the system performance of the existing Ceylon Electricity Board MV tower line distribution network of Kalutara area. Subsequently, the System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) of each and every tower line are computed using past ten-year historical data. Synergy Electric Software is used to model the entire network and carry out the technical analysis. Routine maintenance cost of the existing tower line system is then computed. Subsequently a Mathematical model to optimize the required maintenance schedule is developed. Breakdown of the various cost figures including maintenance cost, age of the line, interrupted time are considered while developing the aforesaid mathematical model and thereafter, SAIFI and SAIDI indexes are recomputed. It has been found that the optimally developed MV distribution maintenance schedule not only improves the reliability indexes of the distribution system but also save maintenance cost without an additional investment.
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Keywords: Medium Voltage distribution, Routine maintenance, SAIFI, SAIDI

Supervisor
1. *Eng. L. A. Samaliarachchi*

Abstract No: EE514

IMPROVEMENT OF ENERGY PERFORMANCE IN WESTERN CENTRAL REGION WATER SUPPLY SCHEMES

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ABSTRACT

Providing water supply to consumers at their premises, be it domestic, commercial or industrial, is one of the largest commodities that consumed electrical energy. Monthly energy usage of National Water Supply and Drainage board (NWSDB) of Sri Lanka is around 25 GWh and the Maximum demand is around 51 MVA. Monthly electricity bill is around 350 million LKR and 350 water supply schemes are operating island wide. NWSDB is divided into 11 Regional Support Centers and 27 regions. Specific Energy Consumption (SEC) is an index and a target introduced annually by NWSDB to measure the usage of energy efficiently for pumping water in these regions.

This research study proposes a method to minimize the SEC and Maximum Demand of Water Supply Scheme in Maharagama region. It has been found that the actual values of SEC and the Maximum demand are higher than the target values given for the said region consisting of 13 pumping stations. Average monthly electricity consumption for pumping water is around 6.9 million LKR. Monthly drinking water production is around 3.5 million of m3. Four main pumping stations in Maharagama region are selected as a case study in this research work.

While carrying out of the study, the water flow rate, electrical power required, suction and delivery pressures were measured, and the existing pump performance are computed. It has been found that the main cause of the energy wastage in these systems is the lower efficiencies at which the pumps are operated at. And also to fulfill the present day drinking water requirement, pumps are operated continuously. Proposed system requires the installation of new pumping capacities, appropriate pipe lines, capacitor banks and VFD's to reduce the specific energy consumption and maximum demand. In this region actual value of SEC is 0.1279 kWh/m3 and maximum demand is 1110 kVA. After applying above mention energy saving methods, SEC reduction in Maharagama region would be 0.0707 kWh/m3 and Maximum demand reduction would be about 169 kVA.

Keywords: Specific Energy Consumption,Maximum Demand, Water supply schemes

Supervisor
1. *Eng. L. A. Samaliarachchi*

Abstract No: EE515

NON-ORTHOGONAL MULTIPLE ACCESS IN PHYSICAL LAYER NETWORK CODED PARALLEL RELAYED CHANNELS

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ABSTRACT

Physical layer network coding (PNC) and Non-orthogonal multiple access (NOMA) are two novel technologies which provide higher spectral efficiencies individually in each scenario. NOMA and PNC together employed in a parallel relay communication scheme could be expected to provide a multi-fold spectral efficiency. The simultaneous signal transmission could introduce additional interferences for the communication process. However, the signal analysis proves that in overall perspective the spectral efficiency could be improved through the joint NOMA-PNC scheme. This project investigates the throughput enhancement and outage probability of NOMA employed PNC coded parallel relay channels compared to NOMA-Time division multiple access (NOMA-TDMA) communication and conventional PNC coded parallel relay channels. Further we introduce a power optimisation algorithm with joint throughput maximisation of the intermediate relay nodes which contribute to optimise the transmitted powers in an efficient way. We demonstrate that a considerable throughput improvement and lesser outage probability is achieved by the joint NOMA and PNC in parallel relay channels. Performance analysis shows that the theoretical evaluation matches the simulation results very well.

Keywords: **Parallel relay channels, physical layer network coding (PNC), non-orthogonal multiple access (NOMA)**

Supervisor
1. *Eng, D. N. Balasuriya*

Abstract No: EE516

ACOUSTIC BASED DEFECTIVE GLASS-WARE DETECTOR

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ABSTRACT

Glass-wares are objects which play a vital role in industry and household. Considering glass containers, they are essential in many areas such as food industry, drink manufactures, medical packaging etc. Approximately hundreds of defects can be developed in a container during the manufacturing process. So, it is more important to detect defective container in order to deliver quality production.

A methodology is proposed here to detect defective glass container based on its acoustic behaviour. This investigation is approached through frequency spectrum analysis of non-defective containers and defective containers which is implemented on the MATLAB software. Acoustic features are extracted from the recorded sound tracks and compared with the non-defective templates available in the database. Therefore, frequency spectrum is obtained by using Fast Fourier Transform (FFT) technique and features are extracted using Cross-Correlation, Pitch and Mel Frequency Cepstrum Coefficients (MFCC) methods in order to isolate the defective containers from non-defective containers.

Considering the system implementation, it is included a striking device to cause vibration to the container and the sound signal is directed by a microphone sensor and amplified it. The amplified signal is passed through a bandpass filter circuitry in order to obtain a narrow signal envelope as it facilitates the process of comparison of defective signal with non-defective signal. Then the defective container is rejected. The project is implemented using a Raspberry pi microcomputer.

Keywords: Cross-correlation, FFT, Feature Extraction, MFCC, Pitch

Supervisors
1. *Eng. W.D.S.S. Bandara*
2. *Dr. Eng. G.N. Gunasekara*

Abstract No: EE517

OPTIMALROUTE IDENTIFICATION FOR GARBAGE COLLECTION

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ABSTRACT

Any material that doesn't needed by owner, producer or processor is garbage. It appears in many ways as agricultural, chemical, electronic municipal and domestic etc. Current garbage collection system is based on visualization. That current system comprised from go to every place where garbage bins are placed, checked it's filling condition and garbage shifted from garbage bin to garbage collection vehicle. There is no guarantee that worker will arrive at the right time and regular garbage vehicle routing and disposal of garbage. So, there is a problem about efficiency of garbage collection procedure.

The proposed is an automatic monitoring and garbage collection system. This research presents route navigation system within a new shortest path routing algorithm for solving road traffic problem. The proposed system consists of two main modules as monitoring system of garbage bins and identification of optimal route using an algorithm. The garbage monitoring system of garbage bins is equipped with ultrasonic sensor for garbage capacity identification and consist wireless connection with a web server. And also, it comprised with a computer display to show the capacity and garbage level in the garbage bins.

The designed system can avoid selecting one-way roads and congested roads when it determines the shortest paths from source to destination. Also, the new routing algorithm is compared numerically with existing algorithms such as the Dijkstra algorithm. Road network in Open University area was chosen for the implementation and road condition, garbage volume, traffic density can be solved within only few seconds using this algorithm. The prototype system was built and some extra functions were added so that its benefits not only offer the shortest path but also provide recharging battery, information and security services for drivers.

Keywords: Ultrasonic sensor, IoT, Route navigation system.

Supervisor
1. *Eng. W.D.S.S. Bandara*

Abstract No: EE518

SOLAR MODULE ARRAY TESTER

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ABSTRACT

The solar array is a serial connection of solar panels (PV modules) which normally, establish in high ground or rooftop which is difficult to reach. When one PV module in series is disconnected the whole array become malfunction. The most common method to check the connection is the manual way and find faulty places. This is labour intensive and time-wasting process. Solar module tester finds the series error connection without checking one by one. This product finds the place that the damaged PV module or disconnected solar panel is situated. To get data PV module array negative and positive ends connect to the PV tester. Then earth wire of solar module array tester grounded properly. When connect inputs testing equipment into the negative and positive of the solar array and the tester take inputs as voltage, current and impedance then calculate by an algorithm and store the results. Using the above values, the algorithm finds the malfunctioning section of PV module and measure the values. Values of this method can be used to identify the module which is disconnected and shows in the display module. In this solar module tester, sensors are connected into Output of the PV module. Voltage, current, capacitance and impedance will be used as inputs. The keyboard of the solar module array tester used to feed the information about the number of solar panels and wire gauge. Using these inputs, the controller goes through a calculation process and displays the erroneous solar panel in the series using a monitor. Advantages of this system are the identification of solar array series faulty location, digital display with results, minimize the faults finding the time, minimize the workforce and very low cost than market product price.

Keywords: **PV tester, solar cells, solar module array tester**

Supervisor
1. *Eng. W.D.S.S. Bandara*

Abstract No: EE519

INTELLIGENT SYSTEM TO CONVERT MUSICAL INSTRUMENT SOUND TO MIDI FORMAT

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ABSTRACT

Most sound processing systems available in music industry such as digital music workstations and synthesizers are designed to use MIDI (Musical Instrument Digital Interface) format. Even though, the productions are made through such workstations, the final recording is made to audio format. Moreover, live recordings and other performances are also recorded in audio format. For some advanced music analysers such as intelligent systems for music processing and automatic chord progression systems MIDI format is needed to store music data. In such cases, music recorded in audio format has to be converted to MIDI format. Since audio files contains more than one musical instrument, the identification of each of those is not straightforward hence cannot be performed with an algorithm. Therefore, this research is focused on designing an intelligent system to recognize the musical instrument and construct the MIDI file correspondingly.

The scope will be limited to identification of two different instruments of same pitch at a time and identification is done based on the analysis of the waveform pattern of instrument sound. Ten different musical instruments from a variety of musical instrument categories are selected and then using Digital oscilloscope different kind of waveform patterns are observed. Next, sampling of difference tones of sound patterns of the musical instruments was carried out. For this research, 12 tons of three (3) different instruments in three (3) different instrument categories samples were taken.

There are two parts in the system; first is feature extraction of the sampled waveform and the second is feature classification. Feature extraction is done with Mel Frequency Cepstral Coefficient (MFCC) algorithm and classification is done with a neural network using MATLAB tool box. Thirteen (13) MFCC features of the sampled waveform have been extracted and then the neural network has been trained using those coefficients. Final Output of the system is the identification of the two music instruments and generate a MIDI file.

Keywords: **Neural network, MIDI, Signal processing, Sound wave pattern, Audio wave spectrum, MFCC**

Supervisors
1. *Dr. (Mrs.) H.U.W.Ratnayake*
2. *Mr. I.A.Premaratne*

Abstract No: EE520

FAIR CALL DISTRIBUTION MODEL FOR A CALL CENTER

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ABSTRACT

Call centres have become popular among many industries as a method of centralizing the information services by providing customer support and streamlining business processes. The productivity and efficiency play a key role in satisfying the customers for the growth of the businesses.

A call center typically has different call queues implemented for incoming calls based on their business requirements. But the call distribution to the desired call center agent is not always fair and efficient which results in low productivity and efficiency. The reason is that the consumption of the calls from the queues and allocation to the correct agents are not done in an optimized manner. Waiting time of callers and call handling efficiency by agent can be varied according to many factors. The aim of this research is to introduce an effective, efficient and fair call distribution model for a call center and to find the factors that affect the performance of a call center agent.

Thus, to achieve the desired target, a suitable forecasting model was identified to forecast an hourly average call waiting time of calls in all the implemented queues in a call center. The extracted data are transformed into Python Pandas Dataframe and the Dataframe is fed into the Holts Winter algorithm's additive method. Then a solution was introduced to capture the unpredictable scenarios where forecasting of average call waiting time can differ from the predicted values. To guarantee the fair call consumption, an algorithm was introduced for the allocation of calls from different queues to a common pool. Hence the call distribution to agents is initiated in a fair an effective manner. In addition to that a regression analysis has been performed to find the factors of callers that affect the performance of call center agents which directly improves the decision making process of supervisors of the call center.

Keywords: **Call center, Performance, Call distribution m**

Supervisors
1. *Dr. H.U.W.Ratnayake*
2. *Ms. N. Meedin*

Abstract No: EE521

VIRTUAL SHOE FIT

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ABSTRACT

Ecommerce is a dynamic and an attractive platform that encourages a diverse population towards online shopping. This platform goes above and beyond expectations with respect to the variety of products, details and specifications, ease of transport, time saving techniques and quality verification with respect to the services and products. However, there has been a gap of inaccuracy or ill-fitting with respect to the sizes of garments and accessories, especially shoes. It is safe to say that the most ill-fitted items that are consumed by customers are shoes when it comes to online shopping.

This paper introduces a mobile application known as Virtual Shoe Fit, which uses a novel approach of providing accurate measurements of the user's captured image of the foot via image processing techniques and algorithms. In addition, this application maps the user's captured image of the foot measurements with the shoe sizes available in the databases and displays the respective shoes for the customer to choose from. In literature, there exist several techniques that are expensive, impractical and involves heavy operation with respect to the technology and the equipment making it more inaccessible to a broader audience.

Image processing algorithms were used for pre-processing the captured image of the foot. The captured images were further processed using neural network via Cascade Trainer GUI software for validation process, where each of the captured image was either accepted or rejected based on the quality and the content. Once the validation is completed, techniques such as masking and pixel ratio were applied to calculate the actual size of the foot. Later the actual size measurement of the foot is mapped with the existing shoes and the most suitable shoes are shown to the customer to choose from.

This application provides a feasible solution to a pervasive problem of purchasing a perfect matching shoes online beneficial to both the supplier and the consumer.

Keywords: **Image processing algorithm, Ecommerce, Mobile application, neural network**

Supervisors
1. *Dr. H.U.W.Ratnayake*
2. *Ms. S. Rajasingham*

Abstract No: EE522

INDOOR SHORT-RANGE DATA COMMUNICATION USING HIGH-FREQUENCY AUDIO SIGNALS

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ABSTRACT

Current indoor short-range wireless communication depends on either radio frequency (RF) or infrared (IR) systems (optical wireless systems). However, excessive use of frequency bands causes overcrowded the frequency spectrum. Due to this reason, other forms of wireless communication might have an advantage.

Nevertheless, with IR systems data propagates over a line-of-sight channel only, and this technique suffers from daylight and artificial light interference. Eye safety regulations strictly limit its output power. RF communication can be limited by issues such as regulation of frequency bands, interference with other electronic equipment, and health issues. To overcome these disadvantages, new methods of wireless communication would be welcome, especially in room communications (over ranges of a few meters). High-frequency audio signal is an excellent alternative method for short-range wireless data communication.

In this project, design and implement short-range ultrasonic data communication system between devices. On-Off-Keying (OOK) modulation scheme and commercially available ultrasonic transducers used for design the system. Two 6th order bessels bandpass filters were designed with 40kHz and 25kHz centre frequencies to neutralise the environmental noises and inter-channel interference. Two parallel OOK channels with different frequencies used with 12kHz channel spacing to increase the throughput of the system. In a typical indoor environment, the system can communicate with a bit rate of 3 kbps in approximately 1 meter without errors. Performance of the system depending on indoor environmental factors such as temperature, humidity and air turbulence.

Unlike radio waves, sound waves are regulation free, and they cannot interfere with current wireless devices operating at radio frequencies. There are also no known adverse medical effects of low-energy ultrasound exposure. Current ultrasonic technology is not a competitor to radio-based wireless communication technology. It does not have the same flexibility and coverage range as a radio system has. However, they can be two parallel technologies working together side by side to make more secure and reliable wireless networks.

Keywords:ultrasonic, On-Off-Keying, bandpass filter, transducer

Supervisor
1. *Eng. D.S.Wickramasinghe*

Abstract No: EE523

HIGH-SPEED VEHICLE DETECTION & PENALTY CHARGING SYSTEM IN SRI LANKAN HIGHWAYS

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ABSTRACT

Although the speed limits are clearly shown in the Sri Lankan highways over speed is detected manually by police officers using speed guns (Laser/ Radar guns). Over speed is very dangerous and causes life and property damage due to accidents. Due to the weather and road conditions, the maximum speed can vary from 100kmph to 60kmph. Therefore maintaining the proper speed limit has become an essential requirement in the highways. The existing system is full of inaccurate procedures and a lot of blind spots. Due to bad weather conditions and other reasons, continuous speed detection has never been possible.

This system aims at providing a fully automated solution using Image Processing techniques. The project uses Python version 3.6 with OpenCV libraries as the development environment. The image frames obtained from a CCTV camera is processed using background subtraction, morphological operations such as opening and closing. Features like centroid were extracted from those were tracked through the frames, and the speed was detected according to the calculation at the highway operation centre to detect the speed of the vehicles based on the known distance travelled during a sequence of frames and frame rate of the camera used. When high speed is detected, the image frame is further analysed using Image Processing techniques to obtain the license plate number. The detected license numbers are stored locally. Once a vehicle is exiting at any interchange, the license plate number is recognised, and a request is sent to the highway operations centre to check if the detected vehicle number has been identified as a vehicle with high speed. In case of detection, a beep sound is made to notify the police officer at the exit point to continue with the legal actions.

After the fine tunings hope that the total accuracy will be about 80% at the speed detection and 75% at number plate detection, the accuracy can be improved by upgrading the detection camera features at the Highway. From this implementation, the Police can limit the rush driving in the Sri Lankan Highway by charging a penalty to the over speeders, and it will help to all the highway users to safely drive with their families.

Keywords: Speed detection, Image processing, License plate recognition, OpenCV, Python

Supervisor
1. Eng. D.S Wickramasinghe

Abstract No: EE524

SURFACE WATER QUALITY PARAMETERS CHANGES PREDICTION SYSTEM IN "KALA OYA RIVER BASIN"

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ABSTRACT

Water is vital for all aspect of human and ecosystem survival and health. Thus, quality of water is very important. Evaluations of water quality parameters are necessary to enhance the performance of an assessment operation and to plan developing of better water resources management. The main objective of this study is to provide fairly accurate predictions for water quality parameters.
The research was carried out by using the secondary data collected from Mahaweli Authority of Sri Lanka for Kala Oya River basin located near Rajanganaya reservoir. Water collected in that area can be utilized in drought situations. Unfortunately, the quality of water there is deteriorated by anthropogenic activities, indiscriminate disposal of sewage, human activities and also due to industry waste.
Artificial Neural Network (ANN) captures the embedded unsteady behaviour in the investigated problem using its architecture and nonlinearity nature compared to other classical modelling techniques. Therefore, this study attempts to predict water quality parameters such as Nitrate [NO_3], PH and Dissolved Oxygen [DO] at Kala Oya River basin utilizing an ANN. In this research tensor flow model will be used to develop the deep neural network.

Keywords: **Water Quality Parameters,KalaOya River Basin, Predict Water Quality, Artificial Neural Network, tensor flow**

Supervisors
1. *Dr. H.U.W.Ratnayake*
2. *Dr. B.C.L. Athapattu*

Abstract No: EE525

AUTOMATED FEEDBACK CONTROLLED KU BAND DISH ANTENNA ALIGNMENT SYSTEM

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ABSTRACT

The paper presents a simple, accurate and efficient tracking system for Geostationary Earth Orbit (GEO) Satellites. In general, the satellite signal strength is not strong enough for all the channels, which would result in a quality loss of both the pictures and the sound. In order to obtain a better picture quality, the antenna have to be rotated several times in different directions until it achieves the best signal reception.Therefore, to get the exact angle of position of the dish, it needs to be adjusted manually.In this project an automated feedback and computer-controlled dish antenna alignment system is proposed.

The antenna system consists of a satellite dish position controller which is madeupofaPIC microcontroller, analog position sensors, and DC motors. They are connected to a PC (Graphical User) interface through serial communication from whichthe controller takes the user inputs, for the desired satellite pointed position. The control system drives the satellite dish to specific azimuth and elevation angles based on the user inputs computed via a mathematical formula. This system is consisting of more than 90% signal quality level where is used to point in real time GEO satellites. The look angle & Tune angle difference is less than 0.5 degrees and average tuning time is less than 1 minute.The dish alignment system could be used in international and long-distanced television broadcasting procedures as one of the major applications.

Keywords: **GEO satellites, Feedback controlled, Alignment system, PC Interface, Satellite dish, PIC microcontroller**

Supervisor
1. Dr. U.S. Premarathne

Abstract No: EE526

DEVELOPMENT OF THE SENSOR FOR MEASUREMENT OF SEDIMENT FLOW RATE OF UMA OYA INTO RANTEMBE RESERVOIR

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ABSTRACT

This presents the research work on developing sensor for sedimentation monitoring which is more reliable, cost effective and time consuming as engineering solutions and facilities providing for usage of insitu condition and real time sedimentation monitoring. Sedimentation is an increasingly serious natural hazard problem that have been discussed in Sri Lanka for seeking solution for critical environmental and economic issues since many decades because of low management of catchment area and lack of soil conservation.The main sources of sediment production are the weathering rocks, erosion by the flow of water over soil surface and channel bed erosion.Total Suspended Solid (TSS) and Turbidity are the most important parameters and visible indicator of soil erosion which brings sediments. Correlation between TSS in mg/L and Turbidity in turbidity units(NTU) is erected collecting water samples from the Uma oyalimb-Rantembe reservoir within 25 days and under laboratory experiment relationship of the Turbidity and the TSS was made as 1NTU is equal to 1.5 mg/L accordance in linear regression analysis. The ISO 7027 Turbidity Technique is selective method which is used to determine the concentration of suspended particles in a sample of water by measuring the incident light scattered at 90° angles. Sediment detected sensor was designed, constructed and calibration under laboratory condition. 0-1000NTU provided that linear regression range was used to convert raw sensor data to turbidity values by use of Arduino software.

Main intentions of the study is to identify characteristics relating to the sedimentation effect, such as TSS and Turbidity to enhance technologies and process options that may be feasible to develop sensor for the TSS monitoring and assessments for sedimentation analyses.

Keywords: **Arduino, IR LED, Sensor development,Sedimentation, TSS, Turbidity**

Supervisors
1. *Dr.U.S.Premarathne*
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Abstract No: EE527

REVERSE VENDING MACHINE

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ABSTRACT

Management of non-biodegradable waste is one of the insoluble challenges faced across the world and it is same for Sri Lanka. Among the non-biodegradable waste, a major portion is represented by used PET bottles which are dumped in unmethodical ways. Unavailability of mechanisms, methods and reasonable compensation in managing this waste category has been the reason behind this sensitive issue.

In developed countries, reverse vending machines are deployed to collect used PET bottles then the collected bottles are sent for recycling. Reverse Vending Machines are a good solution to accept used empty PET bottles and offer a compensation to the consumer. But the cost of a machine at basic level is priced at high value which can't be purchased by local bodies thus it's made difficult to be installed across the country since it may take long time to gain the return of investment. This project is to build a cost effective and reliable reverse vending machine that is suitable for Sri Lankan conditions. Initially, the machine is designed to accept the empty PET bottles. Image processing is the main technology utilized here in this machine. The most significant challenge was to differentiate the PET bottles from the other types of materials specially glass, in a case if someone insert the machine.

Empty PET bottles will be accepted from consumers for recycling by reverse vending machine. All consumers will be registered to a centralized system and they will be provided with an RFID card which consists unique identity so that the record of the number of bottles for compensation will be recorded against that identity. There will be a points redeem system integrated with the centralized system.

Main features of the machine developed; Color sorting according to the color of the PET bottles, foreign objects detection, crushing for easy bailing, notifying the consumer the number of PET bottles submitted and record it in a central data base to compensate the consumers.

Keywords: Reverse Vending Machines, Recycling PET Bottles, Image processing

Supervisor
1. Mrs. H Pasqual

Abstract No: EE528

DESIGN OF A TRANSMITTER AND A RECEIVER FOR AUDIO AND MUSIC APPLICATIONS USING LIGHT FIDELITY TECHNOLOGY (LI-FI)

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ABSTRACT

In Science and Medicine, it is accepted that child's physiology and anatomy is different in many ways from an adult. Children exposed to radiation from wireless electronic and communication devices, or can simply say Electromagnetic Radiation (EMR), can have a profound effect on their immature bodies.
Wi-Fi and Bluetooth are currently the two-prominent short-range wireless technologies used for various wireless applications. However, the radio frequency spectrum used by these methods is very scarce. So, there is a great need of a technology that could overcome all the drawbacks of existing technologies such as harmful health conditions, especially affected for small children and also the scarcity of radio frequency spectrum.
Light Emitting Diodes (LEDs) are inherent with high efficiency and high frequency capabilities. So, they can be used for communication purposes in addition to interior lighting systems. Li-Fi communication using LEDs have become more popular due to its efficiency, durability and immunity to health hazards and have led to its use in a variety of applications, including audio transmission, text transmission and image transmission. This project presents an implementation of a Visible Light Communication (VLC) (also known as light fidelity-Li-Fi) system designed for transmitting audio signals in daycare centers or electromagnetic waves prohibited places.

This proposed system transmits audio data with power LEDs and Photodiodes are used at the reception. Pulse Position Modulation (PPM) is used in transmitter for controlling dimming of LED lighting for preventing health issues. Special geometrical design for transceiver is introduced to reduce co-channel interference. Since varying ambient light condition affects the performance of VLC a moving average filter is used to minimize that. Effect of the fluorescent light will be also removed by filtering out certain frequency component.

The implemented prototype system operates for 22 kHz audio signals within an area of one meter of radial distance with high accuracy.

Keywords: Li-Fi (Light Fidelity), VLC (Visible Light Communication), LED (Light Emitting Diode)

Supervisor
1. Mrs. H Pasqual

Abstract No: EE529

MOVIE SUCCESS PREDICTION SYSTEM

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ABSTRACT

Movie industry is one of the largest entertainment modes and it generates massive income as well as job opportunities. Even though people find less time to watch a movie at a film theatre they find alternative ways of watching such as from their homes or on the go through mobile devices. At present, countries like USA, Canada, China, United Kingdom, Japan and India are having very popular film industries. Billions and millions of money are been spend on the production of these films yet some become a failure due to various reasons such as poor quality of production, less performance of actors, actresses and due to bad timing of release of the film etc.

This study presents a system that is able to predict success or failure of a movie before the release and even before the production of the system. The system models different attributes of producing a film such as the actors, the investment, date of release, etc. Then fit a decision tree model to predict the expected success or failure. This system can be used to take prior idea about the success of the film and on the selected actor, cameramen and so on and as well as the date of release also. Hence this can be considered as a kind of a decision support system even.

System comprises of four modules namely Data Collection, Data pre-processing, Data Re-arrangement and the Prediction model. The data are being collected from the imdb database, themovie.com and omdb.com sites. In data pre-processing section unwanted, duplicated and empty records are being removed. To apply attribute selection algorithm data was converted from json to csv file format and rearranged data based on usefulness. Then the cfcSubsetEval algorithm was applied to identify the most significant attributes and using these data the prediction module was developed using Decision Tree algorithm.

Node JS as server-side language and MYSQL is used as the database in developing the system. The prediction model is built using WEKA tool. The system evaluation was carried out with k-fold cross validation method.

Keywords: **Pre-processing, Data Re-arrangement, Prediction model, Decision tree,**

Supervisor
1. *Dr D.D.M.Ranasinghe*

Abstract No: EE530

IDENTIFICATION OF PLANTS USING LEAF PATTERN (PLANT LOG BOOK)

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ABSTRACT

Sri Lanka is a country rich with various kinds of useful plants mainly for medical purposes. Yet some human activities are affecting these plants in an adverse manner. Some restricted plants are exported and some invasive species are imported into the country. Identification of such endangered plants is a major requirement to stop negative impact on these plants. In addition Ayurveda doctors and students too need to learn and identify medical plants accurately. Hence accurate plant recognition is a very important requirement in many areas.

A digital plant identification system can be used for quick identification of plant species without requiring the help of botanists. Identification of plants using their leaf pattern (Plant Log Book) is created to detect the type of plant and species using a leaf.

The Annona (Anoda) Species is being used in this project. WeliAnoda/ Annona rectivulata, KatuAnoda/ Annona muricata, BehethAnoda, WalAnoda/ Abutilon indicum L, SeeniAththa/ Annona squamosa L are the different varieties of the Annona family. The image of the leaf is being captured using a light box which is created using a LED bulb panel and optical films to spread the light all over the leaf and 700D camera.

Basic Geometric features extracted are Diameter, Perimeter, Major axis length, Minor axis length, Area, Convex area and Eccentricity. Based on the basic geometric features, some digital morphological features of Aspect Ratio, Form Factor, Rectangularity, Narrow Factor, Perimeter Ratio of Diameter, Perimeter Ratio of Physiological Length and Physiological Width and a feature which is extracted using flat, disk-shaped structuring element have been calculated.

MATHLAB Image processing toolbox and neural network toolbox was used for feature extraction, classification and for training the data. Probabilistic neural network and Self - Organizing Map (SOM) were used for the classification. More accurate result was given by the Self - Organizing Map (SOM).

Key Words: Feature Extraction, Neural Network, Image Processing, Probabilistic Neural network, Self Organizing Maps

Supervisors
1. *Dr. D.D.M. Ranasinghe*
2. *Dr. GayanIlleperuma*
3. *Dr. S. Somarathne*

Abstract No: ME501

ELECTROENCEPHALOGRAM (EEG) CONTROLLED ANATOMICAL ROBOT HAND

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ABSTRACT

According to the World Health Organization (WHO), over one billion people are globally experience disabilities. In Sri Lanka, there exist thousands of people who are suffering from varieties of disabilities. Sri Lankan Ministry of Health state that the number of disabled persons in Sri Lanka will be increased by 24.2% by 2025. The aim of this project is to develop an EEG (Electroencephalogram) control robot hand model which is working same as the anatomy of the human hand.

The primary motor cortex is mainly responsible for the finger movements of the human hand. Eight EEG electrodes were attached to a subject's head to cover the primary motor cortex of the brain and collect data for three test runs with 15s length. Signal processing algorithm was developed to remove noise from eight EEG signals. Classifier training function was applied to classify signals according to the motor imagery. According to the outputs of the Classifier Trainer, a set of commands were generated in the Decision Controller function. Motor-Driven plastic strings were used to manipulate the bending angle of the Distal interphalangeal joint (DIP), Proximal Interphalangeal joint (PIP) and Metacarpophalangeal joint (MCP) of the robot hand model according to the instruction given by Decision Controller.

According to the results, eight EEG electrodes are sufficient to retrieve the motor imagery for flexion and extension of finger movements. But movements like a real human hand will have to modify with this practice. The flexion angle for the DIP, PIP and MCP cannot capture accurately due to the insufficient data with eight EEG channels.

Keywords: **EEG Sensors, Bio Signal, Robotic Hand, Bio signal Control, Anatomy, Primarymotor cortex, Motor imagery, MATLAB, Signal Processing**

Supervisors
1. *Eng. W. Ravi de Mel*
2. *Dr. S.R. Liyanage*

Abstract No: ME502

SAFETY PRECAUTION FOR THE ELECTRIC THREE WHEELS IN SRI LANKA

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ABSTRACT

Electric vehicles offer number of advantages over the conventional combustion engines. Lower local emission and the higher energy efficiency are the most important factors found in electric vehicles. Sri Lanka is not much familiar with the electric vehicles, especially electrical three-wheels. Most of the electric three-wheels are manufactured without the safety precautions, and the major disadvantage of the three-wheels is passengers' safety. Due to the safety issues, Sri Lankan **R**egistry of **M**otor **V**ehicles (**RMV**) does not allow vehicles importers to sell their electric vehicles. Hence, companies are looking for the safety device which can use with the electric vehicles (three-wheels). The aim of this project is to develop electrical safety system for the passenger's safety.

When the abnormality detected from the safety unit the entire electrical system of the vehicle will shut down immediately. The electric system of the vehicles is comprised with three-phase motor and high current consuming devises such as inverters. The main power supply was 72 VDC and the safety unit was designed to detect current variation 60 – 380 A. **H**igh **C**urrent **S**witching **C**ontroller (**HCSC**) was the main power controller of the safety system and **IGBT** unit was controlled by the **ATMEL** micro controller. Industrial current sensors are used to detect abnormality of the electrical system of the vehicle.

According to the test results, the switching system was response to the vehicle's safety issues such as current leakage within 10 – 40 ms of time. After abnormality detect, the entire electrical system was shut down immediately.

Keywords: **Safety Precaution, Electrical Safety, Three-Phase motors, IGBT, ATMEl, Microcontroller, Inverter**

Supervisor
1. *Eng. H.D.N.S Priyankara*

Abstract No: ME503

DATA MONITORING SYSTEM WITH THE AID OF MODBUS RTU COMMUNICATION PROTOCOL USING C#.NET

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ABSTRACT

MODBUS is a serial communication protocol developed and published by the MODICON in 1979. Most familiar usage of the MODBUS communication protocol is the **P**rogrammable **L**ogic **C**ontroller (**PLC**). The Aim of the research is to retrieve electrical parameters from the power analyzer devices and display data using the MODBUS communication protocol. The Main objective is to develop a **G**raphical **U**ser **I**nterface (**GUI**) using Visual Studio C# to communicate with the devices with the aid of MODBUS RTU and RS-485 protocol.

A single power analyzer device attached to the industrial Soft-Starter panel was used for this research. The power analyzer and PC were synchronized using the RS-485 connection. MODBUS communication algorithm was developed to retrieve data from the holding registers (MODBUS function code 03) of the device. Data Monitoring GUI was used to visualize real time data retrieved by the C# developed communication algorithm. The Results were observed and verify accuracy by obtaining several trials. Voltage, Current, Total Harmonic Distortion and Power factor for each phase were showed in the Data Monitoring GUI.

According to the results of both real-time data from power analyzer device and Data Monitoring GUI, C# serial communication development environment is possible to use for the acquisition of data for the MODBUS RTU communication protocol.

Keywords: **MODBUS RTU, C#, Serial port communication, Microcontroller, Visual Studio, GUI, RS-485, Power Analyzer**

Supervisor
1. *Eng. H.D.N.S. Priyankara*

Abstract No: ME504

BIONIC LEG FOR INACTIVE MUSCLE OF THE THIGH

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ABSTRACT

This paper presents a novel approach for the current bionic leg issues by designing and development of a bionic leg which is controlled by upper limb motion using Artificial Neural Network (ANN) model. Having a leg amputee impacts a person physically and mentally throughout his life. Medicines are highly costly but it can only cure the physical pain. Active Bionic Legs are considered as the best solution for the leg amputation. Also most of the commercial bionic legs are act on the signals that extract from the thigh muscles. If the amputation happens in the upper knee by causing damage on thigh muscles such as military accidents made difficult to extract Electromyography(EMG) signals to operate current available Active Bionics Legs. This study focused on analyze the arm swing pattern related to the human gait cycle and develop an Artificial Neural Network model using upper limb motion (arm swing motion) related to the lower limb motion (leg motion). ANN model for whole system is graphically represented by using a 3D model and finally presented concept was validated using a prototype. Typically the average duration of one gait cycle for men ranges from 1007 to 1121.9 milliseconds. Designed bionic leg has a capability of predicting the corresponding knee joint angle using human arm swinging pattern under 13.17 milliseconds. As the result of gait cycle with bionic leg may have a percentage time delay deviation by 1.15% between human gait cycle of normal healthy person and a disable person wearing the bionic leg. Signal filtering algorithms and other signal processing concepts were able to decrease the prediction time during the running period. The delay of the bionic leg can be minimized by using improved hardware and precise sensor modules. This approach can increase the limitations of the current bionic legs and this study will help for increasing the stability of fully autonomous humanoid robot that has similar walking patterns as a human. More research and development on this approach will increase the efficiency and effectiveness of bionic legs and it will be a good solution for the rising demand for the bionic legs for upper knee amputees, commonly in military cases and other accidents with having inactive muscles of thigh.

Keywords: Leg amputation, Upper limb motion, Human Gait Cycle, Electromyography, Artificial Neural Network, Active Bionic Leg.

Supervisors
1. *Eng.T. M. D. N. T. Medagedara*
2. *Eng. P. D. S. H. Gunawardane*

Abstract No: ME505

DESIGN ENHANCEMENT OF A COCONUT DEHUSKING MACHINE

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ABSTRACT

Coconut is the fruit of the coconut tree (*Cocos nucifera*) which belongs to the *Arecaceae* family.Sri Lanka is the world's 5th largest coconut producer and is one of the major plantation crop which accounts for approximately 12% of all agricultural produce. Coconut has a pre-capita consumption of 120 nuts/year/head in Sri Lanka. Nut is the most economical part in a coconut palm. In Sri Lanka, about 2,500 Million nuts are produced per year. Coconut should be dehusked prior to any postharvest application on flesh. Iron spike is the most used tool for de-husking coconuts in domestic as well as in commercial environment. Attempts made so far in the development of dehusking methods have only been partially successful and not effective in replacing manual methods. Studies conducted during this research shows that the reasons for the failure of these methods include nut breakage, unsatisfactory and incomplete dehusking, spoilage of useful coir, grater effort needed than manual methods, etc. Therefore, there are no any completely successful mechanical, semi-automated or fully automated methods available in Sri Lanka for coconut de-husking process. This research was aimed to find a solution for the under-utilization of coconut dehusking machines currently available in Sri Lanka. Although there are two paths to continue (*i.e.* find a solution for domestic or manual dehusking machine and find a solution for the industrial de-husking machine), only an industrial semi-automated machine has been introduced. This machine includes dehusking unit mounted on a frame with electric motor as a power source along with speed reducing unit. The dehusking unit includes a pair of cylindrical rollers with tynes (cutting pins) on its surface. Tynes have been designed to a special profile to minimize the damage to the nut and useful coir layer which is a major flaw in the existing methods. These rollers rotate in opposite direction with different speeds so that the tynes can properly penetrate into the husk and tear it away from the shell. Better tearing of husk from the shell occurs when the coconut offers good mesh with the tynes and it depends on the depth of insertion of nut into rollers and profile of the tynes. The tests carried out on the designed machine shows that the nut breakage is well below 15% which is less than that of the existing coconut de-husking machines. Further test are to be carried out in order to increase the output productivity of the machine.

Keywords*:* Dehusking unit, Tyne, Rollers, Tearing, Output productivity

Abstract No: ME506

A SOLID WASTE MANAGEMENT SYSTEM AND A SUITABLE ANAEROBIC DIGESTER SYSTEM FOR DEDICATED ECONOMIC CENTRE AT DAMBULLA

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ABSTRACT

Dedicated Economic Centre (DEC) located at Dambulla is the largest wholesale market for sales and distribution of vegetable and fruits in Sri Lanka. Average quantity of sales at DEC is recorded as 26,500 Metric tonnes per week. Over 10 tonnes of Fruits and Vegetable Waste (FrVW) and Food Waste (FW) are dumped to the jungles as food for elephants. It is a huge burden for the DEC as well as Dambulla Municipal Council (DMC) while creating many issues to the public and the environment. The aim of this project was to find a solution to make use of FrVW collected at DEC. The objectives of the project were to introduce a system of sorting and collecting FrVW and Food Waste (FW), find biomethane potential and select the best type of Anearobic Digester (AD) system for DEC after studying the anaerobic digestion process and available AD's and finally design a more efficient, economically and technically sound AD system for the DEC.

It was studied the best way of sorting and handling the waste at DEC by visiting the site to gather data via a Questionnaire as well as physically observing and measuring daily collection of waste. It also was studied all types of AD's under a literature survey first and then visiting and investigating selected active and non active AD's in Colombo and suburbs in Sri Lanka. After doing a performance analysis on selected AD's, it was chosen a Continuous Stirred Tank Reactor (CSTR) system. Some experimental data was used in calculating biogas potential from similar research done by Sri Lankans. In this study, daily accumulation of average FrVW and FW were recorded as 7853kg and 567kg per day respectively. It was recorded the daily accumulation of all kind of waste consist with Vegetable waste, Fruit waste, Food waste, Plastic, Packing materials and wood as 77%, 1 % ,5.6 %, 0.15%, 16.5% and 0.5% respectively. The daily biogas potential, electricity consumption and gas consumption were recorded as 218m^3, 780 kWh and 36 m^3 respectively. It was found that by using a Biogas Generator (BG), it can generate 655 kWh of electricity per day. It was investigated the expenses of the DEC per month and recorded the monthly expenses for handling waste, electricity bills and gas expenditure as Rs.400,000.00, Rs.853,000.00 and Rs.260,000.00 respectively. By introducing an AD for DEC, while saving energy cost as well as cost involved in handling waste, it can be generated additional income as well by selling the slurry comes out from the AD as fertilizer.

Keywords: dedicated economic centre, anaerobic digester, fruit and vegetable waste

Supervisor
1. Eng. D.C. Wijewardena

Supervisor

Abstract No: ME507

A SYSTEM FOR QUICK ASSESSMENT OF SOIL CONDITION AND TO DETERMINE THE CORRECT AMOUNTS OF EXTERNAL INPUTS IN CROP PRODUCTION

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ABSTRACT

In Agricultural soil, nitrogen (N), phosphorus (P), potassium (K), and organic matter (OM) are the main four factors affecting the yields in crop production. It has been a common problem in many developing countries that fertilizers and crop protection chemicals are used with little or no awareness of the correct dosage. The requirement of these external inputs differ from crop to crop, and also with existing soil conditions. The advice provided by the agricultural extension officers is mainly based on past experiences and no individual assessments of sites are done in their recommendations. On the other hand, standard laboratory procedures to determine the soil conditions take long time to prepare the soil for testing and give results. When the elements essential for plant nutrition are low in availability or unbalanced, then chemical fertilizers and soil amendments are required to be added, to enhance crop yields. Incorrect fertilizer application or unbalanced/inadequate availability of nutrients can lead to depletion of soil nutrient reserves and loss of plant nutrients. Lack of balance nutrients also encourages excessive uptake of these nutrients supplied in excess, but with no benefit. Unbalanced fertilization is uneconomic, and the waste of scarce resources. Agriculture extension officers do not have sufficient details and means to guide the farmers for fertilizer usage to avoid this unfavourable situation in crop production. This research proposes an in-situ soil N, P, K and OM testing equipment for agriculture officers. The proposed device can analyse the past data in the area and also test the soil parameters in the field, and give the percentage of soil N, P, K and OM requirements.

The equipment enables the facility to test soil pH and Electrical conductivity in the field using standard Laboratory sensors and enable a path to determine Soil N, P, K, and OM by processing unique algorithms built from past data. This will help agriculture officers to recommend suitable fertilizers, quantity and also will help to reduce the excessive chemical usage and gradually establish the chemical balance of the soil.

Keywords: **NPK Tester, Chemical fertilizer, Soil characteristics, Standard Soil testing, Data analysis**

Supervisor
1. *Prof. N.S. Senanayake*
2. *Eng. H.D.N.S Priyankara*

Abstract No: ME508

DESIGN & FABRICATE A PYROLYSIS REACTOR TO DISPOSE MUNICIPAL SOLID WASTE

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ABSTRACT

Disposing Municipal Solid Waste (MSW) is a huge burden for municipalities in Sri Lanka. Most of municipalities use incineration, anaerobic digestion and land filling as waste disposal methods. The main objective of this research is to find a more efficient method to dispose municipal solid waste in cost effective and environmental friendly manner.

Municipal waste samples were collected by visiting Municipalities of different cities and sub urban areas. After separating and categorising different types of MSW, properties of waste were analysed in order to select the disposal method. Pyrolysis process has been selected to dispose solid waste while extracting syngasgas as waste can be used as a feedstock. Pyrolysis is athermos-chemical conversion of carbonaceous feedstock in the absence of oxygen to produce bio-fuel (bio-oil, bio-char, and syngas). This process yields 60-70 % bio-oil, 15-25% bio-char and 10-15% syngas. Hence pyrolysis process was studied thoroughly and designed a pyrolysis reactor where temperature lies between 500 °C to 800 °C.

Several experiments were conducted by fabricating the designed pyrolysis reactor. All experiments were successful and were able to extract syngas from MSW. It was found from the experiment results 20% of MSW can be converted in to syngas by the fabricated pyrolysis reactor. Further properties of syngas are to be analysed.

Keywords: Pyrolysis, Reactor, Municipal Solid Waste, Energy

Abstract No: ME509

DESIGN AND DEVELOPMENT OF A FLORAL PAPER PRODUCTION MACHINE

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ABSTRACT

Reusing and recycling used papers is the current solution to reduce pollution and waste generating daily by papers. But recycling papers is not 100% eco-friendly as it consumes water, chemicals, energy and emits carbon dioxide and toxic gases to the atmosphere.As an alternative solution, waste flowers can be used to produce new papers which will biodegrade faster than regular paper. Although same process as producing regular papers is applicable for producing floral papers from waste flowers still there is no established recipe, technique or machinery. Hence this project was carried out to investigate possibility of producing floral papers from waste flowers in large quantities and to introduce an automated floral paper production machine.

Demand for floral paper, its products and possible value-added products out of waste flowers have been identified. Extensive studies have been carried out by conducting a survey on daily generation of flower waste and disposal methods. Several experiments were conducted in order to produce floral papers and investigate its quality and to establish a proper production mechanism. Existing paper manufacturing and recycling methods have been studied prior to designing the waste floral paper production machine. Finally, the designed automated floral paper production machine was fabricated, quality of sample papers were tested and the possibility of producing papers from waste flowers is proven and discussed as results.

Keywords: Waste, Floral paper, Pollution, Paper production

Abstract No: ME510

INVESTIGATION OF MECHANICAL BEHAVIOR ON AUTOMATIC HOT PRESSED TITANIUM BASED ALLOY SPECIMENS

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ABSTRACT

Titanium alloys are used in a wide range of applications, such as aerospace, naval, automotive and certain dental and biomedical applications. Also, the above mentioned industries need titanium - based alloy components with good physical properties.Many researchers have done many works on titanium - based metal powders, but very few have been able to give a correct definition of the mechanical properties and behavior of titanium - based alloys.

The aim of this study is to study the mechanical behavior of titanium - based alloy specimens produced by automatic heat mounting presses with different heat treatment temperatures. The objectives are to study the metallurgical behavior of selected titanium - based alloy material, to study the feasibility of using automatic hot mounting presses to manufacture titanium alloy powder - based components and finally to analyze the mechanical behavior of the titanium - based alloy specimen manufactured by automatic hot mounting presses at different heat treatment temperatures.

The first step was a literature review. Different types of titanium alloys, their structures and properties were identified in this literature review. Ti-6Al-4V was selected as the appropriate metal powder, and then metal powder was purchased. Specimens were made using an automatic hot mounting press by mixing metal powder with a binder material. The total weight of a specimen is 10 grams, and metal powder and binder material have been mixed under five different weight fractures. Mechanical properties of compacted specimens have been measured. After that, specimens were heat treated at different heat treatment temperatures and different times. These heat treated specimens were tested to investigate mechanical behavior. Results obtained from experiments were analyzed.

According to the analyzed results, the specimen containing six grams of titanium alloy powder and four grams of binder element are considered the best specimen. Because it showed higher hardness and compressive strength values than other specimens.

Key Words: Titanium, Ti Alloys, Hot Mounting Press, Ti6Al4V powder

Abstract No: ME511

INVESTIGATION OF THE STRUCTURAL CRASHWORTHINESS OF THREE-WHEELERS

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ABSTRACT

Three-Wheelers have been widely used as a means of transportation for over two decades in most South Asian countries. With increasing traffic intensity and the desire to reach destinations faster, Three-Wheelers secured a niche spot of being safer than motorbikes, faster and more comfortable than public transport. Further, three wheelers are more economical compared to purchasing a car. As per statistics at least 5% of deaths in Sri Lanka in the year 2017 were due to road accidents out of which the second largest cause directly involve Three-Wheelers whereas the first being motor cycles. The high rate of fatalities raised concerns over the safety of Three-Wheelers.

A detailed literature review was carried out related to crashworthiness, chassis structures, impact attenuators and occupant protection. The common gasoline powered Three-Wheeler comprised mainly of an independent frame type chassis with a front face and lacked structural integrity to form a protective shell for the occupants and a crumple zone to absorb impact energy during a collision. A numerical analysis was carried out using Finite Element Methods on a conventional Three-Wheeler which was modelled using Ansys software with material properties that of similar to original design.

A series of crash tests were performed as per European New Car Assessment Program (EuroNCAP) Version 1.0.4 of 2017. The test series covered the behaviour of the model under a Full Width Frontal Collision as per the Heavy Quadricycle class parameters.

The initial results revealed that in a conventional gasoline powered Three-Wheeler the acceleration during a collision can reach up to 28 G. Severe deformation was also noted on the steering column and the mid-section, allowing the Three-Wheeler to fold in half, severely increasing the risk of fatalities.

Having studied the behaviour of a conventional Three-Wheeler, the structure was modified and optimised to accommodate a crumple zone as well as form a protective shell to the occupants. With crush tubes and plastic hinge being the conventional methods of absorbing energy during a collision, a total of six different alternatives were designed and analysed. The optimum passenger shell geometry was derived by means of Topology Optimization of ANSYS. Taking into consideration the behaviour of alternatives and topology optimization, a final design was selected.

Supervisor
1. Eng. H.S.LakmalPerera

The final design included a centralised crumple zone and the results revealed that the structural integrity has also improved. Occupant dynamic behaviour during impact has also improved with less tendency for occupants to be propelled outwards, increasing risk of whiplash.

Keywords: **Three-Wheelers, Crashworthiness, Frontal Impact Analysis, Topology Optimisation, Crumple Zone**

Abstract No: ME512

MINI INJECTION MOLDING MACHINE FOR RECYCLING PLASTIC WASTE

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ABSTRACT

Plastic waste is a global environmental issue today. It is vital to find solutions to recycle waste plastics within the premises of home, office, schools, factories or any organizations rather than giving the responsibility to municipalities or any other organization. Because it is a costly exercise making issues of collecting, transporting and recycling. Injection molding is a very convenient method of recycling plastic waste. There are over 1000's of students studying in schools. They use Ball Point Pens (BPP) daily in their day to day life. After using these pens, they throw it away creating environmental issues because it takes long time to degrade. Therefore, manufacturing a machine to convert this waste to a useful product helps to manage waste while generating an income. At the same time, it can be used as a demonstration model for Advanced Level (A/L) engineering technology stream students as well as students learning Physics as a subject in A/L. At the same time, it helps students to gain knowledge in plastic recycling processes.

In was studied various plastic waste recycling processes. It was selected Injection Molding as a solution for recycling plastic waste in Schools. It was studied the material properties such as type of plastics and its behavior, melting points etc and selected a plastic badge for school. The material was found as polystyrene. It was studied the process of Injection Molding and the machineries after visiting few factories as well as the facilities available at National Engineering Research and Development center (NERD). Then it was studied all components in the machine such as hopper, barrel, screw, drive unit, injection cylinder, heater bands, nonreturn valve, mold clamping, pressing and handling unit and their design parameters. The band heaters, pumps, motors, control units etc was found from the market. The mold was designed and machined in a workshop. After buying accessories and designing and making all necessary components of the machine, it was assembled in the workshop in the school premises. After manufacturing the machine, it was tested using polystyrene beads which are compatible with the BPP waste materials.

Keywords:ball point pens, polystyrene, national development center.

Supervisor
1. Eng. Dr. S.D.R. Perera

Abstract No: ME513

MINIMIZE THE SHAFT FAILURE AND BEARING FAILURE OF COLD ROLLED RIBBED STEEL BAR MACHINES

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ABSTRACT

Worldwide steel ribbed bar production process is based on two processes. They are hot rolling process and cold rolling process. Ceylon Steel Corporation (Pvt) Ltd Company produced steel bars using these two processes. Wire Mill II plant produces cold rolled ribbed steel bars using cold rolled machines. It was found that uneven shaft and bearing failures occurred on these cold rolled machines. Therefore, this project is focused on minimizing the shaft failures and bearing failures of cold rolled machines.

First objective was to investigate the failure frequencies of shafts and bearings and running conditions of cold rolling machines. Second objective was to identify the parameters which influence the failure of shaft and bearing of the cold rolling machines. Third objective of the project was to design and development of a shaft to overcome the failures.

To achieve the above objectives, vibrational data analysis, running temperature measurements of bearings and shaft, finding chemical composition of shaft material, hardness test, tensile test, microstructure observations, observation of sharp edges of the shaft, bearing spacer alignment and lubrication leakages were carried out.

Then, it was found that shaft failure edge stress concentration is higher than the material fatigue limit. Chemical composition of the shaft material differs from parent material (manganese content is low). Improper dimensions of the bearing spacer and the assembling and inadequate lubrication conditions were the main effects for bearing failures.

Shaft design was optimized to reduce failure edge stress concentration by lowering the material fatigue stress.

Bearing spacer dimensions and shaft dimensions were changed for preventing from bearing failures and the dimensions of bearing block was changed for proper grease filling into the bearings.

Supervisor
1. Eng.J.H.S.K.Jayamaha

Keywords: Cold Rolled Ribbed Steel Bar, Shaft Failure, Bearing Failure

Abstract No: TE501

SUSTAINABLE STREET WEAR COLLECTION TO RAISE AWARENESS OF PROTECTING THE CORAL REEF

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ABSTRACT

Waste materials releasing to the water is one of the most polluted way of the sea pollution in the world. According to world health organization 80%of all fresh water is made by textile dying, treatments and fabric wastage, plastics, polythine dumping to the sea. Sea pollution directly makes huge impact on corals which are playing pivotal role to protect land from sea erosion, and making a home to life under water.

My aim is to design a Street wear collection to raise awareness of protecting the coral reef through using **environment contrary waste material like polythine, straw, CD cards, safety pins** to minimalize waste addition to the water. The target customers spend the eco friendliest heritage lifestyle with an emphasis on fashion and also freelance professionals who tries to experience and **convey massages to society**. And also circulate the wastage and introducing the new way of the how to minimize the contrary wasting through the concept of "**Live to love**".

The collection is made targeting of the green team segment of Bestival festival in UK for the late summer in 2019, starting in September in late summer. The festivals celebrate Musicians, street artists, street performers, Architecture and design post graduates from across the south of England and all over the world. The main segment of the festival is called green team segment who wants to express their ideas in no diffidence through the fashion

I was highly suggested to accomplish this street wear collection through the London fashion brand of " Reiss '' On this brand have luxury, quality and much defined styles and aesthetic and also I was hope to do a creative wear collection through the brand and with my creativity.

Keywords: fashion industry, design, manufacture, sustainable, raise awareness, protecting the coral reef, environment contrary waste material.

Supervisors
1. *Eng. P.R. Dadigamuwa*
2. *Eng. H. S. LakmalPerera*

Abstract No: TE502

ORIENTAL MASQUERADE

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ABSTRACT

"Oriental Masquerade" is a women's wear power dressing collection for S/S '19. Inspired by the handcrafted masks created by skilled artisans in the past, this collection unfolds the story of creativity behind "Traditional Masks of Sri Lanka". The Mask gives a majestic, powerful feeling through facial expressions and its three-dimensional form. Likewise, this collection is about increasing confidence and adding sentimental value to the wearer. The unique exotic prints and laser cut details represents the three-dimensional form of the mask, and adds value to this creative power dressing collection.

Power dressing is the practice of dressing in a style intended to show that one holds an important position in business, politics and other fields. It's a fashion style that enables women to establish their authority in a professional & political environment, traditionally dominated by men. "Power suit" for the women, is a gender specific professional dress code & is designed mainly to look modern & feminine while giving comfort and mobility to fit their independent & active lifestyles. Power dressing has its symbols in public figures such as Margaret Thatcher, Princess Diana and today this style has been completely modified.

Most of the popular international brands have their own versions of power dressing. Sri Lanka was chosen as it has a huge market gap for corporate wear outfits to be worn by the working class, modern women. Ladies holding top positions in the corporate sectors in Sri Lanka, are ambitious, loves perfectionism in everything they do & are hard workers. They love to be highlighted from the crowd and have their own fashion styles. In the present day, Sri Lankan women do not have a specific outfit collection for power dressing.

My attempt is to design a collection of outfits for power dressing for young women who lives in Sri Lanka for the age group of 25 to 35 years old.

Supervisor
1. Mrs. D. Abeysekara

This collection was designed for my own brand" Doyenne". Here the brand originality is given priority and the Sri Lankan cultures, values, social aspects are valued in the brand's product items. This brand mainly focuses on producing outfits for women and to cater all needs of women.

Keywords: power dressing, modern women, confidence, authority, workingclass, traditionalmasks, uniqueprints, laser cuts, threedimensional, fashionable, Mexico

Abstract No: TE503

SUSTAINABLE COUTURE
A GREEN CARPET COLLECTION DONE FOR THE GREEN CARPET FASHION AWARDS CEREMONY ENGAGING ENGINEERED ECOFRIENDLY FABRIC MARBLING METHOD.

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ABSTRACT

Fashion designers are inspiring because we hold a powerful thread that can re-sew the industry. Designers are the inspiration behind every design and the sustainability of a product is ultimately in designers' hands. The final collection Sustainable Couture explores the way in which fashion design, In particular how the sustainability in fashion can influence and create innovative trends.

The aim of this concept is to combine Green Carpet Challenge's principles of sustainability, new textile developments, textures, and research data and design methodologies to better inform the final design outcome – In this case as the final year project, an innovative concept known as **Green Artisan** for the final collection of garments.

The design collection 'SUSTAINABLE COUTURE' under the concept Green Artisan is done for the Green Carpet Fashion Awards Ceremony, 2019 Italia, for the Iconic women that participates in the event. An experimental textile printing method is developed, which is known as 'Eco-friendly Fabric Marbling' using Permaset Aqua Eco Friendly paints on natural silk fabrics incorporating engineered print placements manually. The specialty of this technique is that the use of a screen printing paste as a diluted paint. The final hand feel of the fabric after marbling delivered exceptionally soft handle which is due to the unique polymer binding of the pigment to the fabric. The textures also include recycled embellishments and trims under the name #Lifeisplastic.

Supervisor
1. *Mrs. D.H.P.S. Gunasekara*

This design collection includes women's couture garments made out of marbled fabrics. The above is achieved by designing the collection under the brand 'DOLCE AND GABBANA', which is by identifying a new market gap through the analysed research data. The project explores the ways of launching the collection **'SUSTAINABLE COUTURE'** via strategic planning procedures.

Keywords: **Sustainable, Eco friendly Marbling, Engineered prints, Green Carpet Fashion awards**

Abstract No: TE504

FOURTH INDUSTRIAL REVOLUTION GARMENTS; 3D PRINTED READY-TO-WEAR COLLECTION – 2018

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ABSTRACT

Using a technological innovation systems approach, the research attempts to understand **3D printing**knownas4thindustrialrevolutiontechnology which has started making its way into the fashion apparel industry. A number of designers are making use of the **additive manufacturing technology** to produce one-off complex designs. Fashion schools are increasingly adapting the 3D printing services programs dedicated to fashion and design emerging in the market. Furthermore, the application of 3D printing techniques in fashion industry and the annual Hi-Tech Fashion weeks are steadily increasing in the international market. It has also opened up a **gap** in the market for new technologies to come through and make an impression on the apparel industry.

Such a technology, which refers to the layer by layer creation of physical objects based on digital 3D files, has been described as having the power to disrupt and transform the manufacturing system as we know it. 3D printing transforms the design and development process by expanding spheres of possibilities, enhancing design quality and limiting development cost. It also incurs great consequences for manufacturing as it reduce transaction costs, resolves the scale-scope problem and fosters **zero-waste production.**

In this study under the concept "4th Industrial Revolution Garments" the entire collection is enriched with 3D printed elements, integrated with normal textiles. The 3D prints made from **Biodegradable plastic filaments** are more flexible and durable enough to be worn and washed. Concept designs were developed by using **Rigid Origami** (folding architecture) and **Interloped** technique.Based on the evidentthat3Dprintingcanbecombinedwithnormaltextilean

Supervisor
1. *Mrs. D.H.P.S. Gunasekara*

averageare interested in its potential and would like to see further application of this technology in fashion. This indicates that future research is guaranteed.

Keyword:fashionindustry,design,manufacture,3Dprinting,digitaltechnology, innovation systems, RigidOrigami

Supervisor
1. Mrs. D. H. P. S. Gunasekara

Abstract No: TE505

FASHIONABLE RAIN WEAR COLLECTION FOR URBAN WOMEN IN JAPAN

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ABSTRACT

This is a women's fashionable rainwear collection for "Burberry", targeting urban women of ages 25-35 living in Japan, which is one of the highest rainfall countries in the world. With the concept of "to make a rainy day a pleasant day" this collection is inspired by the "swallow bird", a distinctive bird with bold plumage and a long, slender, deeply forked tail. Throughout this collection the swallow birds' body, feathers, legs and body movements are incorporated into the designs. This collection aims to produce a fashionable and stylish rainwear collection using different techniques and unique silhouette types.

Rainy wear is described as waterproof clothing worn by protect the body from the rain and help to make the wearer comfortable on a rainy day. Due to the fashion consciousness of the modern women, they do not like to wear the raincoats which have a standard shape and few fashionable features. Therefore, in order to address this problem, an innovative and fashionable rain wear collection was designed by incorporating unique silhouette types, different techniques and colorful fabrics. This will encourage the fashionable women to buy and wear the designed collection.

For this collection, the fabric and cut work techniques are developed using PVC Polythene fabric and lace fabrics. As the target market is Japanese customers, the colors pink, yellow, orange and sea green are used in the color pallet of this collection.

Keywords: rainwear, collection, fashionable, swallow bird

Abstract No: TE506

ECO-FRIENDLY FABRIC DYE EXTRACT FROM KIKIRINDIYA (ECLIPTA PROSTRATA)

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ABSTRACT

"Kikirindiya" (Ecliptaprostrata) is a herb very frequently used as an indigenous medicine. The extract of the plant contains a dark bluish colouring matter and is used for tattooing as it leaves an indelible mark on the skin. Keekirindiya dye extracted fromleaves and stem parts grinded without water and colour components were extracted. This liquid has dark bluish colour and gives a good staining power for fabric. The 100% cotton PFD fabric was dyed with Keekirindiya dye and different mordants such asCopper Sulpahate, Ferrous Sulphate, Alum and Banana inflorence were used. In this research fabric samples were dyed using pre mordant method.

The study was carried out in two different temperatures: 70°C &90°C and the dyeing time was one and half hour. The study showed optimum dyeing temperature as 90°C. It ensured good levelling and better penetration of dye in to the fabric. Three types of steeping hours were used in dyeing process. Increasing the steeping hours ensured good levelling and better penetration of the dye into the fabric and gave different color shades.

According to ISO BO2: 2014 the colour fastness to light was tested. The ISO standard 105-CO6 was usedtestwash fastness properties. Rub fastness was tested according to the standard ISO x 12: 2016 and fastness to perspiration was determined by ISO105EW054:2013 test method. The wash fastness and light fastness rating was assessed using the grey scale. The study evident the Keekirindiya dye can be used for linings, interlinings andintimate apparel for sensitive skins because of skin healing ability and the dyed fabrics havegood fastness properties.

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Keywords: **Kikiridiya dye, dyeing parameters, Colourfasstness, Mordants**

Abstract No: TE507

EFFECTIVE USAGE OF REWARDING FOR EXECUTIVE LEVEL EMPLOYEES IN SRI LANKAN GARMENT INDUSTRY

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ABSTRACT

People do a job, for the salary which helps to make their living and the designation which gives them the social status. This implies that all the people expect something from the organisation in return to their service. Therefore, it is a basic thing that an organisation can retain its employees if they are treated well. Because of this most of the organisations reward its employees.

But the reward is a cost to the organisation. Therefore, the rewarding system should be effective to be beneficial for both the employee and the organisation.
The project was to research whether the prevailing rewarding system for executive level employees in technical departments is effective or not and implement a new rewarding system which treats the draw-backs of the prevailing rewarding system.
When the prevailing rewarding and appraisal systems are considered most of the technical executive level employees do not satisfied. This is due to weaknesses in prevailing system.
Therefore, a suitable new rewarding system has been introduced through this project which has solutions to the limitations in existing rewarding system.

Keywords: **Rewarding system, Executive level employees, effective usage**

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Abstract No: TE508

DETERMINATION OF THE FASTNESS PROPERTIES OF SILK FABRIC BY USING TERMINALIA CHEBULA(ARALU)

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ABSTRACT

Natural dyes produce very uncommon, soothing and soft shades as compared to synthetic dyes. The aim of the study was to evaluate the performance of the dye extracted from *Terminalia chebula* (Aralu) in silk dyeing.

The dried Aralu fruit powder was used to extract natural dye for dyeing silk fabrics by using aqueous extraction method which has given shade of bronze colour.The study proved that the *Terminalia chebula* dye is an acidic dye which pH value of the dye bath was 3.74 because it contains the hydrolysable tannins like chebulagic acid, chebulinic acid and corilaginetc.To analyse the best colour yield, extraction was done at different temperatures, different time periods, different pH conditions, different liquor ratios and different dye concentrations. It was found that the best colour yield can be achieved at the temperature 90°C and the period of the time was 60minutes with 1:3:10 material to liquor ratio. Dyeing was carried out by simultaneous mordanting method using Ferrous Sulphate and Potassium Aluminium Sulphate. Final dye receipt was developed by optimizing above mentioned variables. Results were assessed using a colour assessment cabinet and grey scales. To assess the fastness properties of the extracted dye, colour fastness to washing (ISO 105 C01 A2S) and colour fastness to light (AATCC-16) were carried out.Breaking strength was tested (ASTM D5035;1995) to ensure the strength of the dyed silk fabric.Thus, it can concludethat, Aralu fruit powder have good potentiality for dyeing of silk fabric which contain protein fibres as this is an acidic dye and have good fastness properties too.

Keywords: ***Terminalia chebula,*** **Colour fastness, Acidic dye, Aqueous extraction, Mordants**

Abstract No: TE509

FIBER OPTICS RAVE PARTY WEAR COLLECTION FOR CUSTOMER RANGE OF 25TO 30 AGED AT MEXICO MARKET, INSPIRING FROM "ALCOHOL UNDERMICROSCOPE"

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ABSTRACT

The impression is that drinking is cool, but the nervous system changes that come from drinking alcohol can make people do stupid or embarrassing things, like throwing up or peeing on themselves. Drinking also gives people bad breath, and no one enjoys a hangover. One half of all drowning deaths among teen guys are related to alcohol use.

The collection is made target Mexico market. Mexico is famous and known for its meth addiction throughout the world .Mexico is also famous for not only meth's but other addiction drug exporting. Mexico is considered as the hearth of meth production, and its consumer numbering is increasing day by day especially the number reached the top echelons in 2012.

The collection is made targeting the Rave party in 2019. A Rave party means music, dance parties, happiness and recreation licensed nightclubs. It is not about drug use, sex, rape, molestation, alcohol, cultural abuse, or miscreation.

The target customer such Insane ravers, Pop musicians, and Hooligans. They requires a range that is vibrant, colorful, bright and dark in the glow costumes.

That collection is made with Plastic fiber optics. Fiber optic lighting uses optical fiber as a "light pipe," transmitting light from a source through the fiber to a remote location. The light may be emitted from the end of the fiber creating a small spotlight effect (also called

Supervisor
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"end glow") or emitted from the outside of the fiber along its length, looking like a neon or fluorescent tube (also called "side glow").

I propose to accomplish the above through the festival life style brand "j'valentine" .That brand creates party friendly garments.

Keywords: **Plastic Fiber Optics, Rave Party Wear, Alcohol Under Microscope, "J" Valentine Brand, Mexico**

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