One Day International Webinar on Mathematical Modeling and its Application

(MMA-2020)

18th September, 2020

Abstracts

Organized by
Department of Mathematics
Govt. General Degree College, Muragachha

(Affiliated to the University of Kalyani)

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Patron:

Dr. Tapas Chandra Saha, Officer-in-Charge, Govt. General Degree College Muragachha

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Objective:

The objective of the webinar is to bring the leading mathematician, researchers, students across the country as well as world in a common platform and to stimulate and equip with the recent development in mathematical modeling and its application.

About the Department:

Govt. General Degree College, Muragachha, affiliated under University of kalyani is performing important leading role to spread education in Nadia District. Department of Mathematics, Govt. General Degree College, Muragachha was established in 2015. Presently in the department CBCS under graduation courses (Honours/Program) are running

Dr. Tapas Ch. Saha

Officer-in-Charge
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Economic Analysis of a Stochastic Model on Three-Similar Units Three-Phased Mission System Considering LCFS Pattern in Repair

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Abstract: The present paper deals with a stochastic model on three-similar units three phased-mission systems where in system carries out different tasks at different phases. Therefore, the system configuration varies depending upon the requirement at the phases. The system in three consecutive phases is considered respectively in series, parallel and series configuration. Here, the priority in repair is given to the failed unit in the model i.e. LCFS repair pattern is followed for failed unit. Using Semi-Markov Process and regenerative point techniques the various measures of the system at each phase are obtained. The system is analyzed graphically taking a particular case and various conclusions are made regarding the reliability of the system at each phase as well as for the whole system.
Keywords: Three phased mission system, series configuration, parallel configuration, reliability, Semi-Markov and regenerative point techniques.

NUMERICAL STUDY OF HEAT TRANSFER AND FLUID FLOW OF MAGNETOHYDRODYNAMIC NATURAL CONVECTION IN A SINUSOIDAL ENCLOSURE FILLED WITH NANOFLUID

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Abstract: We have considered the buoyancy-driven heat transfer enhancement due to natural convection inside enclosure having a sinusoidal upper wall filled with Cu-water nanofluid under the influence of the magnetic field. The left wall is linearly heated, the right wall is kept cold, the bottom wall is uniformly heated and the upper sinusoidal wall is kept insulated. The effect of different amplitudes of the upper curved wall is considered. The governing equations are non-dimensionalized and are written in stream function- velocity formulation. Bi-Conjugate Gradient Stabilized (Bi-CGStab) method has been employed for the numerical simulation. The considered parameters are as follows: Rayleigh number *(Ra),* Hartmann number *(Ha)* and nanoparticle volume fraction *(φ)*. The Prandtl number is kept fixed at 6.2. The simulated results are displayed through streamlines isotherms and local Nusselt number. The results indicate that the rate of heat transfer increases significantly with the increase of Rayleigh number and nanoparticle volume fraction whereas decreases with the increase of Hartman number and amplitude of the sinusoidal wall.

Keywords: Natural convection, sinusoidal enclosure, Magnetohydrodynamic, Nanofluid, Nusselt number.

STABILITY AND BIFURCATION ANALYSIS OF A THREE-SPECIES FOOD CHAIN MODEL WITH SEXUALLY REPRODUCTIVE GENERALISED TYPE TOP PREDATOR AND CROWLEY-MARTIN TYPE FUNCTIONAL RESPONSE BETWEEN PREDATORS

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Abstract: The main objective of this paper is to interpret the dynamical behavior of sexually reproductive predator on the three species prey-predator interaction model. The biological effect of sexually reproductive species in an ecological system is explored. Here, we have considered a continuous tri-trophic food chain model with Holling type-II functional response between the prey and intermediate predator, Crowley-Martin senses functional response between intermediate predator and top predator and the top predator is of sexually reproductive type. The positivity and boundedness of the system and the condition of existence of equilibrium points has been established here. The feasibility and local stability of the solutions about the interior equilibrium point has been investigated. Global dynamics of the co-existence of all the species are shown through the global stability of the interior equilibrium point. The center manifold theorem has been used to find the nature of the solution for the non-hyperbolic case and the direction of bifurcations is obtained by computing the first Lyapunov number. Some Bifurcation analyses are carried out in the neighborhood of the interior equilibrium point. Numerical simulation has been performed to establish the theoretical findings by using the MATLAB and finally some concluding remarks are given.

Keywords: Holling type-II functional response, Crowley-Martin senses functional response, Globally asymptotically stability, Hopf bifurcation, Center Manifold Theory

WORMHOLE SOLUTION AND ENERGY CONDITIONS IN $f(R)$ GRAVITY THEORY

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Abstract: This paper deals with static, spherically symmetric wormholes in $f(R)$ gravity theory. Exact wormhole solutions for $f(R)$ are found with anisotropic matter field and for some particular choices of the shape functions. For isotropic matter distribution it has been shown that wormhole solutions are possible for zero-tidal force. Finally, energy conditions are examined and it is found that all energy conditions are satisfied in particular domain with a particular choice of the shape function.

Key words: wormhole, modified gravity, exotic matter.

THE PROPAGATION OF HARMONIC PLANE WAVES IN A NONLOCAL THERMOELASTIC SOLID MEDIUM

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Abstract: The present paper deals with the investigation of the propagation of thermoelastic plane harmonic waves in a nonlocal thermoelastic medium. The Green and Naghdi theory II of generalized thermoelasticity with elastic nonlocal effect is adopted to address this problem. The problem of reflection of thermoelastic waves due to an incident coupled longitudinal elastic wave from the rigid and thermally insulated boundary of a homogeneous, isotropic nonlocal thermoelastic half-space is also studied. The amplitude ratios of the reflected waves are determined analytically. For a particular model, the effect of elastic nonlocality parameter on the variations of phase speeds, attenuation coefficients and amplitude ratios of the reflected waves is presented graphically and analysis of these results is given.

Keywords: Green and Naghdi theory II, Nonlocal, Attenuation, Reflection.

MATHEMATICAL MODELLING OF VISCOUS ACCRETION FLOW TOWARDS SUPERMASSIVE BLACK HOLE

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Abstract: In this article we investigate some properties of Dark Energy dominated accretion flow towards a Black hole or a compact object. We take the equation of state of Modified Chaplygin Gas as representative of Dark Energy to construct our model. We also incorporate viscosity by introducing Shakura-Sunyaev viscosity parameter. To avoid the complexity, arise with General Relativistic equations we consider Pseudo-Newtonian potential, introduced by Mukhopadhyay [1]. Here we show the variation of radial speed of the accreting matters [2] and sound speed with respect to the radial distance from the central Black Hole. We construct a C-programming for solving the hydrodynamical equations and use GNUPLOT for plotting.

Keywords: Dark Energy, Accretion disc, Black hole.

References:

[1] Mukhopadhyay, B.: - “Description of pseudo Newtonian potential of the relativistic accretion disks around Kerr black holes”, ApJ, 581 (2002) 427-430

[2] Dutta, S., Biswas, R., - “Fate of an accretion disc around a black hole when both the viscosity and dark energy is in effect”, Euro. Phys. J. C, (2017) 77:717

MODELING OF HEAT AND MASS TRANSFER IN NATURAL CONVECTIVE BOUNDARY LAYER FLOW OF A NANOFLUID OVER A VERTICAL FLAT PLATE

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Abstract: Effect of electrification of nanoparticles on heat and mass transfer in natural convective boundary layer flow of a Cu-water nanofluid past a vertical flat plate is investigated. Electrification mechanism considered in two component Buongiorno's model. The PDEs of flow field are transformed into a set of coupled ODEs which are solved with respect to transformed boundary conditions using MATLAB bvp4c solver. The effects of governing dimensionless parameters such as Electrification parameter, Thermophoresis parameter, Brownian motion parameter and buoyancy ratio on dimensionless velocity, temperature and nanoparticle concentration profiles examined graphically. The numerical results obtained for dimensionless skin friction, heat and mass transfer coefficients and it is noticed that both the heat and mass transfer coefficients enhance whereas the dimensionless temperature and concentration profiles reduce with increase in electrification parameter.

Keywords: nanofluid, heat and mass transfer, electrification, Buongiorno's model.

IMPROVED SIMILARITY MEASURE IN NEUTROSOPHIC ENVIRONMENT AND ITS APPLICATION IN FINDING MINIMUM SPANNING TREE

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Abstract: Minimum spanning tree finds its huge application in network designing, approximation algorithms for NP-hard problems, clustering problems and many more. Many research works have been done to find minimum spanning tree due to its various applications. But, till date very few research works are available in finding minimum spanning tree in neutrosophic environment. This paper contributes significantly by defining the weight of each network edge using single valued neutrosophic set (SVNS) and introduce a new approach using similarity measure to find minimum spanning tree in neutrosophic environment. Use of SVNS makes the problem realistic as it can describe the uncertainty, indeterminacy and hesitancy of the real world in a better way. We introduce two new and simple similarity measures to overcome some disadvantages of existing Jaccard, Dice and Cosine similarity measures of SVNSs for ranking the alternatives. Further from the similarity measures we have developed two formulas for the entropy measure proving a fundamental relation between similarity measure and entropy measure. The new entropy measures define the uncertainty more explicitly in comparison to other entropy measure existing in the literature which has been established using an example.

Keywords: Similarity measure, entropy measure, decision making, minimum spanning tree.

TWO PROOFS OF THE QUADRATIC RECIPROCITY LAW

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Abstract: We use two Mathematical Models for proving the Quadratic Reciprocity Law. One is Combinatorial Model due to C.F. Gauss and G. Eisenstein which involves counting in two ways the lattice points inside the rectangle in the Euclidean plane whose vertices are $(0,0)$, $(\frac{p}{2},0)$, $(0,\frac{q}{2})$ and $(\frac{p}{2},\frac{q}{2})$ and another is Linear Algebraic Model due to I. Schur which involves sign in the quadratic Gauss Sum.

Key Words: Legendre symbol, Quadratic Gauss Sum, Quadratic Reciprocity Law.

AN EXPLORATION ON MATHEMATICAL MODELLING FOR NANOFLUID SIMULATION

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Abstract: In this study, a mechanism of heat transport enhancement is proposed based on the cross coupling of thermal and electric transports in nanofluids. Nanofluids having ultrafine solid particles promise new working fluids for application in energy devices. Many studies have been conducted on thermophysical properties as well as heat and fluid flow characteristics of nanofluids in various systems. The main aim of this study is to present the latest developments and progress in the mathematical modeling of nanofluids flow. For this purpose, a comprehensive review of different nanofluid computational fluid dynamics (CFD) approaches is carried out. This study provides detailed information about the commonly used formulations as well as techniques for mathematical modeling of nanofluids.

Keywords: Nanofluid, Numerical simulation, single and two-phase methods

PLANE HARMONIC WAVES IN NONLOCAL THERMOELASTIC SOLID OF TYPE III

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Abstract: The generalized thermoelasticity theory based upon the Green and Naghdi model III of thermoelasticity as well as the Eringen's nonlocal elasticity model is used to study the propagation of harmonic plane waves in a nonlocal thermoelastic medium. We found two sets of coupled longitudinal waves which are dispersive in nature and experience attenuation. In addition to the coupled waves, there also exists one independent vertically shear-type wave which is dispersive but experiences no attenuation. All these waves are found to be influenced by the elastic non-locality parameter. The problem of reflection of the thermoelastic waves at the stress-free insulated and isothermal boundary of a homogeneous, nonlocal thermoelastic half-space has also been investigated. The formulae for various reflection coefficients are determined in various cases.

Keywords: Nonlocal elasticity, Plane harmonic waves, Dispersion, Attenuation, Reflection.

FIRST-PASSAGE TIME DISTRIBUTION OF NONLINEAR PERCOLATIVE RRTN MODEL

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Abstract: The Random Resistor cum Tunneling Network (RRTN) model allows the possibility of extra phenomenological (semi-classical) tunneling process into a classical RRN bond percolation model. We could identify two time-scales (*i.e.,* $\tau\ t, \tau\ s$) in the RRTN current dynamics, where only one of them is linearly independent (S. Bhattacharya, Physica A, v521, pp113, 2019**).** Recently, we have investigated on the bulk current dynamics in the first-passage (percolation) route where one may identify the first-passage time ($\tau\ b$) as an additional time-scale in this route. We showed that $\tau\ b$ is purely correlated on $\tau\ t$ and $\tau\ s$. (S. Bhattacharya, arxiv:2006.08699, 2020**)** In this presentation, we intend to study the First-passage time distribution for sufficient members of statistical ensemble. The first few moments of the distribution are calculated, from where we propose a finite-size scaling for them.

WATER WAVE PROPAGATION OVER AN INFINITE STEP IN THE PRESENCE OF A THIN VERTICAL BARRIER

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Abstract: Problems of water wave propagation over an infinite step in the presence of a thin vertical barrier of four different geometrical configurations are investigated in this paper. For each configuration of the barrier, the problem is reduced to solving an integral equation or a coupled integral equation of first kind involving horizontal component of velocity below or above the barrier and above the step. The integral equations are solved employing Galerkin approximation in terms of simple polynomials multiplied by appropriate weight functions whose forms are dictated by the edge conditions at the corner of the step and at the submerged end(s) of the barrier. The reflection and transmission coefficients are then computed and depicted graphically against the wave number.

Keywords: Water wave scattering, infinite step, integral equation, Galerkin approximation, reflection and transmission coefficients

ON ESTIMATION OF EXTENDED CHEN STRESS STRENGTH RELIABILITY MODEL WITH PROGRESSIVE CENSORING AND APPLICATIONS

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Abstract: Here, the estimation of the stress-strength reliability parameter $R = P(X > Y)$ of the extended Chen distribution based on progressive type-II censoring sample where X and Y are strength and stress independent random variables and have same distribution. The maximum likelihood, uniformly minimum variance unbiased and Bayes estimation methods are used to estimate the parameter R. We applied Lindley's approximation method for Bayes estimation of the unknown stress-strength parameter. In addition, importance sampling and the Gibbs within Metropolis-Hasting samples procedure are applied. For the purpose of the interval estimation, we propose asymptotic, bootstrap confidence intervals of the proposed estimator in the presence of both stress-strength parameter and progressive type-II censoring scheme. A Monte Carlo simulation study is carried out to compare the precision of the Bayes estimate of the unknown parameter. Two sets of practical data are analyzed for the illustration purpose.

Keywords: EM algorithm, Bayes estimates, Lindley's approximation, importance sampling, MH algorithm, confidence interval.

Normal Almost Contact Metric Manifolds Admitting Almost Ricci Soliton

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Abstract: The object of the present paper is to study almost Ricci solitons in a 3-dimensional non-cosymplectic normal a.c.m. We first prove that if in a 3-dimensional normal a.c.m the metric g admits almost Ricci soliton and V is pointwise collinear with ξ, then either the manifold is Sasakian or V is constant multiple of ξ and the manifold is an η-Einstein manifold, provided $\alpha, \beta = constant$. In converse case we prove that if a 3-dimensional non-cosymplectic normal a.c.m. manifold, with α, $\beta = constant$, is η −Einstein then almost Ricci soliton reduces to a Ricci soliton. Beside these the paper also includes that if a 3-dimensional non-cosymplectic normal almost contact metric manifold admits an almost Ricci soliton (g, ξ, λ) then the manifold is of constant scalar curvature. This paper concludes with some interesting corollaries and a remark.

Key-Words: Almost Ricci soliton, Normal almost contact metric manifolds, η −Einstein manifolds.

A GEO ENVIRONMENTAL ANALYSIS OF SOLID WASTE MANAGEMENT IN BERHAMPORE MUNICIPALITY, MURSHIDABAD DISTRICT, WEST BENGAL, INDIA

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Abstract: *This article plans to concentrate on such tricky situation of strong waste age, Poor administration framework in results in Berhampore Municipality, Murshidabad District, West Bengal. The issue is the result of fast unplanned urbanization, high populace development rate is 6.38% (in 2001-2011), and karma of city sense among tenants disregarding high education rate is 78.07% (2011). The volume of uncollected residential waste is about 104.37 tons/day in 2019 because of carelessness of administration. Significant locales of poor waste administrations are at vegetable market, agro-based enterprises, emergency clinic, Nursing home, neurotic focuses inescapable make a sullying mark on the Urban scene. Things or things that are never again important or don't have any further fall in the class of wastes (also named as refuse, trash, asylum, garbage and so forth). Toward the start of human progress, squanders were created in the types of bones or different pieces of creatures they chased for their nourishment or as wood they slice to make their trucks and so forth. Progression of human advancement with the ways of modern mechanical and social unrest has started an emotional change in the everyday way of life utilization design. Which is answerable for consistently expanding strong squanders differing in amount just as quality.*

Key words: *Municipal Solid waste, Waste management, Urban environment.*

(p,q) −ORDER AND (p,q) −LOWER ORDER OF ENTIRE FUNCTIONS OF SEVERAL COMPLEX VARIABLES ON THE BASIS OF CENTRAL INDEX

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Abstract: In this paper we show that (p,q) −order and (p,q) −lower order of an entire function of several complex variables can be express in term of its central index. Also, we give some estimate on growth of composite entire functions of several complex variables.

AMS Subject Classification (2010): 32A15; 32A22; 32H30:

Keywords: Entire function, central index, (p q)-order and (p,q) −lower order

UPPER AND LOWER BOUNDS FOR ESSENTIAL NORM OF DIFFERENCE OF COMPOSITION OPERATORS

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Abstract: Operator theory is an area of mathematics which attracts both pure and applied mathematicians in its vast area. Difference of Composition operators and difference of weighted concrete operators which have gained increasing attention during the last three decades, mainly due to the fact that they provide, just as for example, Hankel and Toeplitz operators, ways and means to link classical function theory to functional analysis and operator theory. The aim of this paper is considering properties and applications of Difference of composition operators between some spaces of holomorphic functions on the unit disk. In the present paper we are mainly concerned about the upper and Lower Bounds for Essential Norm of Difference of Composition Operators on the unit disk. We will also study examples on these spaces.

Keywords: Composition operators; difference of Composition operators, Upper and Lower Bounds, Essential norm.

AN ANALYTICAL APPROACH TO STUDY THE DRUG DIFFUSION THROUGH TRANSDERMAL DRUG DELIVERY SYSTEM

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Abstract: *Transdermal drug-delivery provides an adequate suitable route for oral drug delivery having a large number of benefits over other drug-delivery routes. For this purpose, mathematical modeling can provide detailed insights to study drug-diffusion through the transdermal drug-delivery system (TDDS). A mathematical model is developed to discuss this type of drug-delivery and drug-diffusion, with suitable initial and boundary conditions, which generalizes the work of several others in this regard. The domain(skin) of the problem is discretized into seven compartments and for each compartment and the corresponding interfaces, the model is solved using the analytical eigenvalue method with the help of Fourier-series method. The model results are simulated and presented graphically using the Wolfram MATHEMATICA software. Finally, the model simulations are compared with the experimental data to prove the efficiency of the model. The model has applications in biomedical and biophysical situations for the drug delivery through TDDS.*

DIJKSTRA'S ALGORITHM FOR SHORTEST PATH PROBLEM UNDER HESITANT FUZZY ENVIRONMENT USING HESITANT FUZZY BONFERRONI MEANS

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Abstract: Hesitant Fuzzy Set (HFS) has been a very popular and useful tool to express the uncertainty of Decision Makers (DM). In this paper, a well-known problem called the Shortest Path Problem (SPP) has been considered in an uncertain environment. The cost parameters for travelling each arc have been considered as Hesitant Fuzzy Numbers (HFN) which is the more generalized form of fuzzy numbers. A heuristic methodology for solving the SPP has been developed, which aim to exploit tolerance for imprecision, uncertainty and partial truth to achieve tractability, robustness and low cost solution corresponding to the minimum- cost path or the shortest path. The Modified Hesitant Fuzzy Dijkstra's Algorithm (MHFDA) has been proposed in this paper for solving Hesitant Fuzzy Shortest Path Problem (HFSPP) using Hesitant Fuzzy Bonferroni Means. A numerical example illustrates the effectiveness of the proposed method.

Keywords: Score function, Addition of two hesitant fuzzy numbers, Bonferroni Means.

IMPACT OF COVID-19 ON GLOBAL ECONOMY AND ENVIRONMENT DURING LOCKDOWN PERIODS

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Abstract: Coronaviruses are 120 Nano meter in diameter, Sigle-stranded group RNA virus. The coronaviruses were identified by a group of virologists in1968 in journal for the first time. Covid-19 endemic is a global concern, due to its high spreading and alarming fatality rate. Mathematical models can play a decisive role in mitigation the spread and predicting the growth of the epidemic. The ongoing corona pandemic 2019 is emerged as viral disease in Wuhan of China by the end of 2019 at first. Now Coronavirus is spread to about 213 counties in the world. The most powerful countries in terms health & wealth also could not leave themselves out from the cycle of the virus. In this article is to describe ongoing situation of Coronavirus and its impact on global economy and environment with an analysis the need for preparedness in future to combat such virus.

MACHINE LEARNING IN PORTFOLIO OPTIMIZATION

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Abstract: Last decades, a considerable progress has been made in the financial mathematics field. Financial optimization can be defined as generating the greatest revenue while minimizing input costs to achieve consistently higher profits in the short, medium and long-term, while simultaneously complying with relevant financial constraints. Portfolio is defined as a collection of investment assets. Portfolio Optimization is the process of selecting the best portfolio or asset distribution, out of the set of all portfolios being considered, according to some objective such as maximizes factors like expected return and minimizes costs like financial risk. Machine Learning algorithms offers a number of potential advantages over existing traditional prediction models on both accuracy and decision-making support. The Portfolio optimization model has limited impact in practice due to estimation issues when applied with real data. To address this, we adapt the Machine Learning methods: Regularization to enhance prediction accuracy for portfolio optimization. Here, we introduce Performance Based Regularization (PBR), where the idea is to constrain the sample variances of the estimated portfolio risk and return, which steers the solution towards one associated with less estimation error in the performance. We consider PBR for both mean variance and mean conditional value at risk (CVaR) problem. We show that the PBR model establish asymptotic optimality of both simple average approximation (SAA) and PBR solution and the corresponding efficient frontiers.

Keywords: Machine Learning, Portfolio Optimization, Regularization, Risk Measure, Mean Variance, Mean Value At risk (CVaR), asymptotic optimality.

INSCRIPTION ON STATISTICAL CONVERGENCE OF ORDER α

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Abstract: In this article we recall a remarkable result stated as "For a fixed $\alpha, 0 < \alpha \leq 1$, the set of all bounded statistically convergent sequences of order α is a closed linear subspace of m (m is the set of all bounded real sequences endowed with the sup norm)" by Bhunia et al. (Acta Math. Hungar. 130 (1-2) (2012), 153–161) and to develop the objective of this perception we demonstrate that the set of all bounded statistically convergent sequences of order α may not form a closed subspace in other sequence spaces. Also, we determine two different sequence spaces in which the set of all statistically convergent sequences of order α (irrespective of boundedness) forms a closed set.

Keywords: Statistical convergence of order α, Hilbert-Cube space, Fréchet Sequence Space.

MATHEMATICAL MODELING IN NETWORK ANALYSIS

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Abstract: In this paper, an attempt has been made to investigate the critical path and least time taken to complete a project in network analysis in a real life problem using the basic concept of graphs and tables in mathematical modeling. Here a relationship between float and critical path has also been investigated. Forward and backward pass method is used to carry out the investigation. So, our analysis showed a strong relationship between float and critical path. Overall a conclusion has been made that by prioritizing the different tasks using critical path, time, money and many other resources can be minimized in a project.

AGRI-WAREHOUSE MANAGEMENT – A CONCEPTUAL MODEL

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Abstract: India's agriculture sector contributes 16% to the GDP. Presently, 58% of the country's population depends on agriculture as the primary source of livelihood. India has emerged as 7th largest exporter of agricultural commodities across the world. With the rise in Agri-production the need of proper warehouse management also increases. Census shows that majority of produce get wasted due to lack of technology at the post-harvest time and poor warehouse management. The marked deterioration of food grains caused due to poor infrastructural facilities is 10-40% of the total agricultural production. Thus, the focus of the study is to formulate a conceptual warehouse mathematical model that deals with to minimize the losses depending upon the nature of crops. Complexity of the model increases if organically produced crops were considered due to their shorter life span.

Keywords: warehouse management, food production, conceptual model, challenges

ON DIFFERENT PHENOMENON OF (α, β) −PYTHAGOREAN FUZZY SUBGROUPS

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Abstract: A Pythagorean fuzzy set (PFS) is a very efficient and powerful tool for handling uncertainty. In this presentation, we defined the notion of (α, β) − Pythagorean fuzzy set (PFS) as a generalisation of Pythagorean fuzzy set (PFS). We propose a new fuzzy subgroup, called (α, β) −Pythagorean fuzzy subgroup (PFSG). We investigate various properties of our proposed fuzzy subgroup. We present the concept of (α, β) −Pythagorean fuzzy coset (PFC) and (α, β) −Pythagorean fuzzy normal subgroup (PFNSG). Furthermore, we discuss the effectiveness of (α, β) −Pythagorean fuzzy set (PFS) over other fuzzy environments.

Keywords: Pythagorean fuzzy set, (α, β) −Pythagorean fuzzy set, (α, β) −Pythagorean fuzzy subgroup.

A COMPARATIVE STUDY OF PHYSICAL, PHYSIOLOGICAL AND ANTHROPOMETRICAL PROFILE OF YOUNG MALE TRIBAL AND NONTRIBAL FOOTBALLERS

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ABSTRACT: Tribal population constitutes about 8.6% of the total population of India. India is a dwelling place of almost more than half of the world's tribal population. In India, till date several tribal communities are widely distributed throughout the geographical extent. Tribals in India have to struggle hard for their survival and development. The main objective of our current study was to assess different physical, physiological and anthropometrical components of Indian amateur male tribal and nontribal footballers. The study was conducted on total $(n = 20)$ male football players; out of which 10 tribal and 10 nontribal of Sports Authority of India (SAI), Kolkata and Cuttack. Mineral content of nontribal footballers was significantly higher than that of tribal population were respectively 4.75 ± 0.51 and 2.57 ± 0.37 kg. Muscle mass, glycogen content and relative back strength were significantly higher in tribal than that of non-tribal footballers and were respectively 27.32 ± 3.29 kg, 459.8 ± 63.95 gm, 2.2 ± 0.33 and 24.32 ± 3.4 kg, 417.1 ± 28.96 gm., 1.5 ± 0.16. The findings of the present study showed that tribal footballers were found to be more muscular having higher relative back strength as compared to their nontribal counterparts. These physical and physiological differences could be due to the genetically predisposed.

Key Words: Tribal; Non-tribal; Football; Anthropometry; Physiological profiles.

SPRUCE BURDWORM MODEL WITH AND WITHOUT DELAY

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ABSTRACT: In this paper I analyse a spruce Budworm model to understand the dynamic of spruce budworm which is very important for the protection of spruce and fir trees of Canada and Northern Minnesota (also in resent time Indian Himalayan range forest). We derived a delay differential equation from the system, and is validated by comparing with the data. This model designed to identify the critical factor that effect the Budworm population dynamics. The effect of budworm population growth also yields the loss in wood industry by irruptions done by budworm. I formulate the mathematical model to find out the steady state and the existence of the steady state. The bifurcation analysis and the hysteresis effect of the model has been discussed. Analysis of the equilibrium stability and examination of amplitudes and periodic oscillations are conducted, and the effect of the Budworm control, immature population control and predation by the birds are assessed.

Keywords: Mathematical modelling, Dynamical System, Steady state, Equilibrium