

DIBRUGARH UNIVERSITY

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**FACULTY OF
SCIENCE AND ENGINEERING**

Research Publications in Journals

1. N. Dehingia, P.Gogoi and P. Dutta, *Ag nanoparticle enhanced radiative behaviour of Eu³⁺ ions in sol-gel silica matrix*, CERAMICS INTERNATIONAL-ELSEVIER 47, 23404-23412 (2021).

Abstract:

AgNP doped Eu SiO₂ glasses were prepared by the sol-gel method with fixed Eu³⁺ and varying Ag concentrations. The samples have been characterized structurally by XRD, SEM, EDX and TEM. The effects of incorporation of AgNPs on the radiative properties of the Eu³⁺ in SiO₂ matrix are studied with the help of Absorption and Photoluminescence Spectroscopy. Various radiative parameters like oscillator strength, Judd Ofelt intensity parameters, spontaneous emission probabilities, branching ratio, radiative lifetime, emission cross-section etc. are calculated from the observed absorption and photoluminescence spectra using Judd Ofelt theory, whereas the experimental lifetime of ⁵ D₀ state of Eu³⁺ ion and colour chromaticity is estimated from lifetime and CIE 1931 colour chromaticity measurements. The observed enhancement in the absorption and emission intensities of Eu³⁺ ions are elucidated in the light of enhanced local field in the vicinity of the AgNPs due to the LSPR effect and also the network modifying role of AgNPs.

2. Dibya Jyoti Borah, A.T.T. Mostako, and A. Malakar, *Tailoring the crystalline phase and size of the MoO₃ quantum dots via sonication induced modified top-down method*, J. ALLOYS COMPD. 891, 161870 (2021).

Abstract:

In this paper, a modified top-down method is adopted to synthesize highly stable and water-soluble Molybdenum trioxide quantum dots (MoO₃ QDs) without any surfactants. In this sonication induced modified method, commercial Molybdenum Oxide powder and Hydrochloric acid were used as the precursor and etchant, respectively. The impact of sonication bath temperature on the morphological, microstructural, size, crystal-structural, and optical properties of MoO₃ QDs have been systematically investigated. The controlled sonication bath temperature during the synthesis process results in the tunability of the QDs. The mechanism behind the

controlled size of the QDs deeply rooted in the acoustic cavitation phenomenon. The synthesized QDs exhibit poly-crystallinity with mixed phases: orthorhombic (α -MoO₃) and hexagonal (h-MoO₃). Interestingly, the complete elimination of the hexagonal phase from the QDs has been observed as a function of sonication bath temperature.

3. Rituparna Hazarika, Bulumoni Kalita, *Elucidating the Therapeutic Activity of Selective Curcumin Analogues: DFT Based Reactivity Analysis*, STRUCTURAL CHEMISTRY, 32, 1717(2021).

Abstract:

Density functional theory (DFT) has been employed to study the structure, stability and reactivity of curcumin and some of its important analogues by computing HOMO-LUMO energy gap (H-Lgap), ionisation potential (IP), electron affinity (EA), chemical potential (μ), chemical hardness (η), electrophilicity index (ω) and density of states (DOS). In this study, curcumin is found to be more reactive in dimethyl sulfoxide (DMSO) solvent than in the gas phase in both of its *enol* and *keto* isomeric forms. Next, reactivities of the *keto* based curcumin analogues are found to follow the order of 1,5-bis(3,4-dimethoxyphenyl)penta-1,4-dien-3-one (GO-035) > 1,5-bis(3,4,5-trimethoxyphenyl)penta-1,4-dien-3-one (GO-Y016) > 1,5-bis[3,5-bis(methoxymethoxy)phenyl]penta-1,4-dien-3-one (GO-Y031) > 1,5-bis[3,5-dimethoxy-4-(methoxymethoxy)phenyl]penta-1,4-dien-3-one (GO-Y030) > dibenzalacetone (DBA) in both gas and DMSO solvent phases. However, there is enhancement in reactivities of the complexes in DMSO solvent from those in gas phase. The reactivity order is observed on the basis of H-L gap, IP, μ , η and DOS analyses. Moreover, GO-Y030, GO-Y031 and DBA possess similar electrophilic behaviours as indicated by their comparable EA and ω values, while GO-Y016 and GO-035 behave as the strongest and the weakest electrophiles. Further, nature of the reactive sites in the curcumin analogues have been identified via local reactivity descriptors and the molecular electrostatic potential (MEP) maps, results of which are consistent with the molecular orbital analyses.

4. Dhruva Jyoti Gogoi and Umananda Dev Goswami, *Quasinormal Modes of Black Holes with Non-Linear-Electrodynamic sources in Rastall Gravity*, PHYSICS OF THE DARK UNIVERSE 33, 100860 (2021).

Abstract:

One of the notable modifications of General Relativity (GR) is the Rastall gravity. We have studied the quasinormal modes of black holes in Rastall gravity in presence of non-linear electrodynamic sources. Here the impacts of cosmological field, dust field, phantom field, quintessence field and radiation field on the quasinormal modes in presence of electrodynamic sources have been investigated. Apart from this, we have also checked the dependency of quasinormal modes with the Rastall parameter λ , black hole structural constant N and charge of the black hole Q . The study shows that the quasinormal modes corresponding to the black hole with non-linear electrodynamic sources show significant deviations from a general charged black hole in Rastall gravity under certain conditions. Further, the behaviour of black holes and hence the quasinormal modes depend on the type of surrounding field considered.

5. Jyatsnasree Bora and Umananda Dev Goswami, *Radial oscillations and gravitational wave echoes of strange stars for various equations of state*, MONTHLY NOTICES OF THE ROYAL ASTRONOMICAL SOCIETY 502, 1557 (2021).

Abstract:

We study the radial oscillations of non-rotating strange stars (SSs) and their characteristic echo frequencies for three equations of state (EoS), viz., MIT Bag model EoS, linear EoS, and polytropic EoS. The frequencies of radial oscillations of these compact stars are computed for these EoSs. In total, 22 lowest radial frequencies for each of these three EoSs have been computed. First, for each EoS, we have integrated Tolman-Oppenheimer-Volkoff equations numerically to calculate the radial and pressure perturbations of SSs. Next, the mass-radius relationships for these stars are obtained using these three EoSs. Then the radial frequencies of oscillations for these EoSs are calculated. Further, the characteristic gravitational wave echo frequencies and the repetition of echo frequencies of SSs are computed for these EoSs. Our numerical results show that the radial frequencies and also echo frequencies vastly depend on the model and on the value of the model parameter. Our results also show that the radial frequencies of strange stars are maximum for polytropic EoS in comparison to MIT Bag model EoS and linear EoS. Moreover, SSs with MIT Bag model EoS and linear EoS are found to emit gravitational wave echoes. Whereas, SSs with polytropic EoS are not emitting gravitational wave echoes.

6. Dhruva Jyoti Gogoi and Umananda Dev Goswami, *Gravitational Waves in $f(R)$ Gravity Power Law Model*, INDIAN JOURNAL OF PHYSICS (January, 2021).

Abstract:

We investigate the different polarization modes of gravitational waves in $f(R)$ gravity power law model in de Sitter space. It is seen that the massive scalar field polarization mode exists in this model. The mass of the scalar field depends highly on the background curvature and the power term n . However, we found that the model does not exhibit a massive scalar mode for $n = 2$ and instead, it shows a breathing mode in addition to the tensor plus and cross modes. Thus, mass of the scalar field is found to vary with n within the range $1 \leq n \leq 2$.

7. Chandan Duarah, *$\mu - \tau$ reflection symmetry in the standard parametrization and contributions from charged lepton sector*, PHYSICS LETTERS B 815, 136119 (2021).

Abstract:

The $\mu - \tau$ reflection symmetry of the lepton mixing matrix accommodates maximal atmospheric mixing ($\theta_{23} = \pi/4$) as well as maximal Dirac CP phase ($\delta = \pm\pi/2$) for the Dirac case. In the standard parametrization of the PMNS matrix the reflection symmetric nature is not directly visible while substituting the maximal values of the mixing parameters. This issue has been addressed in this paper. It is found that the reflection symmetry in the 'standard' PMNS matrix can be restored by allowing maximal values of the Majorana CP phases (α, β) as well, along with maximal δ . To accommodate non-maximal values of θ_{23} and δ we consider charged lepton contributions to the neutrino mixing and implement the proposed scheme of reflection symmetry in the neutrino mixing matrix. The charged lepton correction scheme succeeds in the prediction of lepton mixing parameters consistent with the global 3ν oscillation data.

8. Naba Jyoti Gogoi and Prabwal Phukon, *Thermodynamic geometry of 5D R-charged black holes in extended thermodynamic space*, PHYSICAL REVIEW D 103, 126008 (2021).

Abstract:

We study a five-dimensional R-charged black hole in extended thermodynamic space. Here, we consider pressure and volume as conjugate thermodynamic variables. We begin with a thermodynamic study based on Maxwell's equal area rule and then compute the Ruppeiner scalar curvature for a number of different charge combinations. We mainly focus on three characteristic cases: an R-charged black hole with three equal charges, two equal charges, and three unequal charges. Based on our analysis, we make an attempt to relate the Ruppeiner scalar curvature with the phase structure of the black hole.

9. Hazarika, R., Garg, A.; Chetia, S.,Phukan, P.; Kulshrestha, A.; Kumar, A.; Bordoloi, A.; Kalita, A. J.; Guha, A. K.; Sarma, D., *Magnetically Separable ZnFe₂O₄ Nanoparticles: A Low Cost and Sustainable Catalyst for Propargyl Amine and NH-Triazole Synthesis*, APPLIED CATAL A: GENERAL, 625, 118338 (2021).

Abstract:

The multicomponent reaction (MCR) strategy for the construction of important molecular scaffolds is in trending nowadays and among them, A³-coupling stands in a significant position. Aldehyde, amine and alkynes are coupled in this particular reaction via C-H activation process. Herein, we have reported zinc ferrite nanoparticles as magnetically separable heterogeneous catalyst for A³-coupling reaction with attractive attributes like excellent productivity, selectivity and better reusability. Moreover, the catalyst can also be effectively applied for the synthesis of various NH-triazoles with quantitative yields of the products. A plausible mechanism has been proposed for the synthesis of NH-triazoles followed by validation with computational study.

10. Phukan, P.; Kulshrestha, A.; Kumar, A.; Chakraborti, S.; Chattopadhyay, P.; Sarma, D., *Cu(II) ionic liquid promoted simple and economical synthesis of 1,4-disubstituted-1,2,3-triazoles with low catalyst loading*, J. CHEM. SCI. 2021 (accepted manuscript, in press).

Abstract:

In this work, we have described a very simple and low metal loading copper based ionic liquid as solvent and catalyst for regioselective synthesis of 1,4-disubstituted 1,2,3-triazoles. The proposed protocol proved its efficiency by showing excellent tolerance to a large array of electronically diverse substrates without the use of external base, solvent and ligands. Moreover, from cytotoxicity analysis the catalyst was found to be non-toxic in nature due to extremely low loading of copper metal (0.1 mol %).

11. Phukan, P.; Chetia, R.; Boruah, R.; Konwer, S.; Sarma, D., *Fabrication of polypyrrole/Cu(II) nanocomposite through liquid/liquid interfacial polymerization: A novel catalyst for synthesis of NH-1,2,3-triazoles in PEG-400*, MATERIAL ADV. 2021 (accepted manuscript, in press).

Abstract:

In the present paper, we have reported the synthesis and application of polypyrrole (PPy)/Cu(II) nanocomposite as an efficient heterogeneous catalyst for synthesis of 4-aryl-NH-1, 2,3-triazoles. The nanocomposite was prepared via liquid/liquid interfacial polymerization where copper and initiator (FeCl₃) were dispersed in the aqueous phase and the monomer was dissolved in the organic phase. The synthesized sample was characterized by Fourier transform infrared

spectroscopy (FTIR), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), X-ray diffraction (XRD), transmission electron microscopy (TEM) and inductively coupled plasma atomic emission spectroscopy (ICP-AES). Spectroscopic analyses showed successful incorporation of Cu in the polymer matrix and the decoration of copper nanoparticles within the PPy matrix was observed from the morphological analysis. Herein, we have developed a simple one-pot, multi component system using PPy/Cu catalyst for synthesis of NH-triazoles. Keeping in view the principles of green chemistry, the reactions were performed in low-cost and environment friendly solvent polyethylene glycol 400 (PEG 400). A very low loading of copper (0.01 mol %) catalyzed the reaction very efficiently with excellent yield of the desired product. Furthermore, the catalytic system can be recovered and recycled up to 5th consequent cycles maintaining its catalytic activity with excellent yields of triazoles. To the best of our knowledge no previous work has been reported for synthesis of 4-aryl-NH-1,2,3-triazoles using this efficient novel catalyst.

12. Phukan, P.; Sarma, D., *Synthesis of Medicinally Relevant Scaffolds- Triazoles and Pyrazoles in Green Solvent Ionic Liquids*, CURR. ORG. CHEM., 25, 1523-1538 (2021).

Abstract:

The use of natural and environment-friendly energy sources for the betterment of the living society has become an active concern in both government and public sectors. Due to this, responsible use of global resources has become a growing concern among people. Similarly, in the chemical industry especially in pharmaceutical fields, there is constant pressure in reducing hazardous organic solvents and environmentally detrimental laboratory materials. The use of ionic liquids for the efficient synthesis of a wide array of fundamentally important structural motifs has gained tremendous importance in the scientific era. In this review, the synthesis of two such medicinally relevant moieties, namely, triazole and pyrazole, in a green and sustainable ionic liquid have been discussed.

13. Garg, A.; Hazarika, R.; Dutta, N.; Dutta, B. Sarma, D., *Bio-waste derived catalytic approach towards NH-1,2,3-triazole synthesis*, CHEMISTRYSELECT, 6, 7266-7270(2021).

Abstract:

A bio-waste derived catalyst towards the synthesis of 4-arylNH-1,2,3-triazole is reported. Curd whey is the major byproduct produced from dairy industry which is mostly discarded to water or used as fertilizer and animal feed after drying. Here, whey is used as an efficient bio-waste derived catalyst for straight forward synthesis of NH-1,2,3-triazoles under very mild condition. Current method is highly versatile, inexpensive, offers various NH-1,2,3-triazoles in good to

excellent yields. The solvent-catalyst combination can be effectively reused up to 4th consecutive cycles without significant loss in its catalytic efficiency.

14. Elnagdy, H.; Gogoi, N. G.; Handique, J. G.; Sarma, D., *CuO-NPs/TFA: A new catalytic system to synthesize a novel series of pyrazole imines with high anti-oxidant properties.*, BioNanoSci. 2021 (Accepted, in press).

Abstract:

We report here the synthesis of a novel series of pyrazole analogs involving the condensation reaction between 5-amino-1H-pyrazole-4-carbonitrile derivatives and carbonyl compounds. The reactions proceeded in acidic media, and were catalyzed by copper oxide nanoparticles (CuO-NPs) which were synthesized under green condition. The tea leaves extract served as green reducing agent for the conversion of copper nitrate to CuO-NPs. The developed methodology afforded the desired products up to 90% yields in 6 h. The newly synthesized compounds were tested for antioxidant properties. Out of 15 newly developed pyrazole compounds, 11 showed better antioxidant activity than the standard antioxidant drug Trolox.

15. Dutta, B.; Garg, A.; Phukan, P.; Kulashetra, A.; Kumar, A.; Sarma, D., *Designing a new basic ionic liquid [DHIM][OH] as a task specific bifunctional catalyst for facile microwave assisted metal free synthesis of 5-amino-1,2,3-triazoles*, New J. Chem., 45, 12792-12797(2021).

Abstract:

A green protocol for the synthesis of a series of 5-amino-1,2,3-triazoles from benzyl cyanide and phenyl azide derivatives catalyzed by the novel bifunctional ionic liquid [DHIM][OH] under microwave irradiation has been developed. The bifunctional ionic liquid which acts as a catalyst can be accessed through rapid preparation *via* incorporation of microwave irradiation. To the best of our knowledge, the present approach is the first method to employ an organocatalyst under microwave irradiation to access rapid assembly of 5-amino-1,2,3-triazoles under mild conditions. Furthermore, small *E*-factor values associated with the products confirm greener attributes of the current protocol.

16. Rajput, M.; Konwar, M.; Sarma, D., *Preparation of a Novel Environmentally Friendly Hydrophobic Deep Eutectic Solvent ChCl-THY and its Application in Removal of Hexavalent Chromium from Aqueous Solution*, Water Environ. Res., 2021. (Accepted manuscript, in press).

Abstract:

A liquid–liquid extraction methodology was developed for the removal of Cr(VI) from contaminated water using a novel green hydrophobic deep eutectic solvent (DES) as an efficient sole extracting agent. The hydrophobic DES was obtained by mixing choline chloride and thymol in 1:4 molar ratio at 70°C for 10 min and was denoted as ChCl-THY(1:4). The ChCl-THY(1:4) works efficiently for removal of high (20 mg/L) and low (500 µg/L) concentration of Cr(VI) from artificially contaminated natural water with >95% extraction efficiency (E%) at optimized reaction conditions (pH 2–6, 40°C). The DES was characterized by ¹H NMR and FTIR spectroscopy, and the data suggest that interaction occurs between Cl⁻ ion of choline chloride and H atoms of thymol molecules. Physicochemical properties such as density, melting point, moisture, and solubility were studied and discussed. Herein, no sharp melting point was observed for ChCl-THY(1:4) in DSC curve. DES was regenerated using 0.1 M NaOH as stripping agent, and 50%–60% extraction efficiency could be attained in the next cycle. A plausible mechanism of interaction between Cr(VI) species and DES was also explored with the help of FTIR spectroscopy.

17. Agarwal, S.; Phukan, P.; Sarma, D.;Deori, K., *Versatile precursor dependent copper sulfide nanoparticles as multifunctional catalyst for photocatalytic removal of water pollutants and synthesis of aromatic aldehydes and NH-triazoles*, Nanoscale Advances, 3, 3954-3966(2021).

Abstract:

A series of copper sulfide (CS) nanoparticles (NPs) were synthesized just by varying the amount of the sulfur precursor and have been explored for the first time as a three-way heterogeneous catalyst in the photocatalytic oxidation of a number of aromatic alcohols, photocatalytic degradation and the reduction of water pollutants, and the facile synthesis of pharmaceutically important moiety 4-aryl-NH-1,2,3-triazoles. The green and novel protocol was successfully developed for the synthesis of covellite (CuS, Cu²⁺) and the covellite-villamaninite (CuS–CuS₂) (copper in Cu²⁺, Cu¹⁺) phases of copper sulfide, employing EDTA both as the chelating and capping agent *via* a simple precipitation method at room temperature using water as the solvent. A blue shift in the absorption spectra and band gap in the range of 2.02–2.07 eV prompted the investigation of the as-synthesized CS nanoparticles as the photocatalyst under visible light irradiation. In the absence of any oxidizing or reducing agent, covelliteCuS nanoparticles showed the highest photocatalytic efficiency for the degradation of methylene blue (MB) and the reduction of carcinogenic and mutagenic Cr(VI) to non-toxic Cr(III). Interestingly, the mixed phase of CS (CuS–CuS₂), where Cu is present in both +1 and +2 oxidation states, was found to be the most efficient catalyst compared to CuS toward the visible light-mediated selective oxidation of various benzyl alcohols to their corresponding aldehydes. However, in the synthesis of substituted NH-1,2,3-triazoles, single-phase CS nanoparticles (*i.e.*, CuS) provided the best catalytic result. This significant outcome certainly opens up the scope for realizing the present demand of low-cost multifunctional semiconductor nano-materials, which will have a huge impact on the economy and environment when they show more than two potential applications.

18. Garg, A.; Borah, N.; Sultana, J.; Kulashetra, A.; Kumar, A.; Sarma, D., *Silica immobilized CuNHC: An effective route to 1,2,3-triazoles via azide-alkyne cycloaddition and multicomponent click reaction*, Appl. Organomet. Chem., 35, e6298(2021).

Abstract:

A new silica supported copper N-heterocyclic carbene (Cu-NHC@SiO₂) complex is prepared and characterized by scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX) and X-ray photoelectron spectroscopy (XPS) analyses. This complex is an efficient and easily retrievable catalyst for 1,2,3-triazole synthesis through direct azide-alkyne cycloaddition reaction as well as one-pot reaction using arylboronic acids. This catalytic system is also suitable for synthesis of 4-aryl-NH-1,2,3-triazoles from diverse benzaldehydes. Further, the catalyst can efficiently be recycled up to fifth cycle for all the three methods of 1,2,3-triazole synthesis through direct azide-alkyne cycloaddition and multi-component reactions.

19. Dutta, A.; Trivedi, P.; Gogoi, D.; Chetia, P.; Chaturvedi, V.; Sarma, D., *Anti-TB Evaluation of Novel 2,3-Dihydroquinazolin-4(1H)-Ones and in Silico Studies of The Active Compounds*, Med. Chem. Res., 30, 1366–1376(2021).

Abstract:

In vitro anti-tubercular activity of a series of 15 novel 2,3-dihydroquinazolin-4(1H)-one analogues were evaluated against Mycobacterium tuberculosis H37Ra (ATCC 25177 strain). Among the series, seven compounds showed moderate to good anti-TB activity with minimum inhibitory concentration (MIC) values ranging from 25.0–12.5 µg/mL. Further, in silico experiments were carried out to identify the probable ligand-protein interaction. Molecular docking of the target compounds into the active site of enzymes 1DQY Antigen 85C from Mycobacterium Tuberculosis and 2NSD Enoyl Acyl Carrier Protein Reductase reveals notable information on the possible binding interactions.

20. Dutta, A.; Garg, A.; Borah, J.; Borah, R.; Sarma, D., *Deep eutectic solvent mediated controlled and selective oxidation of organic sulfides and hydroxylation of arylboronic acids*, Current Res. Green Sustainable Chem., 4, 100107(2021).

Abstract:

A mild and efficient protocol has been developed for the controlled oxidation of wide variety of organic sulfides to corresponding sulfoxides using deep eutectic solvent (DES) as catalyst and hydrogen peroxide as oxidant under ambient condition. In presence of benzyl alcohols along with sulfides, DES selectively oxidizes only the sulfides to corresponding sulfoxides. The DES is

prepared by using zirconium oxychloride and urea (1:5 M ratio) which is thermally stable up to 213°C. The prepared DES can also be effectively applied for hydroxylation of arylboronic acids without using any additional catalyst and solvent.

21. Rajput, M. K.; Konwar, M.; Sarma, D. , *Ultrasonication Assisted Chelating Ligand Free Extraction of Pb(II) from Aqueous Solution by Using Room Temperature Ionic Liquids*, Int. J. Environ. Sci. Technol. 2021. (Accepted manuscript, in press).

Abstract:

This work aims to study the extraction of Pb(II) from contaminated aqueous solutions using imidazolium-based room temperature ionic liquids as sole extracting agent, i.e., without using any chelating agent and mixing agent. Secondly, ultrasonication technique is employed first time, to facilitate the swift contact of potentially toxic metal ions present in aqueous solution with ionic liquid. Furthermore, various salting-out agents were investigated to reduce the leaching of ionic liquid (IL) cations into aqueous phase upon extraction of toxic metal ion. >90% of Pb(II) was removed from artificially contaminated aqueous solution using 100 mg of IL in 6 min sonication time. Moreover, the used ionic liquid was proved to be selective for Pb(II) in real water conditions. MgSO₄ salt at 1.0 M concentration found to be superior salting-out agent without having any adverse effect on the extraction efficiency. Determination of total dissolved organic carbon in treated aqueous solution was used as potential tool to propose the mechanism of metal ions transfer to ionic liquid phase from aqueous solution. This study shows that ultrasonication-assisted extraction of potentially toxic lead metal ion from aqueous system using imidazolium-based ionic liquids as sole extracting agent followed by the application of salting-out agents to reduce the release of IL cations in aqueous phase offers great potential for practical application.

22. Dutta, A.; Sarma, D., *Base promoted metal-free approach towards synthesis of quinazolin-4(3H)-ones and 2,3-dihydroquinazolin-4(1H)-ones under microwave irradiation*, Sus. Chem. Pharm., 20, 100402 (2021).

Abstract:

A metal, solvent and oxidant free approach has been developed for the synthesis of quinazolin-4(3H)-ones in a concise and convergent fashion under microwave irradiation. Using the same metal free catalyst 2,3-dihydroquinazolin-4(1H)-ones were also synthesized in water as green and sustainable solvent. Starting from 2-aminobenzonitriles and carbonyls, the desired products were isolated in good to excellent yields. These protocols provided a simplistic and an expeditious approach for the assembly of diverse structural quinazolinones.

23. Chetia, M.; Konwar, M.; Pegu, B.; Konwar, S.; Sarma, D., *Synthesis of copper containing polyaniline composites through interfacial polymerisation: An effective catalyst for Click reaction at room temperature*, J. Mol. Structure, 1233, 130019 (2021).

Abstract:

Polyaniline (PANI) supported Cu (Cu/PANI) catalyst served as an efficient heterogeneous catalyst for the regioselective synthesis of 1,4-disubstituted-1H-1,2,3-triazoles via click chemistry approach. Herein, we have illustrated the development of two copper based heterogeneous catalysts using PANI as solid support through interfacial polymerization method. The catalysts can be easily recycled and reused resulting excellent yields of the triazoles. The main advantages of the protocol are ease of preparation, heterogeneous nature of the catalysts, use of water as a co-solvent and room temperature reaction conditions. In this paper, three different protocols have been described for the synthesis of 1H-1,2,3-triazoles using our developed Cu-PANI catalysts.

24. Dutta, A.; Trivedi, P.; Kulashetra, A.; Kumar, A.; Chaturvedi, V.; Sarma, D., *Sustainable Parts-Per-Million Level Catalysis with Fe(III): One-pot Cascade Synthesis of 2,3-Dihydroquinazolin-4(1H)-ones in Water*, *Applied Organomet. Chem*, 35, e6116(2021).

Abstract:

A silica-supported iron complex has been identified as a highly active and reusable catalyst for the synthesis of medicinally important 2,3-dihydroquinazolin-4(1H)-ones. The catalyst was fully characterized by various spectroscopic analyses such as Fourier-transform infrared spectroscopy (FT-IR), ultraviolet-visible (UV-VIS), scanning electron microscopy (SEM), scanning electron microscopy with energy-dispersive X-ray spectroscopy (SEM-EDX), energy-dispersive spectroscopy (EDS) mapping, X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), electron paramagnetic resonance (EPR), inductively coupled plasma atomic emission spectroscopy (ICP-AES), elemental analysis, Brunauer-Emmett-Teller (BET) isotherm and thermogravimetric analysis (TGA) analysis. A diverse library of 2,3-dihydroquinazolin-4(1H)-ones including some new analogues were successfully synthesized in good to excellent yields with parts-per-million (ppm) levels of Fe using water as a solvent. The active catalyst has high turnover number (TON) and turnover frequency (TOF) at the optimized condition, which were 30,087 and 30,087 h⁻¹, respectively. Ppm level catalysis, wide substrate scope, shorter reaction time, reusability of the catalyst, green solvent media and gram-scale synthesis make this protocol eco-friendly and sustainable.

25. Konwar, M.; Sarma, D., *Advances in Developing Small Molecule SARS 3CLpro Inhibitors as Potential Remedy for Corona Virus Infection*, *Tetrahedron*, 77, 131761 (2021).

Abstract:

Originated in China, coronavirus disease 2019 (COVID-19)- the highly contagious and fatal respiratory disease caused by SARS-CoV-2 has already infected more than 29 million people worldwide with a mortality rate of 3.15% (according to World Health Organization's (WHO's) report, September 2020) and the number is exponentially increasing with no remedy whatsoever

discovered till date. But it is not the first time this infectious viral disease has appeared, in 2002 SARS-CoV infected more than 8000 individuals of which 9.6% patients died and in 2012 approximately 35% of MERS-CoV infected patients have died. Literature reports indicate that a chymotrypsin-like cystein protease ($3CL^{pro}$) is responsible for the replication of the virus inside the host cell. Therefore, design and synthesis of $3CL^{pro}$ inhibitor molecules play a great impact in drug development against this COVID-19 pandemic. In this review, we are discussing the anti-SARS effect of some small molecule $3CL^{pro}$ inhibitors with their various binding modes of interactions to the target protein.

26. Satter Rohman, and Rahul Kar, *Sandwich complexes of Ruthenium, and Osmium with group 13 analogues of N-Heterocyclic carbene ligands: Efficient future compounds to reduce carbon monoxide poisoning*, Computational and Theoretical Chemistry 1198, 113179-113186 (2021).

Abstract:

In the present work, sandwich complexes have been designed in line with a recent report [J. Organomet. Chem.863 (2018), 54–59]. The electronic and thermodynamic properties of newly designed complexes are compared with ruthenocene ($RuCp_2$), and osmocene ($OsCp_2$). Such complexes are found to have sufficient stability in comparison to their corresponding metallocenes. Binding energy, and heterolytic bond dissociation energy of these complexes increase, with respect to the ‘ene’ centre, as we move from top to bottom along the group. Substitution of electron-donating moieties on these complexes increases their binding energy. Further, such complexes are investigated for application in reducing CO poisoning. Boron containing complexes can favorably bind CO molecules. Finally, TDDFT calculations have been performed to explore the excited state properties. Intra molecular charge transfer observed in boron containing complexes may be explored for applications in photovoltaics.

27. Rakiba Rohman and Rahul Kar, *Tuning the antioxidant property of potential calixdrugcalix[4]tyrosol: Role of aza and thia linkages*, Structural Chemistry(2021) (accepted).

Abstract:

Calix[4]arenes are the most renowned and widely studied calix[n]arenes, which are established to have quite a few biological(e.g., antibacterial, antifungal, antioxidant, etc.) activities. Among

these, calix[4]tyrosol is experimentally recognized to be a potential antioxidant molecule, though its quantum chemical explanation is hitherto unknown. A molecular-level understanding of these molecules, with potential to act as drug as well as radical scavengers, would define strategies to tune and improve their efficacy. This work explores the conformational favorites of calix[4]tyrosol, its radical scavenging ability toward nine prototype oxyradicals, its metal chelation ability toward Cu(I/II) ions, and its photophysical properties. More importantly, some novel antioxidant systems are designed through inclusion of aza- and thia- linkages in calix[4]tyrosol. Our results support the experimental findings suggesting the cone conformer of calix[4]tyrosol to be the most stable one due to the presence of strong intra molecular hydrogen bonding. On top of this, our findings signify calix[4]tyrosol as a potential prooxidant. Among all the calix[4]aromatics, the newly designed aza-calix[4]tyrosol is found to have the finest antioxidant property.

28. Bondeepa Saikia, Chimi Rekha Gogoi, Aziza Rahman, Anupaul Baruah, *Identification of an Optimal Foldability Criterion to Design Misfolding Resistant Protein*, *Journal of Chemical Physics*, 155(2021).

Abstract:

Proteins achieve their functional, active and operative three dimensional native structures by overcoming the possibility of being trapped in non-native energy minima present in the energy landscape. The enormous and intricate interactions that play important role in protein folding, also determine the stability of the proteins. The large number of stabilizing/destabilizing interactions makes proteins to be only marginally stable as compared to the other competing structures. Therefore, there are some possibilities that they become trapped in the non-native conformations, and thus get misfolded. These misfolded proteins lead to several debilitating diseases. This work performs a comparative study of some existing foldability criteria in computational design of misfold resistant protein sequences based on self consistent mean field theory. The foldability criteria selected for this study are E_f , Δ , and ϕ that are commonly used in protein design procedures, to determine the most efficient foldability criterion for the design of misfolding resistant proteins. The results suggest that the foldability criterion Δ is significantly better in designing a funnel energy landscape stabilizing the target state. The results also suggest that inclusion of negative design features is important for designing misfolding resistant proteins, but more information about the non native conformations in terms of ϕ leads to worse results compared to even simple positive design. The sequences designed using Δ shows better resistance to misfolding in the Monte Carlo simulations performed in the study.

29. G. D. Kalita, P. P. Sarmah, G. Kalita and P. Das, *Bimetallic Au–Pd nanoparticles supported on silica with a tunable core@shell structure: enhanced catalytic activity of Pd(core)–Au(shell) over Au(core)–Pd(shell)*, *Nanoscale Advances*, 3, 5399 (2021).
30. G.D. Kalita, M. R. Das and P. Das, *Fabrication of magnetically separable ruthenium nanoparticles decorated on channelled silica microspheres: Efficient catalysts for chemoselective hydrogenation of nitroarenes*, *Dalton Transaction*, 50, 13483-13496 (2021).
31. A. Puzari, A. Gogoi, P. Das, *An unsymmetrical Schiff-base derived recyclable Pd-catalyst for Suzuki–Miyaura and Sonogashira reactions in aqueous media*, *J. Chem. Sci.* 2021, 133, 56(2021).
32. M. Borah, N. Saikia, P. Das, *A combined computational and experimental study of Fe(II) complexes with hemilabile phosphine-based P,O donor ligands*, *J. Molecular Structure*, 1230, 129661(2021).
33. D Borah, A. Puzari and P. Das, *Highly efficient aqueous-phase Sonogashira coupling catalyzed by Pd-PEPSI/PPh₃ under aerobic condition*, *J. Chem. Sci.*, 133:103 (2021).
34. S Bordoloi, R Chetia, G Borah, S Konwer, *Removal of As(III) and As(V) from water using reduced GO-Fe₀ filled PANI composite*, *Journal of Applied Water Engineering and Research*, 1-12 (2021).

Abstract:

A novel ternary adsorbent was prepared by reductive deposition of zerovalent iron on reduced graphene oxide through in-situ polymerization of aniline. SEM/EDS study showed an irregular, porous, and heterogeneous surface morphology with iron available for As binding. Batch adsorption experiments were conducted to determine the optimum conditions for As adsorption with optimum adsorbent dose, initial concentration of As, pH etc. Under optimized conditions, the maximum removal percentage of As was 99.6% for As(III) and 89% for As(V). The adsorption of arsenic on the composite was fitted well to the pseudo-second-order kinetic model and obeyed both Langmuir [$R^2 = 0.955$ for As(III) and 0.992 for As(V)] and Freundlich [$R^2 = 0.975$ for As(III) and 0.993 for As(V)] models. In aqueous solutions, the common co-ions phosphate hindered As removal more than the any other ions. The absorptive ability of adsorbent was compared with those of different adsorbents and found to be considerably efficient.

35. B Pegu, S Bordoloi, R Boruah, S Konwer; *Synthesis of biochemically reduced graphene-oxide/Fe⁰ containing polyaniline ternary hybrid composite through interfacial polymerization for supercapacitors*, Bulletin of Materials Science 44 (4), 1-9 (2021).

Abstract:

A novel electrode material for supercapacitor has been developed based on biochemically reduced graphene oxide/zerovalent iron (rGO/Fe⁰) and polyaniline (PANI) ternary hybrid composite synthesized by interfacial polymerization. The composites were characterized by Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), ultraviolet–visible absorption (UV–Vis), X-ray diffraction (XRD), X-ray photoelectron spectrum (XPS) and electrical conductivity measurements. The composites exhibited noticeable improvement in electrical conductivity and excellent electrochemical reversibility when compared to bare polymer. The electrochemical properties of the composite electrode are investigated by galvanostatic charge–discharge, electrochemical impedance spectroscopy (EIS) studies. The enhanced specific capacitance with higher conductivities is observed in PANI/rGO/Fe⁰ (342 F g⁻¹) when compared with PANI (182 F g⁻¹) and PANI/rGO composites (294 F g⁻¹) with a constant current density of 1.0 A g⁻¹. The cyclic stability of the composite, following 500 cycles of operations, was at 68.6 (PANI), 80.6 (PANI/rGO) and 95.4% (PANI/rGO/Fe⁰) of their initial capacitance. The higher conductivity, higher specific capacitance and cyclic self-stability of PANI/rGO/Fe⁰ ternary composite can provide new prospects in the field energy storage application.

36. Abhigyan Mahanta, Idweep J. Gogoi, A. Bharali, *A note on the generalized adjacency, Laplacian and signless Laplacian spectra of the weighted edge corona networks*, Physica A, 581(2021), p. 126241.

37. Rubul Moran, Niranjana Bora, A. K. Baruah, A. Bharali, *ST-coloring of Some Products of Graphs*, J. Math. Comput. Sci., 11(1), pp. 337-347(2021).

38. I. J. Gogoi, B. Phukan, A. Pegu, A. Bharali, *On Laplacian spectra of some corona product graphs and applications*, Advances in Mathematics: Scientific Journal, 10(3), pp. 1259-1271(2021).

39. J. Buragohain, Amitav Doley, A. Bharali, *A Note on Extension and Generalization of ISI Index of Graphs*, J. Assam Acad. Math., 11, pp:13-30 (2021).

40. Gohain, B., Dutta, P., Gogoi, S., Chutia, R., *Construction and generation of distance and similarity measures for intuitionistic fuzzy sets and various applications.*, International Journal of Intelligent Systems. 36, 1-34 (2021).

Abstract:

The distance measure between intuitionistic fuzzy sets (IFSs) is a concept of very contemporary interest among the researchers in the field of decision-makings, such as pattern recognition, medical diagnosis, and multiattribute decision- making (MADM) problems. Consequently, diverse distance measures are developed and used in determining the similarity and dissimilarity between IFSs. In the existing methods, the distance measures are calculated based on the geometry of the IFSs. However, the IFSs hold information about the elements in a set. As such, some of the existing distance measures are misleading and unreasonable. Hence, in this paper, a nonlinear distance formula is devised to follow the problem definition. Further, by explicitly proving the distance properties, it is being established that the distance formula is a distance measure. Further, theories for the construction of distance measures are developed. The convex combination of two distance measures is also a distance measure is being proved explicitly. Furthermore, based on the proposed distance measures, similarity measures have been developed. Aside from that, an intriguing idea has been introduced, namely, that an infinite number of distance measures can be constructed from a given pair of distance measures. Additionally, the proposed distance and similarity measures are applied to a variety of problems, including medical diagnosis, pattern recognition, and a MADM problem in COVID-19 face mask selection, where the legitimacy and applicability of the proposed advanced distance measure is demonstrated.

41. Dutta, P., Saikia, B, *Arithmetic operations on normal semi elliptic intuitionistic fuzzy numbers and their application in decision-making*, Granular Computing, 6(1), pp. 163-179(2021).

Abstract:

Decision-making problems are more often tainted with uncertainty. Fuzzy numbers play utmost important role to band uncertainty, more especially intuitionistic fuzzy number (IFN) which is the extension of fuzzy number (FN). Different types of IFNs such as normal and generalized trapezoidal, triangular and symmetric hexagonal IFNs are explored. However, based on nature of the data, semi-elliptic type of IFN may exists in real world decision-making problems. In this paper, a maiden attempt has been made to study normal semi elliptic intuitionistic fuzzy number (NSEIFN). Our emphasis has been on arithmetic operations of NSEIFNs and comparing with the other existing IFNs. Also rank of NSEIFNs has been proposed based on mean and value. Apart from that inverse, exponential, logarithm, square root and nth root of NSEIFNs are derived. Finally, the proposed ranking method is applied to the decision making problem where criteria

and rating of alternatives are represented in terms of NSEIFN. It is observed that the proposed model produces better results and overcome the drawbacks of existing approaches.

42. Dutta, P., *A Sophisticated Ranking Method of Fuzzy Numbers Based on the Concept of Exponential Area*, *New Mathematics and Natural Computation*, 17(2), pp. 303-318 (2021).

Abstract:

Uncertainty is an unavoidable component of decision making process. The ranking of fuzzy numbers which deals with such uncertainties play again a significant role in the process. Fuzzy numbers must be ranked in order to take the appropriate action by a decision maker in any real life situation. A few numbers of ranking techniques have been encountered in last few decades. However, existing techniques are situation-dependent which have drawbacks/shortcomings. In this regard, this paper presents a sophisticated ranking method based on the concept of the exponential area of the fuzzy numbers. The outputs obtained from this approach are obtained to be more efficient in comparison to the other ranking methods and outperform in all situations. The novelty and validity have been established through comparison with existing works. Furthermore, the ranking approach has been applied in medical decision making problem and the results obtained by the approach absolutely conform with analytical results and human intuitions as well.

43. Borah, G., Dutta, P., *Multi-attribute Cognitive Decision Making via Convex Combination of Weighted Vector Similarity Measures for Single-Valued Neutrosophic Sets*, *Cognitive Computation*, 13:1019–1033 (2021).

Abstract:

Similarity measure (SM) proves to be a necessary tool in cognitive decision making processes. A single-valued neutrosophic set (SVNS) is just a particular instance of neutrosophic sets (NSs), which is capable of handling uncertainty and impreciseness/vagueness with a better degree of accuracy. The present article proposes two new weighted vector SMs for SVNSs, by taking the convex combination of vector SMs of Jaccard and Dice and Jaccard and cosine vector SMs. The applications of the proposed measures are validated by solving few multi-attribute decision-making (MADM) problems under neutrosophic environment. Moreover, to prevent the spread of COVID-19 outbreak, we also demonstrate the problem of selecting proper antivirus face mask with the help of our newly constructed measures. The best deserving alternative is calculated based on the highest SM values between the set of alternatives with an ideal alternative. Meticulous comparative analysis is presented to show the effectiveness of the proposed measures with the already established ones in the literature. Finally, illustrative examples are demonstrated

to show the reliability, feasibility, and applicability of the proposed decision-making method. The comparison of the results manifests a fair agreement of the outcomes for the best alternative, proving that our proposed measures are effective. Moreover, the presented SMs are assured to have multifarious applications in the field of pattern recognition, image clustering, medical diagnosis, complex decision-making problems, etc. In addition, the newly constructed measures have the potential of being applied to problems of group decision making where the human cognition based thought processes play a major role.

44. Borah, G., Dutta, P., Hazarika, G.C, *Analysis of fractional derivatives in thermal and solutal transfer equations of second-grade non-Newtonian fluids: A numerical study*, Heat Transfer, 50(5), pp. 4233-4247 (2021).

Abstract:

A numerical analysis is carried out using Atangana–Baleanu and Caputo–Fabrizio time-fractional derivatives to study the mixed convective unsteady flow of a second-grade fluid past an infinite vertical porous plate under the influence of a uniform transverse magnetic field. As finding the exact solutions of fluid equations presents huge difficulties due to the vagueness or uncertainty associated with the fluid parameters, fuzzy theoretic concepts are used rather than the classical crisp theoretic ones. Governing partial differential equations are made dimensionless and are then subject to fuzzification. The finite-difference scheme is used to discretize the equations, and hence suitable programming codes are developed in PYTHON for *AB* and *CF* fractional derivatives. The results are obtained and plotted graphically. Interpretations based on these physical parameters imply that both *AB* and *CF* methods agreed well.

45. Dutta, P., Borah, G., *Multicriteria decision making approach using an efficient novel similarity measure for generalized trapezoidal fuzzy numbers*, Journal of Ambient Intelligence and Humanized Computing, 12: 1-23 (2021).

Abstract:

Multi-criteria Decision Making (MCDM) has a huge role to play while ruling out one suitable alternative among a pool of alternatives governed by predefined multiple criteria. Some of the factors like imprecision, lack of information/data, etc., which are present in traditional MCDM processes have showcased their lack of efficiency and hence eventually it has paved the ways for the development of Fuzzy multicriteria decision making (FMCDM). In FMCDM processes, the decision makers can model most of the real-life phenomena by fuzzy information-based preferences. The availability of a wide literature on similarity measure (SM) emphasizes the vital

role of SM of generalized fuzzy numbers (GFNs) to conduct accurate and precise decision making in FMCDM problems. Despite having few advantages, most of the existing approaches possessed a certain degree of counter intuitiveness and discrepancies. Thus, we have attempted to propose a novel SM for generalized trapezoidal fuzzy numbers (GTrFNs) which could deliberately overcome the impediments associated with the earlier existing approaches. Moreover, a meticulous comparative study with the existing approaches is also presented. This paper provides us with an improved method to obtain the similarity values between GTrFNs and the proposed SM consists of calculating the prominent features of fuzzy numbers such as expected value and variance. We use fourteen different sets of GTrFNs, to compare the fruition of the present approach with the existing SM approaches. Furthermore, to show the utility and applicability of our proposed measure, we illustrate few practical scenarios such as the launching of an electronic gadget by a company, a problem of medical diagnosis and finally, a proper anti-virus mask selection in light of the recent COVID-19 pandemic. The obtained results with our proposed SM, for the mentioned FMCDM problems, are analytically correct and they depict the efficiency and novelty of the present article.

46. Dutta, P., *Medical Decision Making Using Generalized Interval-Valued Fuzzy Numbers*, *New Mathematics and Natural Computation* 17(2), pp. 439-479 (2021).

Abstract:

Real world problems are often ill defined due to uncertainty caused mainly by the deficiency of precision and data, diminutive sample sizes or data acquired from specialist opinions, artificial/man-made errors, etc. To handle uncertainties of these types, type-I fuzzy set theory (FST) has been more often explored. However, it is not always possible for type-I FST to characterize uncertainty in all real world problems. Examples may be had in the diagnosis of patients that has to be mostly dependent on the buoyancy level of a medical investigator (MI) with a very limited degree of accuracy. In such circumstances, interval-valued fuzzy set (IVFS) is a more suitable apparatus to embody vague linguistic expressions of the patients. Moreover, it has the ability to incorporate the complete degree of confidence of the medical investigator's opinion in certain closed region (i.e. interval). This paper presents a maiden attempt to swot up decision making for MIs using arithmetic of triangular generalized interval-valued fuzzy numbers (TGIVFNs). The TGIVFN has the ability to deal with sequence of things that account for the parameter height of TGIVFN. Parameter heights of TGIVFN characterize the grade of buoyancy of judgments of the decision makers in a very specific compartment. Finally, a case study has been carried out under this setting using live data in order to exhibit the proposed techniques. It is observed that the proposed approach provides a way to perform MI in an explicit demeanor which presents acceptable consequences in comparison to classical techniques. Furthermore, it provides more precision to the decision of the medical investigators.

47. Talukdar, P., Dutta, P., *Distance measures for cubic Pythagorean fuzzy sets and its applications to multi-criteria decision making*, Granular Computing, 6(2), pp. 267-284 (2021).

Abstract :

The main objective of this paper is to develop a sophisticated mathematical expression which can carry much more information than the general intuitionistic fuzzy set (IFS), interval-valued intuitionistic fuzzy set (IVIFS) and cubic intuitionistic fuzzy set (CIFS). CIFS is one of the powerful tools to handle uncertainty in complex situation. It is the simultaneous consideration of both the IVIFS and IFS. As in many real life situation, interval-valued Pythagorean fuzzy set (IVPFS) and Pythagorean fuzzy set (PFS) are more capable than IVIFS and IFS to represent the vagueness or ill-defined information; therefore, it motivates us to enhance the capability of CIFS in complex decision-making problems. This paper presents a novel notion of cubic Pythagorean fuzzy set (CPFS) incorporating IVPFS and PFS simultaneously, to encounter uncertainty in a more specific manner. Furthermore, a family of distance measures for CPFSs is defined and applications of the proposed distance measures are shown in medical decision-making problem.

48. Hazarika, G.C., Dutta, P., Borah, J., *Numerical analysis of an MHD flow in fuzzy environment in presence of induced magnetic field*, Heat Transfer, 50: 1-24 (2021).

Abstract:

Due to the uncertain behaviour of real-life problems, fuzzification is one of the most suitable ways to find the interval at which the problems show their accurate results. Various imprecise parameters and conditions make the fluid flow problems more uncertain. Here, we try to solve a boundary value problem of fluid mechanics numerically using fuzzy conditions. The fuzzified governing partial differential equations along with the fuzzified boundary conditions are solved by finite difference method using Python (an object-oriented programming language). The values of the parameters and the boundary conditions are taken as triangular fuzzy numbers. α -cut technique is used to find the results and they are presented graphically for various values of α and the involved parameters.

49. Debasish Dey, Madhurya Hazarika, Rupjyoti Borah., *Entropy generation analysis of magnetized micropolar fluid streaming above an exponentially extending plane*, Latin American Applied Research, 51(4), 255-260.

Abstract:

Numerical procedure of solving boundary value problems using MATLAB software has been applied to study the irreversibilities caused by magnetized micropolar fluid streaming above an extending surface. The factors responsible for irreversibilities are thermal and concentration distributions, Lorentz force etc. The entropy generation rates are shown pictorially through some figures and irreversibilities are shown in tabular form.

50. Debasish Dey, Bhagyashree Mahanta., *Rheology of power law fluid flow around a stagnation point in porous medium with energy dissipation*, Latin American Applied Research, 51(4),223-228.

Abstract:

An investigation on two-dimensional stagnation point flow past a stretching or shrinking surface in a porous medium with energy dissipation using power law model is carried out in this paper. By applying some similarity transformations, the governing partial differential equations are converted to non-linear ordinary differential equations. Consequently, numerical calculations of these equations are done by using MATLAB built- in bvp4c method. Impact of various parameters such as Prandtl number, permeability parameter and magnetic parameter are depicted graphically on velocity and temperature distributions. Also, the numerical values for velocity gradient and shear stress are shown in tabular form. From the analysis, it is noted that Prandtl number helps in reducing the shear stress, Also, as the power law parameter increases, a decrease in velocity is observed.

51. Debasish Dey, Bhagyashree Mahanta., *Modelling of multi-phase fluid flow with volume fraction past a permeable stretching vertical cylinder and its numerical study*, Latin American Applied Research., 51(3),. 165-171.

Abstract:

A steady two-dimensional mixed convective multi-phase fluid (base fluid containing dust particles) flow past a vertical stretching cylinder in presence of volume fraction has been investigated. The surface of cylinder is embedded by porous medium in presence of non-uniform source/sink. Governing partial differential equations of the problem for both fluid and dust phases are converted into ordinary differential equations using similarity transformations. MATLAB built-in bvp4c solver technique is used to solve the resulting non-linear differential equations. The results are presented in graphical forms for various values of flow parameters.

52. Debasish Dey, Rupjyoti Borah, *Stability analysis on dual solutions of second- grade fluid flow with heat and mass transfers over a stretching sheet*, International Journal of Thermo-fluid Science and Technology, 8(2).

Abstract:

Stability on dual solutions of second-grade fluid flow over a stretching surface with simultaneous thermal and mass diffusions has been studied. The fluid flow is governed by Lorentz force and energy dissipation due to viscosity. Lorentz force is generated due to the application of magnetic field along the transverse direction. In methodology, suitable similarity transformation and MATLAB built-in bvp4c solver technique have been adopted. Effects of some flow parameters are exhibited through figures and tables and a special emphasis is given on the existence of dual solutions. A stability analysis is executed to determine the stable and physically achievable solutions. For the laminar flow, the drag force on the surface for the time-independent case is reduced due to amplifying values of Bu , it enhances the drag force for the time-dependent case. This shows the effectiveness of the first solution (during steady case) over the unsteady case.

53. S Borkotokey, S Chakrabarti, RP Gilles, L Gogoi, R Kumar, *Probabilistic network values*, *Mathematical Social Sciences*113, 169-180 (2021).

Abstract:

We consider a class of cooperative network games with transferable utilities in which players interact through a probabilistic network rather than a regular, deterministic network. In this class of wealth-generating situations we consider probabilistic extensions of the Myerson value and the position value. For the subclass of probabilistic network games in multilinear form, we establish characterizations of these values using an appropriate formulation of component balancedness. We show axiomatizations based on extensions of the well-accepted properties of equal bargaining power, balanced contributions, and balanced link contributions.

54. N Kakoty, P Baruah, S Borkotokey, *The role of the non-productive players in cooperative games with transferable utilities: a survey*, *International Journal of General Systems*, 1-21(2021).

Abstract

Decision support systems apply the models of cooperative games with transferable utilities (TU games) for aggregating and ranking attributes based on their interdependent features. In TU games, players work together for a common goal under binding agreements. The contributions by the players to achieve this common goal generate some worth. A solution is a distribution of the total worth generated by all the players together. The Shapley value is the most popular solution of TU games. When cooperative game theoretic models are used in decision support systems, especially in Artificial Intelligence and Machine Learning models, the Shapley value is frequently used as a suitable solution, partly because it is easy to understand and partly because

of its marginalistic approach. However, alternative criteria also exist in the literature that can be of interest to the practitioners.

55. D Choudhury, S Borkotokey, R Kumar, S Sarangi, *The Egalitarian Shapley value: a generalization based on coalition sizes*, *Annals of Operations Research* 301 (1), 55-63 (2021).

Abstract:

In designing solution concepts for cooperative games with transferable utilities, consolidation of marginalism and egalitarianism has been widely studied. The α -Egalitarian Shapley value is one such solution that combines the Shapley value and the Equal Division rule, the two most popular extreme instances of marginalism and egalitarianism respectively. This value gives the planner the flexibility to choose the level of marginality for the players by varying the convexity parameter. In this paper, we define the Generalized Egalitarian Shapley value that gives the planner more flexibility in choosing the level of marginality based on the coalition size. We then provide two characterizations of the Generalized Egalitarian Shapley value.

56. X Jin, RR Yager, R Mesiar, S Borkotokey, L Jin, *Comprehensive Interval-Induced Weights Allocation with Bipolar Preference in Multi-Criteria Evaluation*, *Mathematics* 9 (16) 2002 (2021).

Abstract:

Preferences-involved evaluation and decision making are the main research subjects in Yager's decision theory. When the involved bipolar preferences are concerned with interval information, some induced weights allocation and aggregation methods should be reanalyzed and redesigned. This work considers the multi-criteria evaluation situation in which originally only the interval-valued absolute importance of each criterion is available. Firstly, based on interval-valued importance, upper bounds, lower bounds, and the mean points of each, we used the basic unit monotonic function-based bipolar preference weights allocation method four times to generate weight vectors. A comprehensive weighting mechanism is proposed after considering the normalization of the given absolute importance information. The bipolar optimism–pessimism preference-based weights allocation will also be applied according to the magnitudes of entries of any given interval input vector. A similar comprehensive weighting mechanism is still performed. With the obtained weight vector for criteria, we adopt the weighted ordered weighted averaging allocation on a convex poset to organically consider both two types of interval-inducing information and propose a further comprehensive weights allocation mechanism. The detailed comprehensive evaluation procedures with a numerical example for education are presented to show that the proposed models are feasible and useful in interval, multi-criteria, and bipolar preferences-involved decisional environments.

57. R. Mesiar, R., A. Kolesarova, S. Borkotokey, *2-set-based extended functions*, Iranian Journal of Fuzzy Systems, University of Sistan and Baluchestan, 1735-0654 (2021).

Abstract:

We generalize set-based extended functions, recently introduced by Mesiar et al., into 2-set-based extended functions. In both cases, an efficient reduction of repeated data to be fused is considered which prepares a sound background for big data processing. We discuss and study several types of 2-set-based extended functions, in particular, 2-set-based extended aggregation functions, including t-norms, t-conorms, uninorms, nullnorms and OWA operators.

58. N Baruah, SK Sarma, S Borkotokey , *A Single Document Assamese Text Summarization Using a Combination of Statistical Features and Assamese WordNet*, Progress in Advanced Computing and Intelligent Engineering, 125-136. (2021).

Abstract

In this paper, an extractive text summarization approach using Assamese WordNet is proposed, and the difficulties faced while extracting summary in the Assamese document are discussed. The Assamese language is a low-level language. Synset is applied from Assamese WordNet. The various features used for identifying the most salient sentences to generate effective summary aspects such as TF-IDF, sentence length, sentence position and numerical identification are considered. Automatic Text Summarization in the Assamese language is still in an early stage and this language does not have its own approach. So, the text summarization approach is compared to the approaches applied in Bengali and Bangla language approaches as these languages share a script that is quite similar having slight variations in certain letters.

59. Ali, Tazid; Borah, Chandra, *Analysis of amino acids network based on transition and transversion mutation of codons*, Network Biology, Vol 11, No. 3. 125 -136. (2021).

Abstract

Analysis of the amino acids network is quite relevant for the study of multiple physicochemical amino acids characteristics. The inherent significance of base locations in a codon with chemical varieties of bases, Purine and Pyrimidine, plays the central role in the genetic code analysis. Weighing the transition and transversion mutation of codons and the role of base locations, we have developed a Distance Matrix and subsequently obtained an Amino Acids Network. We have investigated the evolutionary features of amino acids in protein synthesis in this network. For a comparative analysis regarding amino acids, we have examined numerous Centrality

measures and explored Correlation Coefficients checking the Assortativity of the network. Also, as Network Parameters, we have analyzed the Clustering Coefficient, Degree Distribution, and Skewness.

60. Ali, Tazid; Borah, Chandra, *Analysis of amino acids network based on mutation and base positions*, Gene Reports, Vol. 24, No. 3 (2021).

Abstract

In this paper, we have developed a network of 20 amino acids based on a distance matrix of amino acids. This distance matrix is obtained by considering the transition and transversion mutation of codons. We have proposed that the evolutionary pattern of amino acids is reflected throughout this network. We have discussed different measures of centrality: degree centrality, closeness centrality, betweenness centrality and eigenvector centrality, concerning this network and investigated the comparative impact of the amino acids. We have also explored the correlation coefficients between the different centrality measures checking the assortativity of the network. Further, we have explored three network parameters: namely clustering coefficient, degree of distribution and skewness.

61. Verma, K; Basfor, Sanjit and Sharma, B.R., *Analysis of radiation, chemical reaction, Soret and Dufour effects near stagnation point on MHD flow through a stretching sheet*, Advances in Mathematics: Scientific Journal, vol. 10(2), 855-868 (2021).

62. Verma, K., Borgohain, D. and Sharma, B.R., *Analysis of chemical reaction on MHD micropolar fluid flow over a shrinking sheet near stagnation point with nanoparticles and external heat*, International Journal of Heat and Technology, vol 39(1), 2021, 262-268(2021).

63. Verma, k., Borgohain, D. and Sharma B.R., *Soret and Dufour effects on MHD flow about a rotating vertical cone in presence of radiation*, Journal of Mathematical and Computational Science, vol. 11(3), 3188-3204 (2021).

64. S. Chakraborty, S. Shah, P. J. Hazarika, M. M. Ali. , A *Generalized-Alpha-Beta-Skew - Normal Distribution with Applications*, *Annals of Data Science*, <https://doi.org/10.1007/s40745-021-00325-0>.

Abstract:

Recently there is a lot of research related to skewed distributions and their growing relevance in data analytics. In the present work we introduce a new generalized version of alpha beta skew normal distribution and some of its basic properties are investigated. Some extensions of the proposed distribution have also been studied. A simulation study has been conducted to see the performance of the obtained estimators of the parameters using Metropolis–Hastings (MH) algorithm. The appropriateness of the proposed distribution has been tested by comparing it with twelve closely related and nested distributions using Akaike Information Criterion. The Likelihood Ratio test has been employed for testing the relevance of the induction of the additional parameters in the proposed model.

64. S. Chakraborty, J. Mazucheli, A. F. B. Menezes, *Improved maximum likelihood estimation of the parameters of the Gamma-Uniform distribution with bias-corrections*, *Communications in Statistics - Simulation and Computation*.

Abstract:

A two-parameter Gamma-Uniform distribution was recently introduced as a prominent alternative in modeling bounded phenomena. Unfortunately, however, its maximum likelihood estimators (MLEs) are found to be highly biased in finite samples, a limitation that might effect this model's application in data modeling. In this article, we construct nearly unbiased estimators for the unknown parameters of this distribution by deriving analytical bias-corrected maximum likelihood estimators applying the Cox and Snell methodology, the Firth's method and also via the parametric Bootstrap bias correction approach. Our extensive simulation clearly revealed that the three bias reduction methods yield very good estimates which are nearly unbiased and exhibit comparable efficiency. Finally, we consider a real data set where the variable under enquiry is the proportion of unemployed labor force reported across some 158 nations in 2018 to show case the positive gain of incorporating the bias correction in the model fitting.

64. S. Chakraborty, J. Mazucheli, A. F. B. Menezes, *A Collection of Parametric Modal Regression Models for Bounded Data*, *Journal of Biopharmaceutical Statistics*. 31(4), 490-506 (2021).

Abstract:

Modal regression is an alternative approach for investigating the relationship between the most likely response and covariates and can hence reveal important structure missed by usual regression methods. This paper provides a collection of parametric mode regression models for bounded response variable by considering some recently introduced probability distributions with bounded support along with the well-established Beta and Kumaraswamy distribution. The main properties of the distributions are highlighted and compared. An empirical comparison between the considered modal regression is demonstrated through the analysis of three data sets from health and social science. For reproducible research, the proposed models are freely available to users as an R package unitModalReg.

65. S. Chakraborty, S. Shah, P. J. Hazarika, M. M. Ali, *The Balakrishnana-Alpha-Beta-Skew-Normal Distribution: Properties and Applications*, *PJSOR*, 17 (2) 367-380 (2021).

Abstract:

In this paper, a new form of alpha-beta-skew distribution is proposed under Balakrishnan (2002) mechanism and investigated some of its related distributions. The most important feature of this new distribution is that it is versatile enough to support both unimodal and bimodal as well as multimodal behaviors of the distribution. The moments, distributional properties and some extensions of the proposed distribution have also been studied. Finally, the suitability of the proposed distribution has been tested by conducting data fitting experiment and comparing the values of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) with the values of some other related distributions. Likelihood Ratio testis used for discriminating between normal and the proposed distributions.

66. S. Chakraborty, S. Bhattacharjee, *Modeling proportion of success in high school leaving examination-A comparative study of inflated unit Lindley and inflated Beta distribution*, Journal of Mathematical and Computational science, 11 (6), 7170-7198 (2021).

Abstract:

In this article, we first introduced the inflated unit Lindley distribution considering zero or/and one inflation scenario and studied its basic distributional and structural properties. Both the proposed distributions are shown to be members of exponential family with full rank. Different parameter estimation methods are discussed along with supporting simulation studies to check their efficacy. Proportion of students passing the high school leaving certificate examination for the schools across the state of Manipur in India for the year 2020 are then modeled using the proposed distributions and compared with the inflated beta distribution to justify its benefits.

67. S. Chakraborty, *On the new unit Lindley distribution*, Asian Journal of Statistical Sciences, 1(1), 47-50 (2021).

Abstract:

In this article it is shown that the new unit Lindley distribution of Mazuchelli et al. (2020) is in fact complementary of the original unit Lindley distribution of Mazuchelli et al. (2019) and as such almost all properties of the former directly follows from those of the later quite easily. Some illustrative derivation of properties of new unit Lindley distribution from those of the unit Lindley distribution is also presented.

68. S. Chakraborty, A. Biswas, *On the estimation of parameter and stress-strength reliability for unit-Lindley distribution*, Calcutta Statistical Association (CSA) Bulletin. 73 (1), 7-23 (2021).

Abstract:

The unit-Lindley distribution has recently been introduced in the literature as an alternative to the beta and the Kumaraswamy distributions in support (0,1). This distribution enjoys many virtuous properties over the mentioned distributions. In this article, we address the issue of parameter estimation from a Bayesian perspective and study relative performance of different estimators

through extensive simulation experiments. Significant emphasis is given to the estimation of stress–strength reliability employing classical as well as Bayesian approach. Application of an intuitive metric of discrepancy derived from stress–strength reliability is considered and computed for two different geographic regions with respect to an important public health indicator.

69. S. Chakraborty, D. Chakravarty, J. Mazucheli, W. Bertoli, *A discrete analogue of Gumbel distribution: properties, parameter estimation and applications*, *Journal of Applied Statistics* 48 (4), 712-737 (2021).

Abstract:

A discrete version of the Gumbel distribution (Type-I Extreme Value distribution) has been derived by using the general approach of discretization of a continuous distribution. Important distributional and reliability properties have been explored. It has been shown that depending on the choice of parameters the proposed distribution can be positively or negatively skewed; possess long-tail(s). Log-concavity of the distribution and consequent results have been established. Estimation of parameters by method of maximum likelihood, method of moments, and method of proportions has been discussed. A method of checking model adequacy and regression type estimation based on empirical survival function has also been examined. A simulation study has been carried out to compare and check the efficacy of the three methods of estimations. The distribution has been applied to model three real count data sets from diverse application area namely, survival times in number of days, maximum annual floods data from Brazil and goal differences in English premier league, and the results show the relevance of the proposed distribution.

70. S. Chakraborty, Laba Handique, M.S. Eliwa, and G. G. Hamedani, *Poisson Transmuted-G Family of Distributions: Its Properties and Applications*, *PJSOR*, 17 (1) 309-332 (2021).

Abstract:

In this article, an extension of the transmuted-G family is proposed, in the so called Poisson transmuted-G family of distributions. Some of its statistical properties including quantile function, moment generating function, order statistics, probability weighted moment, stress-

strength reliability, residual lifetime, reversed residual lifetime, Rényi entropy and mean deviation are derived. A few important special models of the proposed family are listed. Stochastic characterizations of the proposed family based on truncated moments, hazard function and reverse hazard function, are also studied. The family parameters are estimated via the maximum likelihood approach. A simulation study is carried out to examine the bias and mean square error of the maximum likelihood estimators. The advantage of the proposed family in data fitting is illustrated by means of two applications to failure time data sets.

71. S. Chakraborty, Md. Ibrahim, L. Handique, H. M. Yousof, *A New Three-parameter Xgamma Fréchet Distribution with Different Methods of Estimation and Applications*, PJSOR, 17 (1) 291-308 (2021).

Abstract:

In this article an attempt is made to introduce a new extension of the Fréchet model called the Xgamma Fréchet model. Some of its properties are derived. The estimation of the parameters via different estimation methods are discussed. The performances of the proposed estimation methods are investigated through simulations as well as real life data sets. The potentiality of the proposed model is established through modeling of two real life data sets. The results have shown clear preference for the proposed model compared to several known competing ones.

72. S. Chakraborty, A. Biswas and M. Mukherjee, *On estimation of stress-strength reliability with log-Lindley distribution*, Journal of Statistical Computation and Simulation, 91 (1), 128-150 (2021).

Abstract:

The log-Lindley distribution was recently introduced in the literature as a viable alternative to the Beta distribution. This distribution has a simple structure and possesses useful theoretical properties relevant in insurance. Classical estimation methods have been well studied. We introduce estimation of parameters from Bayesian point of view for this distribution. Explicit structure of stress–strength reliability and its inference under both classical and Bayesian set-ups is addressed. Extensive simulation studies show marked improvement with Bayesian approach over classical given reasonable prior information. An application of a useful metric of discrepancy derived from stress–strength reliability is considered and computed for two categories of firm with respect to a certain financial indicator.

73. Mahanta, K. K., Hazarika, J. , Barman, M.P.and Rahman, T., *An Application of Spatial Frailty Models to Recovery Times of COVID-19 patients in India under Bayesian Approach*, Journal of Scientific Research, Banaras Hindu University, Varanasi, India. Volume 65, Issue 1, 2021, PP:150-155 (2021).

Abstract:

The pandemic COVID-19, starts at the end of the year 2019, and rapidly blowout almost all over the sphere. There were more than 16.4 million people in the world pretentious by the disease up to the month of July 2020 and the miserable part was that we lost more than 0.6 million people in it. Still, an encouraging note for us was that most of the patients, more than 9.57 million people have recuperated from it. In the month of July 2020 India became the country with the third biggest amount of confirmed cases in the universe. In case of the recapture of COVID-19 patients, Spatial factor may play a significant role. To be mindful of this, the research was done to study the recovery time of the COVID-19 patients of India in respect of their spatial locations by means of spatial frailty model under Bayesian mechanism. The study time of the research was from 1st March, 2020 to 25th April, 2020. Arbitrarily selected a sample of 294 COVID-19 positive cases reported during the study period, in seven exceedingly pretentious states of India up to the month of March, 2020, were included in the study which were followed up to 25th April, 2020. Surprisingly the analysis showed that spatial effect actually plays an important role in the recovery time of the COVID-19 patients and it establishes the prominence of the application of frailty model in this circumstance. Besides this, the study also reveals the significant effect of the factors age and gender on their respective recovery times.

74. Geetanjali Devi, *Vasistha: Worshipping or Gathering Entity?*, Sanghati, Volume 9, Issue 1, August 2021.

Abstract:

Vasistha (N 26⁰ 05' 41.0" lat. E 091⁰ 47'03.4" long. 85 mts amsl) being an archaeological site protected by the Directorate of Archaeology, Assam, Ambari is positioned at a hillock named Sandhyachal towards the southern part of Guwahati city, close to the Assam-Meghalaya border region. The site encloses a religious monument dedicated to Lord Shiva and built by Ahom King Rajeshwar Singha (1751-1769 A.D). Apart from holding archaeological, architectural and religious significance, the site is also a key tourist destination. The objective of the present paper is to explore the Vasistha site located at Guwahati in the Kamrup Metropolitan district of Assam, and to have an understanding of the site from the perspective of worshipping as well as gathering site. The data for the present paper was collected during 2013-2015. While conducting the Ph.D. research work on the monuments and sites of Greater Guwahati, Assam, functioning as temples, the researcher observed that certain temples show large scale gathering, whereas, some show insignificant gathering on daily basis which affected the number of priests and individuals

engaged with the temples. The temples with huge gathering require more priests compared to the one with insignificant gathering. The temples with insignificant gathering engage one priest with one attendant, and sometimes the temple administers without any attendant. In such cases, the neighbouring people voluntarily do the cleaning of the temple and its premises. Although the site Vasistha is an important worshiping site but its role as a site for social gathering, recreational activity, and tourist spot cannot be ignored. The site is a traveller's favourite spot not only as a holy place but also because of its natural panorama comprising of hillock, streams, rocks, flora and fauna.

75. Maitreyee Sharma, *Highlighting some of the Ethnic Resemblances between the Mishing Tribe of Assam and the Adi-Minyong Tribe of Arunachal Pradesh*, Bulletin of the Department of Anthropology: University of Gauhati , vol XX.

Abstract:

Culture and ethnic identity are intricately linked and social identities are preserved through the dialects, food and the healing practices by the locally available plants and plant parts in the ecology. Through these cultural concrete ways and elements the ethnic identities are preserved. Ethnic resemblances between two or more geographically dispersed populations speak a lot about their history and origin. A similar kind of ethnic resemblance in socio-cultural dimension has been noticed between the Mishing tribe of Assam and the Adi-Minyong tribe of Arunachal Pradesh. A study on the folklore and folktales suggest that these two tribes who now occupy two different geographically dispersed ecologies, once occupied the same ecology and had the same origin and same route of migration to North East India. A socio-cultural comparison of these two tribes was also made by the present investigator regarding their folk narratives relating to origin and propagation of the tribe and it has been found that they share the same kind of belief though at present some addition and subtraction was noticed among the Mishings of Assam due to acculturation. The present study was undertaken in Assam and its neighbouring hill state-Arunachal Pradesh of North-East India. The information on socio-cultural affinity on dialect, food and healing practices were collected by open ended interviews and by designing a semi-structured schedule. Focus group interviews with the elderly individuals were conducted to know the age-old traditions related to healing practices and oral narratives/folklore and the changes they might have observed in the dialect. The results of the study show that a dialect never originates suddenly but it always has a long history with elements of originality and change with acculturation. The dialects of the Mishing and the Adi-Minyong so similar that it clearly shows evidence of common origin. The Mishings after migration to the plains accumulated new words to communicate with the neighbouring populations as a survival strategy. Likewise, the similarity in the knowledge on the medicinal properties of the herbs and plants for the same

illness and in a similar way throws light on the continuity of the traditional knowledge from the common ancestral population group.

76. Nilutpal Sonowal and Maitreyee Sharma, *A Study on Few Aspects of Demography on the Adolescent Minyong Mothers of Arunachal Pradesh*, Bulletin of the Department of Anthropology: Dibrugarh University, vol 48.

Abstract:

Adolescent mothers are those who achieve biological motherhood or pregnancy within 10 to 19 years of age. In this sense, adolescent pregnancy or childbearing means pregnancy in a woman who is aged between 10–19 years of age. The World Health Organization (WHO) defines adolescents as those people between 10 and 19 years of age. According to the report of World Health Organization (WHO, 2014), about 16 million women aged 15 to 19 and some 1 million girls under 15 years give birth every year in the developing countries and the complications during pregnancy and childbirth are the second cause of death for 15-19 year-old girls globally. This study was conducted among the Minyong tribe of Siang district in Arunachal Pradesh to find out the factors associated with adolescent marriage and childbirth as well as to estimate the pregnancy outcomes of 120 adolescent mothers. Purposive sampling techniques and single stage cluster sampling were used to select the participants. A semi-structured interview schedule was used to harness the data. The results showed that 82.5% of Minyong married at the age of 16-17 years with high prevalence of school dropouts amongst them. The mean age at marriage was 17.57 with a median of 18 years. A linear relationship was found between age at marriage and age at first conception. Childbearing was found to proceed immediately after entering into marriage among these mothers.

77. Chanu, M.B., Thongam, B., Nongalleima, K., Bhat, H.R., Ghosh, S.K., Shakya, A. , *Investigation of Oral Subacute Toxicity and In-Vitro Antioxidant Activity of Standardized Methanolic Extract of Quercus serrata Leaves*, Current Bioactive Compounds, 17(9),2021.

78. Paul, A., Rajiung, M., Zaman, K., Chaudhary, S.K., Bhat, H.R., Shakya, A., *An Overview on Phytochemical and Pharmacological Profile of Morus alba Linn.*, Current Bioactive Compounds, 17(8),2021.

79. Deka, B., Bhattacharjee, B., Shakya, A., Iqbal, A. M. D., Goswami, C., Sarma, S., ***Mechanism of Action of Wound Healing Activity of Calendula officinalis: A Comprehensive Review***, *Pharmaceutical and Biosciences Journal*, 9(1): 28-44, 2021.

80. Shakya, A., Chikhale, R.V., Bhat, H. R., Alasmary, F. A., Almutairi, T. M., Ghosh, S. K., Alhajri, H. M., Alissa, S. A., Nagar, S., Islam, M, ***Pharmacoinformatics-based identification of transmembrane protease serine-2 inhibitors from Morus alba as SARS-CoV-2 cell entry inhibitors***, *Molecular Diversity* (2021).

81. Singh, A. K., Rai, S. N., Maurya, A., Mishra, G., Awasthi, R., Shakya, A., Chellappan, D. K., Dua, K., Vamanu, E., Chaudhary, S. K., Singh, M. P, ***Therapeutic Potential of Phytoconstituents in Management of Alzheimer's Disease***, *Evidence-Based Complementary and Alternative Medicine: eCAM*, 2021, 5578574.

82. Bhattacharjee, B., Deka, B., Shakya, A., ***Understanding Neurobiological Pathways of Pain Regulation and Novel Therapeutics for Pain Management***, *Current Trends in Pharmaceutical Research*, 8 (1): 88-118 (2021).

83. Kangkan Deka, Bibhuti Bhusan Kakoti and Moonjit Das, ***Antiuro lithiatic activity of leaf extracts of Syzygium jambos (L.) alston and its Zinc nanoparticles: An in-vitro and in-vivo approach***, *International Journal of Pharmaceutical Sciences and Research*, Volume: 12(1), (2021).

Abstract:

Urolithiasis is one of the painful urologic disorders that occurs in approximately 12% of the global population. *Syzygium jambos* (L.) Alston (Family: Myrtaceae), commonly known as Rose apple in English and Bogijamun in the Assamese, is an important medicinal plant found extensively in Assam and in the Indian continent. Scientific studies confirmed that the extracts of various parts possess anticancer activity, antioxidant, analgesic, antimicrobial activities, and anti-inflammatory properties. Phytochemical and Pharmacological evaluation of the Plant was carried out with special reference to antiuro lithiatic activity. The *in -vitro* evaluation was done using growth inhibition study of struvite crystals, and *in-vivo* evaluation was done by Ethylene glycol induced urolithiatic model in rats. Our investigation showed that leaf extracts and ZnO-NPs prevented the growth of urinary stones. Further studies should be done to understand pharmacological action and its possible mechanism through elaborate preclinical experimentation and clinical trials in preventing urolithiasis in susceptible populations.

84. Shahnaz Alom, Farak Ali, Rajashri Bezbaruah and Bibhuti B. Kakoti, *Rosa alba linn.: A comprehensive review on plant profile, phytochemistry, traditional and pharmacological uses*, World Journal of Pharmaceutical Research, Volume: 10 (2021).

Abstract:

Flowering or aromatic plants have played a significant role in mankind since the time immemorial. In current scenario, around 80% of the world population completely rely on plant-based treatment due to their low-cost, high availability, less side effects etc. Around 250000 species of flowering plants have been recognized till date, among them nearly 10% are considered to be herbs, which are mainly used for treatment of several diseases and disorders. *Rosa alba* Linn. is an important aromatic medicinal plant belonging to the family Rosaceae. *Rosa alba* Linn. is mainly cultivated in the rose valley of Bulgaria. Currently it is also cultivated in Turkey, Morocco, North America, Northwest Africa and some parts of Asia. It contains large number of phytoconstituents i.e., flavonoids, terpenoids, tannins, glycosides, anthocyanin, phenolic compound, fatty oil and some small amount of organic and inorganic compounds. The plant is known to exhibit numerous medicinal properties such as antioxidant, antimicrobial, memory enhancers, cytotoxic, genotoxic etc. Nevertheless, traditionally it is also used in heart palpitation, headache, cold, leprosy, biliousness, burning sensation, ophthalmic, rheumatism, diabetes, inflammation, microbial infection, uterine infection, stomach problems as well as refrigerant, purifying agent, soothing agent, in skin care, anti-spasmodic, antiseptic, laxative, carminative etc. This review summarises the distribution, morphology, phytochemistry, pharmacology and traditional uses of *Rosa alba* Linn. based on the information gathered by ethno-botanical claims, researches and review articles.

85. Rajashri Bezbaruah, Pobitra Borah, Bibhuti Bhushan Kakoti, Nizar A. Al-Shar, Balakumar Chandrasekaran, Da'san M. M. Jaradat, Munir A. Al-Zeer and Saeid Abu-Romman, *Developmental Landscape of Potential Vaccine candidates based on Viral vector for prophylaxis of COVID-19*, Frontiers in Molecular Biosciences, Volume: 8 (2021).

Abstract:

Severe acute respiratory syndrome coronavirus 2, SARS-CoV-2, arose at the end of 2019 as a zoonotic virus, which is the causative agent of the novel coronavirus outbreak COVID-19. Without any clear indications of abatement, the disease has become a major healthcare threat across the globe, owing to prolonged incubation period, high prevalence, and absence of existing drugs or vaccines. Development of COVID-19 vaccine is being considered as the most efficient strategy to curtail the ongoing pandemic. Following publication of genetic sequence of SARS-CoV-2, globally extensive research and development work has been in progress to develop a vaccine against the disease. The use of genetic engineering, recombinant technologies, and other

computational tools has led to the expansion of several promising vaccine candidates. The range of technology platforms being evaluated, including virus-like particles, peptides, nucleic acid (DNA and RNA), recombinant proteins, inactivated virus, live attenuated viruses, and viral vectors (replicating and non-replicating) approaches, are striking features of the vaccine development strategies. Viral vectors, the next-generation vaccine platforms, provide a convenient method for delivering vaccine antigens into the host cell to induce antigenic proteins which can be tailored to arouse an assortment of immune responses, as evident from the success of smallpox vaccine and Ervebo vaccine against Ebola virus. As per the World Health Organization, till January 22, 2021, 14 viral vector vaccine candidates are under clinical development including 10 nonreplicating and four replicating types. Moreover, another 39 candidates based on viral vector platform are under preclinical evaluation. This review will outline the current developmental landscape and discuss issues that remain critical to the success or failure of viral vector vaccine candidates against COVID-19.

86. Nazim Hussain, Bibhuti Bhushan Kakoti, Mithun Rudrapal, Khomendra Kumar Sarwa, Ismail Celik, Emmanuel Ifeanyi Attah, Shubham Jagadish Khairnar, Soumya Bhattacharya and Ranjan Kumar Sahoo, *Bioactive flavonoids from the Stem Bark of Cordia dichotoma Forst.: Identification, Docking and ADME Studies*, Molbank, Volume: 2 (2021).

Abstract:

Cordia dichotoma Forst. (F. Boraginaceae) has been traditionally used for the management of a variety of human ailments. In our earlier work, the antidiabetic activity of methanolic bark extract of *C. dichotoma* (MECD) has been reported. In this paper, two flavonoid molecules were isolated (by column chromatography) and identified (by IR, NMR and mass spectroscopy/spectrometry) from the MECD with an aim to investigate their antidiabetic effectiveness. Molecular docking and ADMET studies were carried out using AutoDock Vina software and Swiss ADME online tool, respectively. The isolated flavonoids were identified as 3,5,7,30,40 -tetrahydroxy-4-methoxyflavone-3-OL-rhamnopyranoside and 5,7,30 -trihydroxy-4-methoxyflavone-7-O-L-rhamnopyranoside (quercitrin). Docking and ADMET studies revealed the promising binding affinity of flavonoid molecules for human lysosomal α -glucosidase and human pancreatic α -amylase with acceptable ADMET properties. Based on computational studies, our study reports the antidiabetic potential of the isolated flavonoids with predictive pharmacokinetics profile.

87. Gogoi N, Gogoi B, Chetia D, *In vitro antimalarial activity evaluation of two ethnomedicinal plants against chloroquine sensitive and resistant strains of Plasmodium falciparum*, *Clinical Phytoscience*, 7 (1), 1-10 (2021).

Abstract:

Two medicinal plants, *Citrus maxima* (Burm.) Merr. and *Artemisia nilagirica* (C.B. Clarke) Pamp. were selected on the basis of their traditional use in the treatment of fever associated with malaria in Assam (India) and evaluated their antimalarial potential against *Plasmodium falciparum* strains. The processed plant parts of *C. maxima* and *A. nilagirica* were extracted with different solvents from nonpolar to polar by cold maceration technique and then antimalarial activities of the extracts were evaluated against both chloroquine sensitive (3D7) and resistant (RKL-9) strains of *P. falciparum* using Giemsa staining light microscopy technique. The most active extract(s) was further screened for cytotoxicity potential against murine macrophage RAW264.7 cell line using MTT assay. Then preliminary phytochemical screening and qualitative fingerprint analysis of the active extract(s) were done to check the presence of different secondary metabolites. From the *in vitro* study, the hydro-alcoholic extract of *C. maxima* and methanol extract of *A. nilagirica* were found to be most active against both 3D7 and RKL-9 strains. In the cytotoxicity study, the CC50 values of the active extracts were found to be > 100 µg/ml, which suggested the safety of the extracts. The phytochemical and fingerprint analysis revealed the presence of various important plant secondary metabolites in both the extracts. The findings of this study confirmed the presence of antimalarial potential in the hydro-alcoholic extract of *C. maxima* and methanol extract of *A. nilagirica*.

88. Othman IMM, Mahross MH, Gad- Elkareem MAM, Rudrapal M, Gogoi N, Chetia D, Aouadi K, Snoussi M, Kadri A, *Toward a treatment of antibacterial and antifungal infections: Design, synthesis and in vitro activity of novel aryl hydrazothiazolyl sulfonamides analogues and their insight of DFT, docking and molecular dynamic simulations*, *Journal of Molecular Structure*, 1243 (2021).

Abstract:

To find out effective new antibacterial agents, a series of novel aryl-hydrazothiazolyl sulfonamide derivatives were synthesized and well characterized by analytical and spectroscopic techniques. All the compounds were evaluated for their antibacterial and antifungal potential and the results showed excellent antimicrobial activity in one compound against all strains, especially *B. cereus* (MIC = 5.54 µM vs. 17.6 µM), *P. aeruginosa* (MIC = 7.3 µM vs. 12.8 µM), *E. coli* (MIC = 6.4 µM vs. 21.3 µM) and *C. albicans* (MIC = 6.8 µM vs. 26.4 µM) in comparison to the commercial antibiotics, tetracycline and amphotericin B, respectively. The others analogues displayed potent to moderate antimicrobial activity. Structure-activity relationships (SARs) provides specially that incorporation of pyrimidin- 2-ylsulfamoyl group at the *para*-phenyl position is good contributor for improving the antimicrobial activity.

89. Gogoi B, Chowdhury P, Goswami N, Gogoi N, Naiya T, Chetia P, Mahanta S, Chetia D, Tanti B, Borah P, Handique PJ., *Identification of potential plant-based inhibitor against viral proteases of SARS-CoV-2 through molecular docking, MM-PBSA binding energy calculations and molecular dynamics*, Molecular diversity, 1-15 (2021).

Abstract:

The Coronavirus disease 2019 (COVID-19), caused by the novel coronavirus, SARS-CoV-2, has recently emerged as a pandemic. Here, an attempt has been made through *in-silico* high throughput screening to explore the antiviral compounds from traditionally used plants for antiviral treatments in India namely, Tea, Neem and Turmeric, as potential inhibitors of two widely studied viral proteases, main protease (Mpro) and papain-like protease (PLpro) of the SARS-CoV-2. Molecular docking study using BIOVIA Discovery Studio 2018 revealed, (-)-epicatechin-3-O-gallate (ECG), a tea polyphenol has a binding affinity toward both the selected receptors, with the lowest CDocker energy– 46.22 kcal mol⁻¹ for SARS-CoV-2 Mpro and CDocker energy– 44.72 kcal mol⁻¹ for SARS-CoV-2 PLpro, respectively. The SARS-CoV-2 Mpro complexed with (-)- epicatechin-3-O-gallate had shown the best binding affinity.

90. L Patowary, P Kashyap, D Chetia, N Gogoi , *Docking based virtual screening of some new 4-Aminoquinolines against PfCRT*, Current Trends in Pharmaceutical Research, 8 (1), 212-226 (2021).

Abstract:

Some new 4-aminoquinoline derivatives were designed and screened against the chloroquine resistant transporter protein of *Plasmodium falciparum* (PfCRT) by in silico technique. The compounds were designed considering the pharmacophore of chloroquine using MarvinSketch. Then compounds were screened against PfCRT by molecular docking based approach using Discovery Studio 2020. The best compounds were further analyzed for their toxicity, drug-likeness, drug scores and different pharmacokinetic properties. Nine compounds showed better docking results (CDocker energy) than the reference drugs chloroquine and piperazine. Different docking scores of these nine compounds also suggested the excellent binding affinity of these compounds with the target protein. The binding energies of the best docking poses of these nine compounds revealed that four compounds formed more stable protein-ligand complex than the reference drugs. All these four compounds showed similar toxicity profiles with the reference drugs, but had less drug-likeness. The four compounds had more drug score values than the reference drugs with suitable pharmacokinetic properties for the oral route.

91. Gogoi N, Chowdhury P, Goswami AK, Das A, Chetia D, Gogoi B, *Computational guided identification of a citrus flavonoid as potential inhibitor of SARS-CoV-2 main protease*, Molecular Diversity, 25 (3), 1745-1759 (2021).

Abstract:

Although vaccine development is being undertaken at a breakneck speed, there is currently no effective antiviral drug for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causing COVID-19. Therefore, the present study aims to explore the possibilities offered by naturally available and abundant flavonoid compounds, as a prospective antiviral drug to combat the virus. A library of 44 citrus flavonoids was screened against the highly conserved Main Protease (Mpro) of SARS-CoV-2 using molecular docking. The compounds which showed better CDocker energy than the co-crystal inhibitor of Mpro were further revalidated by flexible docking within the active site; followed by assessment of drug likeness and toxicity parameters. The non-toxic compounds were further subjected to molecular dynamics simulation and predicted activity (IC50) using 3D-QSAR analysis.

92. Ghosh S, Chetia D, Gogoi N., Rudrapal M., *Design, molecular docking, drug-likeness, and molecular dynamics studies of 1,2,4-trioxane derivatives as novel Plasmodium falciparum falcipain-2 (FP-2) inhibitors*, BioTechnologia, 102 (3), 257–275 9 (2021).

Abstract:

With the objective of developing 1,2,4-trioxane derivatives as novel antimalarial agents effective against resistant *P. falciparum*, 15 new trioxane derivatives were designed by molecular modification of the 1,2,4-trioxane scaffold as possible antimalarial agents. Molecular modeling studies of trioxane derivatives were performed based on the CADD approach using Biovia Discovery Studio (DS) 2018 software. The protein-ligand docking study was performed against *P. falciparum* falcipain 2 (FP-2) using the simulation-based docking protocol LibDock by the flexible docking method. The assessment of drug-likeness, ADMET properties, and toxicity was also performed. Two compounds that showed the best binding affinity against the target *P. falciparum* FP-2, were investigated by molecular dynamics (MD) simulation studies followed by the calculation of MM-PBSA binding free energy of protein-ligand complexes using DS 2020. Among the 15 compounds, three trioxane derivatives were found to possess promising binding affinity with LibDock scores ranging from 117.16 to 116.90. Drug-likeness, ADMET, and toxicity properties were found to be satisfactory for all the compounds. Among the 15 compounds, two compounds showed the highest binding affinity against FP-2 with LibDock score of 117.166 and 117.200, respectively. MD studies along with MM-PBSA calculations of binding energies further confirmed the antimalarial potential of the two compounds with the formation of well-defined and stable receptor-ligand interactions against the *P. falciparum* FP-2 enzyme. It was concluded that the newly designed 1,2,4-trioxane derivatives can be further studied for *in vitro* and *in vivo* antimalarial activities for their possible development as potent antimalarial agents effective against resistant *P. falciparum*.

93. Gogoi N, Chetia, D, Gogoi B, Das A, *Multiple-targets Directed Screening of Flavonoid Compounds from Citrus Species to find out Antimalarial Lead with Predicted Mode of Action: An In-Silico and Whole Cell-based In vitro Approach*, Current Computer-Aided Drug Design, 2021, 17 (1), 69-82 (2021).

Abstract:

44 flavonoids found mainly in the fruit juice of *Citrus* species having traditional use in malaria-associated fever were selected for *in silico* multiple-target directed screening against three vital targets of the parasite namely dihydroorotate dehydrogenase (*PfDHODH*), dihydrofolate reductase thymidine synthase (*PfDHFR-TS*) and plasma membrane P-type cation translocating ATPase (*PfATP4*) to find out new lead molecule(s). An *in silico* screening was carried out using different protocols of the Biovia Discovery Studio 2018 software and Network analyzer plugin of Cytoscape 3.6.0 followed by *in vitro* screening of the best lead. CF8 or luteolin was found to have good binding affinity against *PfDHODH* and *PfATP4* with –CDocker energy 42.2719 and 33.1447 with respect to their cocrystal ligands. These findings were also supported by structure-based pharmacophore, DFT (Density Functional Theory) study and finally by *in vitro* screening of the lead with IC₅₀ values of 8.23 μ m and 12.41 μ m against 3D7 (chloroquine-sensitive) and RKL-9 (chloroquine-resistant) strain of *P. falciparum*, respectively. The study identified a moderately active lead molecule with predicted mode of action which can be utilized to design some new derivatives with more safety and efficacy by targeting the two enzymes.

94. Pande A, Manchanda M, Bhat HR, Bairy PS, Gahtori P, *Molecular Insights into a Mechanism of Resveratrol Action Using Hybrid Computational Docking/CoMFA and Machine Learning Approach*, j biomol struct dyn. 8, 1-15 (2021).

95. Mandal MK, Ghosh S, Naesens L, Bhat HR, Singh UP, *Facile synthesis, antimicrobial and antiviral evaluation of novel substituted phenyl 1,3-thiazolidin-4-one sulphonyl derivatives*, Bioorg chem. 114:10515315 (2021).

96. Singh S, Mandal MK, Masih A, Saha A, Ghosh SK, Bhat HR, Singh UP, *1,3,5-Triazine: A versatile pharmacophore with diverse biological activities*, Archiv der Pharmazie 354(6) (2021).

97. Masih A, Agnihotri AK, Srivastava JK, Pandey N, Bhat HR, Singh UP., *Discovery of novel pyrazole derivatives as a potent anti-inflammatory agent in RAW264.7 cells via inhibition of NF- κ B for possible benefit against SARS-CoV-2.*, Journal of Biochemical and Molecular Toxicology. 35(3): e22656 (2021).

98. Masih A, Singh S, Agnihotri AK, Shrivastava JK, Bhat HR, Singh UP., *Discovery of novel 1,3,5-triazine as adenosine A2A receptor antagonist for benefit in Parkinson's Disease*, Journal of Biochemical and Molecular Toxicology. 35(3): e22659 (2021).
99. El Bethel L Hmar; S Paul; N Boruah; P Sarkar; S Borah; HK Sharma, *Apprehending Ulcerative Colitis Management With Springing Up Therapeutic Approaches: Can Nanotechnology Play a Nascent Role?* CurrPathobiol Rep, DOI: 10.1007/s40139-020-00218-6 (2021).
100. Ashis Kumar Goswami, Hemanta Kumar Sharma, Neelutpal Gogoi, Ankita Kashyap and BhaskarJyoti Gogoi, *In vitro evaluation and molecular dynamics, DFT guided investigation of antimalarial activity of ethnomedicinally used Coptisteeta Wall*, Combinatorial Chemistry & High Throughput Screening, 24: 1 (2021).
101. Borah, S., Sarkar, P. & Sharma, H.K., *Analysing Curcuma caesia fractions and essential oil for neuroprotective potential against anxiety, depression, and amnesia*, 3 Biotech 11, 240 (2021).
102. Biplajit Das, Sujata Paul, Hemanta Kumar Sharma, *A Review on Bio-Polymers Derived from Animal Sources with Special Reference to their Potential Applications*, Journal of Drug Delivery and Therapeutics, 11 (2): 209-223 (2021).
103. Barnali Gogoi, Kashyap J. Tamuli, Neipihoi, Manobjyoti Bordoloi, Hemanta K. Sharma, *Isolation and characterization of chemical constituents with in vitro anti-hypertensive and anthelmintic activities of Cinnamomumbejolghota (Buch.-Ham.) sweet leaves: An ethno medicinal plant of North East India*, South African Journal of Botany, Volume 140 ; 161-166 (2021).
104. Sudarshana Borah, Priyanka Sarkar, Hemanta Kumar Sharma, *Zederone Improves the Fecal Microbial Profile in Dementia Induced Rat Model: A First Report*, CNS & Neurological Disorders - Drug Targets (In Press).
105. Nath V, Buragohain P, Sharma HK, *A Review on Some Medicinal Plants of North- East India Region Used in the Treatment of Central Nervous System Disorders*, Journal of Drug Delivery and Therapeutics. 2021; 11(5):199-207.

106. Rubina Chowdhury, Priyam Goswami, Rofiqul Islam, Hemanta Kumar Sharma, *Documentation of Natural Resources and the Way Forward: Zanthoxylum, An Exemplar.* Pharma Times , 53 (08-09): 8-16 (2021).

107. Junejo J A, Zaman K, Rudrapal M, Celik I, Attah E I., *Antidiabetic bioactive compounds from Tetrastigma angustifolia (Roxb.) Deb and Oxalis debilis Kunth.: Validation of ethnomedicinal claim by in vitro and in silico studies,* South African Journal of Botany, 143:164 – 175 (2021).

Abstract:

Tetrastigma angustifolia (Roxb.) Deb is an evergreen shrub belonging to the family Vitaceae. This plant species has been used for thousand years in Ayurvedic medicine. Ethnomedicinal study also documents the use of *T. angustifolia* leaves in the management of diabetes. On the other hand, *Oxalis debilis* Kunth. is a tristylous plant commonly known as pink woodsorrel belong to the family Oxalidaceae. This plant has been used traditionally for the treatment of dysentery and diarrhea. Ethnobotanical study also reports the use of leaf decoction of *O. debilis* in the treatment of diabetes. In our earlier work, the antidiabetic activity of hydro-alcoholic leaf extracts of *T. angustifolia* and *O. debilis* have been reported. In spite of ethnomedicinal implications and several scientific studies in the recent past, phytochemical investigations in support of the antidiabetic potential of these plant species are yet to be explored. Therefore, the present study was aimed at the isolation of bioactive phytoconstituents as antidiabetic principle(s) from *T. angustifolia* and *O. debilis* leaves. In this paper, two bioactive compounds, namely apigenin derivative (AGD) and stigmasterol (STM) were isolated from the methanolic leaf extracts of *T. angustifolia* and *O. debilis*, respectively by column chromatographic technique. The structures of the isolated compounds were established by spectroscopic/spectrometric techniques including FT-IR, ¹H NMR and ¹³C NMR and Mass. The isolated flavonoids were identified as 8-hydroxyapigenin 7-O-b-D-glucopyranoside, a derivative of apigenin (AGD) and stigmasta-5,22-dien-3b-ol i.e., stigmasterol (STM). The antidiabetic potential of AGD and STM was evaluated by in vitro α-glucosidase and α-amylase inhibitory assays. To validate the antidiabetic efficacy, molecular docking and dynamics studies were performed using AutoDock Vina and GROMACS software. In vitro assays revealed the antidiabetic potential of AGD and STM with α-glucosidase and α-amylase inhibitory activities. From docking and MD simulation studies, promising binding affinity of AGD and STM for human lysosomal α-glucosidase (5NN8) and human pancreatic α-amylase enzymes (1B2Y) with favorable binding modes, stable protein-ligand complexes and well defined protein-ligand interactions were observed. Based on in vitro and in silico studies, our study reports the antidiabetic potential of the isolated apigenin derivative, AGD (a new flavonoid molecule) and stigmasterol, STM (an existing plant sterol) with α-glucosidase and α-amylase inhibitory activities. However, the flavonoid molecule, AGD possesses better antidiabetic profile than the steroid molecule, STM particularly against human α-amylase enzyme. Our present investigation successfully validates the traditional as well as ethnomedicinal claims of *T. angustifolia* and *O. debilis* as antidiabetic medicines.

108. Bondita Robidas, Subrata Borgohain Gogoi, *Investigation of flow behavior of crude oils with emphasis to upper Assam Basin, India.*, Petroleum Research (Accepted, in Press).

Abstract:

This paper attempts to investigate the viscoelastic nature of eight Crude Oil (CO) samples from the Upper Assam Basin, India. Viscoelasticity was studied using Dynamic Mechanical Analysis (DMA) where shear stress was applied to the CO samples and the resulting displacement (shear strain) was measured. CO transportation through pipelines face serious problems due to their high pour (PP) point and viscosity. In this work, Dynamic Modulus (G^*) was calculated using which the storage and the loss modulus were determined to study the elastic and viscous nature of the samples at 30 °C as the average Pour Point (PP) of the CO samples was near 30 °C. So, especially during the extreme winter season in Assam, when the ambient temperature falls drastically, the lighter components come out from the liquid and precipitates in the inner wall of the pipeline which affects the flow through the pipeline. So, a better understanding of the flow behavior of CO is very important as this will help to identify whether flow improving methods are required or not. Here, in this work viscoelastic properties of the CO samples were investigated from where yield point was determined. Crossover points or the Yield Point (YP) of the samples were determined to understand the flow characteristics before and after the crossover point. All the CO samples were observed to be viscous after the yield point except for two CO samples. Yield stress and yield strain of the samples were calculated from the YP, which exhibited non-Newtonian behavior with maximum yield stress up to 35Pa. After reaching the YP, the CO samples showed the dominance of viscous nature over elastic nature except for two samples. Loss tangent or $\tan \theta$ was also calculated to validate the viscoelasticity of the samples. This study was done to investigate the flow behavior of CO samples of the Upper Assam Basin for pipeline transportation.

109. Gitalee Sharma and Parijat Burhagohain, *Evaluation of Percentage Corrosion Inhibition Efficiency of Mild Steel with Derivatives of Oxazolone*, Journal of Advanced Applied Scientific Research, 3, 16-24 (2021).

Abstract:

Carbon Steel is one of the most widely used material in the transportation pipelines of Oil and Gas industry. However, they are prone to corrosion in acidic environment. As preventive measure various mitigation techniques are employed to bring a stag to its corrosion, one of which is the use of inhibitors. In the paper, the study of the inhibition properties of two oxazolone derivatives have been reported. The compounds were synthesized at ease and in high yield. The corrosion studies were performed on carbon steel in three different concentrations of HCl (1N, 1.5N and 2.0N) solutions using weight loss coupon (gravimetric) method. 1N HCl solution was found to have the most effective inhibition property for the oxazolone derivatives. % Inhibition efficiency was found to be maximum with 100 ppm of inhibitor concentration. Surface analysis like SEM and SEM-EDX was also carried out to find out the surface morphology of the mild steel in the presence and absence of the inhibitor and concentration of inhibitor. The adsorption

of the oxazolones on the mild steel surface was found to obey Langmuir adsorption isotherm. The obtained results revealed oxazolone derivatives as promising effective corrosion inhibitors.

110. MritunjoyDihingia, Anurag Borah, Tridibesh Chakravarty and Gitalee Sharma, *Toxicity Analysis of an Oilfield Reserve Pit in India*, *Bulletin of Environment, Pharmacology and Life Sciences.*, 10 (3), 109-117 (2021).

Abstract:

Drilling processes in Oil and Gas Industry generates a large volume of spent mud which are being directly dumped into pits in the vicinity of the operational site. This paper reports the qualitative analysis of various environmental factors on 8 samples (4 water phase and 4 sludge phase) collected from a reserve pit in India. Heavy metal detection analysis was also performed on the samples, and the results put on an alarm to its proper disposal in order to prevent the toxicity which will be hazardous to the commoners residing near these sites. Moreover, Bioremediation technique has been tested on these samples to bring a slag to its toxicity, which has proved its potential as an efficient waste disposal method.

111. R. Bose, S. Roy, H.P. Mondal, D.R. Chowdhury, S. Chakraborty, *Energy-efficient approach to lower the carbon emissions of data centers*, *Computing (Springer)* (10.1007/s00607-020-00889-4), (2021).

Abstract:

Data Centers require enormous amounts of electrical energy to operate. The resultant emissions in the form of heat, directly, and carbon, indirectly, are cause for concern among Data Center managers and owners. In the past, and in many contemporary instances as well, Data Center managers have struggled to rein in large energy bills as operational activities increased. This paper attempts to address the problems without affecting operational efficiency of Data Centers and while maintaining high standards of system uptime. The latter is made possible by observing a set standard of Power Usage Efficiency and through rationalizing power consumption of equipment and Data Center infrastructure itself. Our research has shown that it is possible to control power consumption, and thus bring about savings in terms of electric bills paid, even when the count of servers in Data Centers racks increase from four to seven. Experiments conducted in the course of our research indicate to maintain a high quality of Data Center operational state and keep power consumption under control even in the wake of rising user numbers. The resultant savings in electrical units consumed, shall ultimately contribute in a small yet meaningful way towards a smaller carbon footprint and a greener planet.

112. A. Ghosh, S. Roy, H.P. Mondal, S. Biswas, R. Bose, *Mathematical Modelling for Decision Making of Lockdown during COVID-19*, *Applied Intelligence* (Springer) (10.1007/s10489-021-02463-7), (2021).

Abstract:

Due to the recent worldwide outbreak of COVID-19, there has been an enormous change in our lifestyle and it has a severe impact in different fields like finance, education, business, travel, tourism, economy, etc., in all the affected countries. In this scenario, people must be careful and cautious about the symptoms and should act accordingly. Accurate predictions of different factors, like the end date of the pandemic, duration of lockdown and spreading trend can guide us through the pandemic and precautions can be taken accordingly. Multiple attempts have been made to model the virus transmission, but none of them has investigated it at a global level. The novelty of the proposed work lies here. In this paper, first, authors have analyzed spreading of the said disease using data collected from various platforms and then, have presented a predictive mathematical model for fifteen countries from first, second and third world for probable future projections of this pandemic. The prediction can be used by planning commission, healthcare organizations and the government agencies as well for creating suitable arrangements against this pandemic.

113. K. Goswami, H. P. Mondal*, M. Sen, *A Review on All-optical Logic Adder: Heading Towards Next-generation Processor*, *Optics Communications* (Elsevier), vol. 48, pp. 126668. (2021).

Abstract:

In this paper few literatures on all-optical adders, reported approximately in last fifteen years, have been reviewed. Being the key element of arithmetic and logic unit (ALU), adder has attracted stirring attention of the researchers. The reviewed articles are primarily categorized into three broad sections based on the platforms utilized in designing all-optical adder namely semiconductor optical amplifier (SOA), plasmonics and photonic crystal (PhC). SOA based designs offer high contrast ratio between the output logic levels, however; at the cost of high response time and operating power. Plasmonic based designs provide miniaturized physical footprint of the devices owing to the tight optical confinement. Nevertheless, the process of fabrication involved with the plasmonic based designs along with the loss incurred at the metal are among the limiting features. In contrast, PhC based designs are much more advantageous owing to the notable characteristics of light propagation. The operating power and bandwidth of operation are also higher as compared to the other designs. Photonic crystal-based designs are further categorized into linear and nonlinear domains based on their operating principle. The design structures and performances have been summarized and a comparison is made. Some insights have been discussed leading to design of more efficient PhC based all-optical adders for next generation ultra-first optical processors.

114. Prasun Banik, Sarat Phukan, Minati Das, *Hydrocarbon Source Potential of Coal-bearing Tikak-Parbat Formation of Barail Group in a Part of the Belt of Schuppen, India*, Journal of the Geological Society of India, Volume: 97. 767-771, Issue: 7 (2021).

Abstract:

The Oligocene succession of the Tikak Parbat Formation has prominent coal bearing horizons. The formation comprises of medium to coarse grained light coloured sandstone, clay and carbonaceous shale with four workable coal seams. Core samples from two wells has been studied with regards to organic matter content and type. Relatively high total organic carbon (TOC) contents are present (average 72.103 wt %) in coal; the hydrogen index (HI) values reach a maximum of 410 mg HC/g TOC, indicating presence of type III-II kerogen, and the organic matter is thermally immature (T_{max} 428°C) in coal. The genetic potential have maximum yield of 246.53 mg/g, so the coal deposits could act as an excellent source rock for hydrocarbons if the burial depth is sufficient. Carbonaceous shale samples are at early mature stage (T_{max} 438°C). Kerogen at this maturity level is within oil window and is capable of generating oil and thermogenic gas upon thermal cracking. The study highlights dense accumulation of reactive macerals (vitrinite + liptinite) and low concentration of inertinite. The empirically derived values for coal reveal a high conversion (>90%) and oil yield (>60%).

115. A Gogoi, N Baruah, SK Sarma, RD Phukan, *Improving stemming for Assamese information retrieval*, International Journal of Information Technology, 2021, <https://doi.org/10.1007/s41870-021-00718-7>

Abstract:

To enhance the Assamese stemmer several approaches and solutions by researchers have been proposed. Such stemmers are important as the features are often applied for application-oriented projects, and especially, to develop information retrieval (IR) systems. Assamese stemming could be defined as a process that strips off a set of suffixes from words. But this process also has certain set back such as vocalization ambiguity, incorrect removal, single solution, etc. In this paper, we have proposed an Assamese stemmer that provides solutions to various drawbacks as proposed earlier and to make use of various features as mentioned above efficiently. We have tested using 20,000 words from 16 different articles, all possible suffixes in the Assamese language were manually collected taking the help of an Assamese linguistic expert. It has achieved quite better accuracy with 86.16%. Also, the accuracy of the system is compared with other existing approaches and our system outperforms all the others. Besides, we proposed an

automatic approach for the evaluation and comparison of Assamese stemmers that takes into account metrics related to the accuracy of results.

116. N Baruah, A Gogoi, SK Sarma, R Borah, *Utilizing Corpus Statistics for Assamese Word Sense Disambiguation*, *Advances in Computing and Network Communications*, volume 736 (2021).

Abstract:

Classification or categorization of a word based on its meaning in respect to a context is one of the major problems in Natural Language Processing (NLP). Such a problem is termed as Word Sense Disambiguation (WSD), and the mentioned problem is seen to be prevalent in all languages across the globe. However, in Indian languages, WSD poses greater challenges due to limitation of digital resources and lack of UNICODE. In this paper, we have made an attempt to highlight the efforts put by researchers to overcome WSD. It is also to be mentioned that for the said purpose, two WSD algorithms for Assamese language WSD are contrasted while asserting the corpus statistics in the approach. Of the two aforementioned WSD algorithms, the first is applied using the Lesk algorithm simpler, while the second is exercised to determine the probability of words and phrases on grounds of condition that co-occur with every meaning of an ambiguous word in disambiguation. Both the algorithms delivered affirmative results for a trained set of corpus. However, compared to the second, the Lesk algorithm yielded better results in terms of overall efficiency of the system developed in comparison to words and phrases co-occurrence.

117. A Gogoi, N Baruah, LJ Nath, *Assamese Word Sense Disambiguation using Cuckoo Search Algorithm*, *Procedia Computer Science*, Volume 189 (2021).

Abstract:

Natural language processing is associated with human-computer interaction, where several challenges require natural language understanding. The Word sense disambiguation problem comprises the computational assignment of meaning to a word according to a specific context in which it occurs. There are numerous natural language processing applications, such as machine translation, information retrieval, and information extraction, which require this task which takes place at the semantic level. To solve this problem unsupervised computation proposals can be effective since they have been successfully used for many real-world optimization problems. In this paper, we propose to solve the word sense disambiguation problem using the cuckoo search algorithm in the Assamese language. We illustrate the performance of our algorithm by carrying out experiments on an Assamese corpus. And comparing them against an unsupervised genetic

algorithm that is implemented in the Assamese language. Results of the experiment show that the cuckoo algorithm can achieve more precision, recall and F-measure, attaining 87.5, 84, and 85.71 percentages respectively.

118. Baruah, N., Khan, A., Ray, D., Phukan, R.D., Gogoi, *Word level English to Hindi neural machine translation*, Journal of Theoretical and Applied Information Technology, 2021, Vol-99(14), (2021).

Abstract:

In today's world English is considered as an important language across the globe. Many resources are available in the English language on the internet, which is not easily understandable, so it is necessary that the English language be translated into the local languages of India so that the people of India can easily understand the enormous amount of English resources. As the information is of a large amount, it is not possible to keep translating things from one language to another manually. Thus, it is very important to translate the given text or information from one language to another automatically and effectively. This paper discusses about Neural Machine Translation (NMT) for converting English text to Hindi text. Neural machine translation (NMT) is one of the most recent and effective translation techniques amongst all existing machine translation systems. In our experiment, we have tested using 4 different models on OPUS, IIT-Bombay English-Hindi parallel corpora, which contains nearly 1084157 sentences and we have been able to get quite good results in terms of BLEU score while comparing to other available English to Hindi Neural Machine Translation models. It has achieved a satisfactory score of 21.07, 22.08, 23.45 and 23.44 (in terms of percentage) for 2-layer, 4-layer, 2-layer (Bidir) and 4-layer (Bidir) LSTM respectively. Also, the accuracy of the system is compared with 4 existing machine translation systems available on the internet for English to Hindi. Human evaluation of the systems is done based on five parameters and our system outperforms all the others.

119. Bhargabjyoti Saikia and Sudipta Majumder, *Analysis of performance vulnerability of MAC scheduling algorithms due to SYN flood attack in 5G NR mmWave*, International Journal of Advanced Technology and Engineering Exploration (IJATEE), Volume-8 (2021).

Abstract:

Fifth-generation (5G) new radio (NR) millimetre wave (mmWave) is a kind of 5G network that operates in the 24GHz to 100GHz frequency range. It offers several opportunities as well as numerous challenges. One of the most prominent challenges that a 5G network faces is intrusion. Intrusion is possible because of existing vulnerabilities in the 5G NR mmWave network architecture. We exploited one such vulnerability to create synchronise (SYN) flood intrusion

into the network. The SYN flood intrusion is a denial of service (DoS) intrusion. The intruder who is involved in the SYN flood intrusion depletes the network's available resources. As a result, it denies genuine UEs/nodes access to the network's services and resources. Since this attack produces many open connections with the server, it slows down media access control (MAC) schedulers' ability to assign available channels to the user equipment. In this article, we proposed a method to exploit existing vulnerabilities of the 5G NR mmWave network to carry out SYN flood attacks. Further, we investigated the effect of the attack on the performance of the MAC schedulers, such as proportionate fair and round robin MAC schedulers. With the addition of SYN flood attack UEs/nodes, we observed that the throughput for proportional fair and round robin MAC schedulers drops dramatically. In the event of an attack, throughput drops by 2.34 % to 37.7%. However, in the event of an SYN flood attack, network delay and jitter increase. The performance of the network suffers as a result of that.

120. Dutta P. and Bora R, *Jaccard Similarity Measure Of Picture Fuzzy Sets And Its Applications*, J. Assam Acad. Math. Vol.11, pp:41-54.

Abstract:

Uncertainty is an important factor of any decision making process and uncertain information or data always restrict us in arriving at a precise result of our analysis. Fuzzy set theory (FST) as well as Intuitionistic fuzzy set (IFS) are employed to overcome this difficulty at some extent. In some complex atmosphere FST and IFS fails to play its role in modeling of uncertainty. As a result Picture fuzzy set (PFS) was developed with the extension of FST and IFS. Furthermore, similarity measure under uncertain environment plays important rule in decision making. In this paper, attempt has been made to devise similarity measures of PFSs based on Jaccard Index. Finally, a case study has been carried out under this setting.

Conference Papers

1. Dibya Jyoti Borah, A.T.T. Mostako, and A. Malakar, *Synthesis of mixed crystalline phases: h- and α - MoO_3 QDs and its phase transformation*, 16th June, 2021, NCETP, National Conference organized by Department of Physics, Tezpur University, Tezpur, Assam, India.

2. Dibya Jyoti Borah and A.T.T. Mostako, *Annealing Effect on the Optical Constants of WO_3 Thin Films*, 28th to 29th June, 2021, NCAFMC, National Conference organized by Department of Physics, Academy of Maritime Education and Training (AMET), Chennai, Tamil Nadu, India.

3. B. Pant, S. Ahmad, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *Characterizing the isotropic diffuse gamma-ray flux (10-300 TeV) by the GRAPES-3 experiment*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

A diffuse gamma-ray emission at ~ 100 TeV can be expected as a result of the interactions of ultra-high-energy cosmic rays (UHECRs) with the cosmic microwave background (CMB) during their propagation. This radiation carries the information on the distribution of energetic sources and hence the cosmological evolution of the universe. The GRAPES-3 is an extensive air shower (EAS) array, located at Ooty in southern India. It consists of 400 plastic scintillators (each 1 m^2) and a large area (560 m^2) muon telescope. The muon telescope has the ability to differentiate the gamma-rays from charged cosmic rays through their muon content. We report on the study of isotropic diffuse gamma-ray flux from GRAPES-3 over 10-300 TeV.

4. D. Pattanaik, S. Ahmad, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P.

Pant, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *Search for gamma rays above 30 TeV from the Crab Nebula with the GRAPES-3 experiment*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The GRAPES-3 is a high-altitude, near-equator extensive air shower array at Ooty, India which is designed to observe cosmic and gamma-rays in TeV-PeV energy range. It consists of a dense array of 400 scintillator detectors operating in conjunction with a 560 m^2 area muon telescope. Due to recent improvements in the measurements of shower arrival time and corrections for shower front curvature based on shower size and age, the angular resolution of the array has been significantly improved. By leveraging the resultant improved angular resolution and an efficient rejection of the cosmic ray background using the muon content of the shower, a search for gamma-rays above 30 TeV from the Crab Nebula has been performed. The results will be presented during the conference.

5. A. Chandra, S. Ahmad, M. Chakraborty, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B.P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *An extensive study for correcting the nonlinear particle density measured by GRAPES-3 scintillator detectors*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The GRAPES-3 extensive air shower (EAS) array located at Ooty is equipped with 400 plastic scintillator detectors spread over an area of 25000 m^2 and a muon telescope of area 560 m^2 built with 3,712 proportional counters. One of its principal objectives is to measure the primary cosmic ray energy spectrum in the TeV-PeV energy region. The response of the photo-multiplier tubes (PMTs) used in the plastic scintillator detectors becomes nonlinear at densities > 50 particles per m^2 in large EAS. We describe a technique to correct for the nonlinearity of these PMTs, thereby extending the dynamic range of the detector for observed particle densities up to 5000 particles per m^2 . The details of the technique will be presented.

6. M. Chakraborty, S. Ahmad, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B.P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *Vetoing the high energy showers in the GRAPES-3 experiment whose cores lie outside the array*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The GRAPES-3 experiment located in Ooty consists of an array of 400 plastic scintillator detectors spread over an area of 25000 m² and a large area (560 m²) muon telescope. Every day, the array records about 3 million showers induced by the interaction of primary cosmic rays in the atmosphere. One of the primary objectives of the experiment is to measure the energy spectrum and composition of the cosmic rays in the TeV-PeV energy range. However, some of the detected showers have cores outside the array. This fraction increases with energy due to the higher lateral spread of shower particles at higher energies. Identifying these events is thus crucial for accurate measurement of the cosmic ray energy spectrum. This work will describe simple cut based as well as machine learning based strategies for identifying and excluding such events and their impact on the cosmic ray energy spectrum as measured by the Bayesian unfolding technique.

7. M. Chakraborty, S. Ahmad, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B.P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *Large-scale cosmic ray anisotropy measured by the GRAPES-3 experiment*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The deflection of cosmic rays (CRs) in the interstellar magnetic field results in an almost isotropic flux as observed on Earth. However, an anisotropy has been observed at the level of $\sim 10^{-4} - 10^{-3}$. The GRAPES-3 experiment located at Ooty, India consists of an array of 400 plastic scintillator detectors. It measures the particle densities and their relative arrival times in extensive air showers produced by the CRs. This information collected is then reconstructed to obtain the energy and direction of the primary CRs. The near-equatorial location of GRAPES-3 provides an opportunity to study this anisotropy in both hemispheres of the celestial sphere in the

TeV-PeV energy range. However, detector and atmospheric effects that induce a few per cent change in the primary CR flux are challenges to be addressed. This work describes the use of the time scrambling method to address some these systematics and observe anisotropy.

8. D. Pattanaik, S. Ahmad, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P. Pant, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *Measurement of the improved angular resolution of GRAPES-3 EAS array by the observation of the Moon shadow*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The Moon acts as a shield against the cosmic rays, preventing them from reaching the earth, which gives rise to a deficit in the flux along the direction of the Moon. The observed deficit can be used for obtaining the absolute calibration of the angular resolution and to verify the pointing accuracy of the array. GRAPES-3 is an extensive air shower experiment located at Ooty, India consisting of a dense array of scintillator detectors. It records $\sim 10^9$ showers per year with a median energy of 10 TeV. With the precise determination of the arrival time of shower particles and an accurate correction for the shower front curvature, a major improvement in the angular resolution of the array has been achieved. This was done by the array division methods including the left-right and even-odd methods. Here, we present a verification of the angular resolution estimates and the pointing accuracy by observing shadow of the Moon in the cosmic ray flux.

9. M. Zuberi, S. Ahmad, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka and F. Varsi (GRAPES-3 Collaboration), *Zenith angle dependence of pressure effect in GRAPES-3 muon telescope*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

A large area (560 m²) muon telescope in the GRAPES-3 experiment at Ooty, India records muon intensity at high cutoff rigidities (R_c) varies from 14 - 32 GV along 169 independent

directions spanning a field of view of 2.3 sr. The threshold energy of the recorded muons is $\sec(\theta)$ GeV along a direction with a zenith angle (θ) and with the average angular accuracy of ~ 4 degrees. The directional capabilities of the muon telescope are exploited for studying the effect of atmospheric pressure on the muon flux as a function of R_c . It is observed that the barometric coefficient relationship with logarithmic R_c can be well described by a second order polynomial function with a high Spearman Rank correlation coefficient of 0.99.

10. M. Zuberi, S. Ahmad, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka and F. Varsi (GRAPES-3 Collaboration), *A study of the Moon shadow by using GRAPES-3 muon telescope*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The GRAPES-3 experiment is designed to perform precision studies of gamma-ray sources in the TeV-PeV energy region. It consists of 400 plastic scintillator detectors spanning an effective area of 25000 m² and a large area (560 m²) muon telescope which records $\sim 4 \times 10^9$ muons every day. With the recent installation of an improved triggerless data acquisition (DAQ) system, the information related to every muon is recorded with a timing resolution of 10 ns. The angular resolution and pointing accuracy of the upgraded muon telescope has been validated by characterizing the shadow of the moon among recorded muons. Here, the details of the analysis and results, as well as the simulation studies to account for the deflection of the particles in the Earth's magnetic field will be presented.

11. F. Varsi, S. Ahmad, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, B. Hariharan, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka and M. Zuberi (GRAPES-3 Collaboration), *Cosmic ray energy spectrum and composition measurements from the GRAPES-3 experiment: Latest results*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The Gamma Ray Astronomy at PeV Energies phase-3 (GRAPES-3) experiment is located at Ooty in India (11.4° N, 76.7° E and 2200 m above m.s.l.). It consists of a densely packed array of 400 plastic scintillator detectors and a large area muon telescope (560 m²). It measures cosmic rays from several TeV to over 10 PeV energies providing a substantial overlap with direct experiments while covering the knee region. Shower parameters are reconstructed by fitting the observed particle densities with the NKG lateral distribution function (LDF). For this analysis, the QGSJET-II-04 hadronic interaction model is used to generate the air shower simulation data for proton, helium, nitrogen, aluminium, and iron primaries. Precise measurements of the average nuclear composition are obtained by fitting muon multiplicity distributions (MMDs) for all simulated primaries with the MMDs measured by the muon telescope. Details of the analysis and preliminary results for the extracted composition and elemental energy spectrum for proton and helium from a few tens of TeV to a few PeV will be presented.

12. B. Hariharan, S. Ahmad, T. Alt, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *Measurement of large angle muon flux in GRAPES-3 experiment using triggerless DAQ system*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The large area muon telescope of GRAPES-3 has been operating continuously for more than two decades with a DAQ which has several limitations. At present, this DAQ is in the process of being upgraded with a FPGA based system. The new DAQ system is designed to be triggerless and capable of recording every hit from the 3712 proportional counters along with a time-stamp (10 ns accuracy) which has significantly expanded the physics horizon of the experiment. This triggerless feature allows the detection of muons beyond the nominal zenith range of the current system ($\theta < 45^\circ$). The upgraded DAQ system has been deployed for 25% of the telescope. An offline software trigger has been developed for the reconstruction of muon tracks by using the timing and pulse height information of each hit in the raw data. For the first time the muons are reconstructed in the entire zenith angle range. The extensive air showers (EAS) at large angles can be studied through the muon component. We present measurements of the flux of the large angle muons and their correlation with EAS triggers.

13. B. Hariharan, S. Ahmad, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, Y. Hayashi, P. Jagadeesan, A. Jain, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *The azimuthal distribution of thunderstorm events recorded by the GRAPES-3 experiment*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The GRAPES-3 experiment reported the measurement of 1.3 GV potential across one of the massive thunderclouds recorded on 1 December 2014 by making use of the muon imaging technique. This measurement is ten times larger than the maximum potential reported previously by balloon and rocket sounding measurements, verifying the almost a century old prediction by C.T.R. Wilson. These measurements rely on the precise estimate of the change in the angular muon flux caused by the acceleration of muons during their passage through the charged layers of thunderstorms. The electric potential is estimated with the help of Monte Carlo simulations by using CORSIKA and other in-house tools. A study of the thunderstorms events recorded since April 2011 displays an asymmetry in their azimuthal distribution which can be understood to be caused by the ratio of μ^+/μ^-

13. A. Jain, S. Ahmad, T. Alt, M. Chakraborty, A. Chandra, S.R. Dugad, U. D. Goswami, S.K. Gupta, H. Hariharan, Y. Hayashi, P. Jagadeesan, P. Jain, S. Kawakami, H. Kojima, S. Mahapatra, P.K. Mohanty, R. Moharana, Y. Muraki, P.K. Nayak, T. Nonaka, A. Oshima, B. P. Pant, D. Pattanaik, G.S. Pradhan, P.S. Rakshe, M. Rameez, K. Ramesh, L.V. Reddy, R. Sahoo, R. Scaria, S. Shibata, J. Soni, K. Tanaka, F. Varsi and M. Zuberi (GRAPES-3 Collaboration), *An Advanced Triggerless Data Acquisition System for GRAPES-3 Muon Detector*, 12-23 July, 2021, 37th International Cosmic Ray Conference (ICRC2021), Berlin, Germany (Online), Proceedings of Science (PoS), Volume 395.

Abstract :

The large area 560 m² directional muon telescope at Gamma Ray Astronomy at PeV Energies phase -3 (GRAPES-3) experiment in Ooty, India was designed primarily to study the extensive air showers (EAS) and made operational in year 1998. It has turned out to be an unique instrument to make fascinating study of exotic phenomenon by introduction of a new parallel data acquisition system (DAQ) in year 2000 to measure the muon directional flux. The recent discoveries of transient weakening of Earth's magnetic shield probed by a Cosmic Ray Burst and measurement of the electrical properties of a thundercloud through muon imaging has demonstrated the capabilities of this instrument. The design of new

triggerless muon data acquisition system (TM-DAQ) using Field-programmable gate array (FPGA) would enhance the present capabilities and open a new window on several physics fronts such as, a) precise measurement of the muon flux for thunderstorm studies, b) study of large angle EAS using the muon component, c) search for exotic particles characterized by early or delayed arrivals. We present here the key salient features of the TM-DAQ along with initial observations.

14. Kuki Kalpita Mahanta, *A Bayesian Analysis of Multivariate Accelerated Failure Time Model with Log-logistic hazard under Frailty Approach*, 7-10 September, 2021, International Conference (Virtual Mode) on Emerging Trends in Statistics and Data Science in conjunction with 40th Annual Convention of Indian Society for Probability & Statistics(ISPS).

Abstract :

Accelerated Failure Time Model is a popular survival model in survival analysis which can be used as an alternative to the Proportional Hazards model. Accelerated Failure Time Frailty Models are the extension of the Accelerated Failure Time Model by adding a factor frailty to this model. In this paper an attempt has been made to derive a new Accelerated Failure Time (AFT) model under frailty approach by using a Log-logistic hazard function in context of Bayesian mechanism. To demonstrate the model a real life survival data set is used and the posterior inferences are drawn using Markov Chain Monte Carlo simulation methods. The newly developed model is also compared with the usual survival model without the frailty term. For model comparison, deviance information criteria (DIC) and the log pseudo marginal likelihood (LPML) are calculated and check the fit of the model by using Cox-Snell residual plot.

15. Dibyendu Mukherjee, Sandip Roy, Rajesh Bose and Haraprasad Mondal, *Potency of Virtualization Technology for Getting Energy Potent Data Center*, IEEE international conference on Innovations in Energy Management and Renewable Resources (IEMRE), 2021, Institute of Engineering and Management, Kolkata, West Bengal, India.

Abstract :

An atmosphere of virtualization allows green datacenter on it which is such an idea that has a significant part on the energy potency of data-center and server. For the augmentation of the potency of the datacenter, an eminent and fruitful method implemented, is via virtualization. It is constituted for making a sole part of hardware operation like several parts, and such mechanization is able to assist to reduce power as well as expenditure of energy. We have found that there is the presence of intricacy of the data center. Besides, profuse servers result in such issues that inflate exertion of energy regarding power as well as cooling. It is nothing but server

virtualization that is integrated with amalgamation is able to assist data-center controllers in terms of potency and expense factors. This research allows us to establish a business profit to make the expense of server power as well as cooling reasonable for more than three years. This is the evidence of the mechanization being fruitful for curtailing costs as well as diminishing consumption of power, fabricating a data-center which is energy potent.

16. Aritra Dutta, Rajesh Bose, Swarnendu Kumar Chakraborty, Sandip Roy and Haraprasad Mondal, *Data Security Mechanism for Green Cloud*, IEEE international conference on Innovations in Energy Management and Renewable Resources (IEMRE), 2021, Institute of Engineering and Management, Kolkata, West Bengal, India.

Abstract :

Data and veracious information are an important feature of any organization; it takes special care as a like asset of the organization. Cloud computing system main target to provide service to the user like high-speed access user data for storage and retrieval. Now, big concern is data protection in cloud computing technology as because data leaking and various malicious attacks happened in cloud computing technology. This study provides user data protection in the cloud storage device. The article presents the architecture of a data security hybrid infrastructure that protects and stores the user data from the unauthenticated user. In this hybrid model, we use a different type of security model.

17. Parismita Gogoi, Sishir Kalita, Wendy Lalhminghlui, Priyankoo Sarmah, S. R. Mahadeva Prasanna, *Learning Mizo tones from F0 contours using 1D-CNN*, 23rd International Conference on Speech and Computer SPECOM 2021, September 27-30, 2021, St. Petersburg, Russia.

Abstract :

This work attempts to build an automatic 1D-CNN-based tone recognizer of Mizo, an understudied Tibeto-Burman language of North-East India. Preliminary research findings have confirmed that along with four canonical tones of Mizo (High, Low, Rising, and Falling), a phenomenon of Rising tone sandhi (RTS) with distinct phonetic characteristics are also observed. As per the authors' knowledge, no work has been reported to identify the RTS along with four distinct tones. Moreover, previous tone recognition works have explored hand-crafted features derived from F0 contour which may not provide the explicit representation of a specific tone category. To address these issues, current work attempts to incorporate the RTS along with four lexical tones and learn tone-specific features directly from F0 contours using a 1D-CNN model. Experimental results conducted for speaker-independent cases show that the proposed 1D-CNN model achieves an accuracy of 68.18%.

18. Surajit Borkotokey, Moirangthem Singh, Rachid Lahcen, Ram Mohapatra, *A Generic Scheme for Cyber Security in Resource Constraint Network Using Incomplete Information Game*, Joint Mathematics Meetings (JMM), AMS/MAA..

Abstract :

We propose a model that efficiently activates the defending mechanism of a resource constraint network where activation of the defending system otherwise consumes a significant amount of resource. Our model is designed so that it executes the activation of the defending system only when it is needed. It is a standard practice in this literature that the defender has incomplete information about the attacker's strategy. As the resource is scarce and precious for the defender, she needs to learn the behavior of the attacker to identify the malicious network agents. Triggered by the lack of unavailability of the information about the attacker's action, the attacker leverage the information asymmetry to misinform and mislead any defense system. Thus, we model the interaction between the defender and the attacker as an incomplete stochastic game. We develop a learning algorithm for incomplete information game to update the strategy for playing the game. The results show that it converges and leads to a Nash equilibrium.

19. Nayan M. Kakoty, Zahnapriya Kalita, Abhijit Boruah, Rajeevlochana C. G, Subir Kumar Saha, *Development of A Technology Programme based on Self-Driven, Self-Learning and Self-Evaluating Approach*, 30th June – 4th July, 2021, Advances in Robotics 2021, organized by IIT Kanpur, Proceedings of the Advances in Robotics 2021 in the International Conference Proceedings Series (ICPS) with ISBN No. 978-1-4503-8971-6. (on the process to be online)

Abstract :

RoboAnalyzer based Online Competition (ROC) is a technology education programme for students and faculty members interested in robotics. The objective of the programme is to enable the young minds to learn how to think and implement innovative solutions to technical problems. ROC is based on a S3 approach, i.e., self-driven, self-learning, and self-evaluating. It focuses on teaching and learning textbook concepts of robotics through visualization using RoboAnalyzer. This paper presents a summary of ROC 2020, and a description of work accomplished by the participants; and their feedback leading to the second edition: ROC 2021. Summarizing the feedback of the participants, this manuscript shows that S3 approach is a useful and promising methodology as a technology education programme.

20. Kaushik Das; Arun Kumar Baruah, *A Study of Data Processing for Object Recognition in Scene Image using FRCNN: A Smart Grid Technology*, 5-7 Feb. 2021, 2021, International Conference on Innovations in Energy Management and Renewable Resources, Kolkata-India, Innovations in Energy Management and Renewable Resources, IEEE.

Abstract :

This paper proposes a new learning about the significance of part elements of a scene image with the effort of data processing. A top down tree structure with every node representing an annotation or bounding box having labeled visual features of an object existing in the image is studied in the paper. The images and its object annotations are from a trained dataset and are parsed to obtain the proposed representation. The images from the datasets and their parsed tree representations will be trained using a network called LSTM (Long Short Term Memory) network. The object detection may not be agnostic to the entire content of the image due to being influenced by the image composition and the discovered parts. The attempt has been made to show the object detection as a representation of the objects and their locations, parts of these objects, and the accuracy of the object detection method has been noted to have an efficient record with the implementation of the baseline Fast Region Based Convolutional Neural Network (FRCNN) method. The tested Google open images datasets are used and found to have increased object detection record in notably respect to the use of high cost sensors in digital devices.

21. Charu Guleria; Kaushik Das; Aryabartta Sahu, *A Survey on Mobile Edge Computing: Efficient Energy Management System*, 5-7 Feb. 2021, 2021, International Conference on Innovations in Energy Management and Renewable Resources, Kolkata-India, Innovations in Energy Management and Renewable Resources, IEEE.

Abstract :

With a sharp and steady growth of handheld devices, Internet of Things (IoT) and their related sectors, the need for more demanding, computation-intensive at subsequently lower latency has arisen. To curb the growing need while moving along the ever-increasing pace of resource-hungry and intensive mobile and handheld applications like the better quality of graphics and animation in the mobile gaming industry, there is an ardent need for powerful computational hardware. By bringing cloud computing resources to the end-users (mobile devices in this context), otherwise known as MEC (mobile edge computing) and thus it proves to be efficient energy management of resources like lower offloading computation and less time taken for computation. The need for capable hardware is solved by using existing cloud services. MEC holds the potential to give a platform to the numerous content marketers and services towards the handheld and mobile industry. The improvement in networking and newer and efficient

technological advancements make MEC a highly potent possibility. A brief overview of MEC, its related research and advances have been discussed in the paper.

22. Rabinder Kr. Prasad, Subrata Chakraborty, Rosy Sarmah, *Lockdown phases and changing clusters of Indian states with respect to number of cases of covid-19*, 5th International Conference On Smart Computing And Informatics (Sci-2021), Hyderabad-India, 17th-18th September, 2021, Springer..

Abstract :

The novel Coronavirus (COVID-19) incidence in India is currently experiencing exponential rise with apparent spatial variation in growth rate and doubling time. We classify the states into five clusters with low to high-risk category and identify how the different states moved from one cluster to the other since the onset of the first case on 30th January 2020 till the end of 30th November 2020. Result clearly shows the impact of the lockdown, the unlock phases in the changing formation of the clusters.

Published Books

1. Pankaj Dutta, A.T.T. Mostako (Editors), *Progresses in Material Science*, ISBN: 978-93-5473-472-4, published by Registrar, Dibrugarh University (2021).

About the book:

To provide a common platform to scientists, engineers, students and faculty members, to discuss about the recent developments in various domains of Material Science Research and to collaborate for more constructive developments, the National Conference on Progresses in Material Science Research (PMSR-2020) was organized by the Department of Physics, Dibrugarh University from February 4th to 6th, 2020. PMSR-2020. It had been designed in such a manner that the multidisciplinary nature of the material science research was highly reflected and collaborations among scientists for interdisciplinary approach could be promoted for the greater progress of research and development. This book is a result of selected contributions from different disciplines to PMSR-2020 by the young researchers and faculty members. The chapters have been chosen from a very diverse areas and peer reviewed.

2. G.C. Borthakur and B.R. Sharma, *Mathematical Physics III (Including Lab)*, ISBN 978-93-91064-00-6, Mahaveer Publications, Dibrugarh (2021).

3. Kangkan Deka, Bibhuti Bhusan Kakoti, *Urolithiasis- Manifestations and Therapeutic considerations: Etiology, pathogenesis and management of Urolithiasis- A Comprehensive Review* , ISBN 978-620-3-4-41019-8, LAP Lamberts Academia Publishing (2021).

4. Catherine Vanlalhriatpuii, L.K. Nath, Bibhuti B. Kakoti, *Nanotechnology in Drug Delivery System*, ISBN 978-620-4-20460-4, LAP Lamberts Academia Publishing (2021).

5. R. Bose, S. Karmakar, S. Roy and H.P. Mondal, *Database Management System Easy Learning*, ISBN 978-620-3-85527-2, LAP Lamberts Academia Publishing (2021).

Published Book Chapters

1. Dibya Jyoti Borah and A.T.T. Mostako, *Molybdenum Oxide - From Thick Film to Quantum Dots*, In: Progresses in Material Science, 2021, pp 25-35, published by Registrar, Dibrugarh University (2021).
2. Nibedita Dehingia and Pankaj Dutta, *Radiative behavior of Pr³⁺ ions in Ag co-doped Silica Matrix*, In: Progresses in Material Science, 2021, pp 25-35, published by Registrar, Dibrugarh University (2021).
3. P. Phukan and D. Sarma, *Ionic liquids as green solvents in the synthesis of pharmaceutically important compounds*, In: Green Sustainable Process for Chemical and Environmental Engineering and Science, Pages: 325-348, January, 2021, Publisher: Elsevier, ISBN: 978-0-12-821885-3, Editors: Rajender Boddula, Dr. Inamuddin.
4. Rimjim Gogoi, Sukanya Baruah, Jiban Saikia, *Azospirillum: A Salient Source for Sustainable Agriculture*, In: Biofertilizers: Study and Impact, Pages: 309-334, Publisher: Scrivener Publishing LLC, ISBN: 9781119724995 (Online), Editors: Inamuddin, Mohd Imran Ahamed, Rajender Boddula, Mashallah Rezakazemi.
5. Dutta, P., Borah, G., *An expected value-based novel similarity measure for multi-attribute decision-making problems with single-valued trapezoidal neutrosophic numbers*, In: Decision-Making with Neutrosophic Set: Theory and Applications in Knowledge Management, Pages: 133–161, Nova Publisher, ISBN: 978-1-53619-419-7, Editor: Garg, H.
6. Dutta, P., *A Sophisticated Similarity measure for picture fuzzy sets and their application*, In: Applied Soft computing: Techniques and Applications, Pages: 89-104, Apple Academic Press (Co-publishing with CRC Press), ISBN: 978-1-77463-029-7, Editors: Bora, S., Panigrahi, R.

7. Dutta,P., *Semi-circular fuzzy variables and its properties*, In: Applied Soft computing: Techniques and Applications, Pages: 105-120, Apple Academic Press (Co-publishing with CRC Press), ISBN: 978-1-77463-029-7, Editors: Bora, S., Panigrahi, R.
8. Dutta,P., *Medical Pre-Screening of Common Diseases: An Interval-Valued Fuzzy Set Approach*, In: Handbook of Research on Modeling, Analysis, and Control of Complex Systems, Pages: 267-292, IGI Global, ISBN: 978-1-79985-788-4, Editor: Azar , A.T.
9. Baruah N., Sarma S.K., Borkotokey S., *A Single Document Assamese Text Summarization Text Summarization Using a Combination of Statistical Features and Assamese WordNet* , In: Progress in Advanced Computing and Intelligent Engineering. Advances in Intelligent Systems and Computing, vol 1199. Springer, Singapore., Editors: Panigrahi C.R., Pati B., Mohapatra P., Buyya R., Li KC.
10. Mahanta, K. K., & Hazarika, J., *The Frailty Approach of Accelerated Failure Time Model as an Alternative to Proportional Hazards Frailty Model: A Bayesian Analysis with Real Life Application*, In: Demystifying Research in Applied Statistics, Department of Statistics, Dibrugarh University. March 2021,pp-164-185, ISBN: 978-81-929186-8-6.
11. Goswami, Arindita, *Contributions of Irawati Karve Towards the Growth of Anthropological Studies in India*, In: Architects of Anthropology in India (Volume-I), Sarthak Sengupta (Editor), Gyan Publishing House, New Delhi, ISBN: 978-81-212-2043-9, pp. 97-110.
12. Geetanjali Devi and Dwipen Bezbaruah, *Archaeological Relics from Temple Vicinity of North Guwahati, Assam*, In: Archaeology in Northeast India: Recent Trends and Future Prospects (Essays Celebrating 150 Years of Research), Page numbers- 157-168, Editors: Milan Kumar Chauley and Manjil Hazarika , Publisher- Research India Press, New Delhi, ISBN- 978-93-5171-171-1.

13. Geetanjali Devi, *D.K.Bhattacharya and his Contributions to Prehistoric Anthropological Studies in India*, In: Architects of Anthropology in India (Vol. 1), Page numbers- 269-275, Editor: Sarthak Sengupta, Publisher- Gyan Publishing House, New Delhi, ISBN- 978-81-212-2043-9.

14. Juanli Kropi, *Architects of Anthropology in India: A passage through Verrier Elwin*, In: Architects of Anthropology in India (Vol. 1), Page numbers- 63-76, Editor: Sarthak Sengupta, Publisher- Gyan Publishing House, New Delhi, ISBN- 978-81-212-2043-9.

15. Maitreyee Sharma, *Factors Determining the Choice of Place of Delivery among the Mishing Mothers of Dhemaji, Assam: A Cross-Sectional Analysis*, In: pp: 73-85, Human Diversity in North-east India: Bio-Anthropological Approaches. Edited by Sarthak Sengupta and Dali Dutta, ISBN: 9789353246211.

16. Bibhuti Bhusan Kakoti, Kangkan Deka, Ngurzampuii Sailo, Rajashri Bezbaruah, *Multifunctional nanocarrier systems targeting brain tumors-A review*, In: Nanocarriers For Drug Targeting to Brain Tumors, Edited by Lalit Kumar and Yashwant Pathak, Publisher : Elsevier, USA (Accepted for Publication).

17. Rudrapal M, Chetia D, *Herbal Drugs: Efficacy, Toxicity, and Safety Issues*, In: Evidence Based Validation of Traditional Medicines-A Comprehensive Approach, Mandal SC, Chakraborty R, Sen S (Eds), Springer Nature Singapore Pte Ltd., 2021, 537-553, ISBN 978-981-15-8126-7, ISBN 978-981-15-8127-4 (eBook).

Abstract:

Herbal drugs are being in use for the management of human health and for prevention as well as to cure human diseases since ancient civilization. In recent days, the use of herbal drugs has been

increased significantly in various forms such as herbal formulations, dietary supplements, and nutraceuticals in the global market. This growing demand undoubtedly proves the therapeutic claims of herbal drugs as biomedicines and/or functional foods. However, the safe use of herbal products/herbal medicines is still challenging due to the toxicity and regulatory issues. This review discusses toxicity-related and safety issues of herbal medicinal products, factors responsible for, and suitable remedial measures. Some challenges associated with monitoring the safety of herbal drugs are also discussed to ensure their effectiveness for adequate protection of public health and the relevant regulatory issues.

18. Nayanmoni Boruah, Himangshu Sharma, and Hemanta Kumar Sharma, *Solid Lipid Nanoparticles for Sustained Pulmonary Delivery of Herbal Drugs for Lung Delivery: Preparation, Characterization, and In Vivo Evaluation*, In: Pathak Y & Islam N (Eds) Handbook of Lung Targeted Drug Delivery Systems Recent Trends and Clinical Evidences, 1st Edition, 2021, CRC Press, pp 361-385. ISBN 9780367490676.

19. Himangshu Sarma, Nayanmoni Boruah, and Hemanta Kumar Sharma, *Formulation and Characterization of Dry Powder Inhalers for Pulmonary Drug Delivery*, In: Pathak Y & Islam N (Eds) Handbook of Lung Targeted Drug Delivery Systems Recent Trends and Clinical Evidences, 1st Edition, 2021, CRC Press, pp 527-537. ISBN 9780367490676.

20. K. Goswami, H.P. Mondal, P. Das and K. Thakuria *Realization of ultra-compact all-optical logic AND gate based on photonic crystal waveguid*, In: Advances in Communication, devices and networking, LNEE Springer Nature, Singapore, ISBN- 978-981-16-2910-5, vol. 776, pp. 61-68.

21. Parismita Gogoi, Sishir Kalita, Wendy Lalhminghlui, Priyankoo Sarmah, S. R. Mahadeva Prasanna, *Learning Mizo tones from F0 contours using 1D-CNN*, In : A. Karpov and R. Potapova (Eds.): SPECOM 2021, Lecture Notes in Artificial Intelligence LNAI 12997, pp. 214–225,2021. Springer Nature Switzerland AG 2021. ISSN 0302-9743 ISSN 1611-3349 (electronic), Lecture Notes in Artificial Intelligence, Springer ISBN 978-3-030-87801-6 ISBN 978-3-030-87802-3 (eBook).

22. Prasun Banik, *Covid-19 and turbulence in Petroleum Products Consumption in India*, In: Impact of Covid -19 on Economy, Business, Education and Social Life (ISBN 978-81-948755-9-8), Page No. 30-37 (Chapter 4), Editors: Dhruva Jyoti Kalita, Adam A. R., Publisher: KripaDrishti Publications, Pune.
23. Moirangthem Tiken Singh, Aninda Chakrabarty, Bhargab Sarma, Sourav Dutta, *An Improved On-Policy Reinforcement Learning Algorithm*, In: Pages- 321-330, Soft Computing Techniques and Applications, Samarjeet Borah, Ratika Pradhan, NilanjanDey, Phalguni Gupta (Editors), Springer, 978-981-15-7394-1.
24. Nomi Baruah, Shikhar Kr Sarma, Surajit Borkotokey, *A Single Document Assamese Text Summarization Using a Combination of Statistical Features and Assamese WordNet*, In: Pages- 125-136, Advances in Intelligent Systems and Computing, Springer, Chhabi Rani Panigrahi, Bibudhendu Pati, Prasant Mohapatra, Rajkumar Buyya, Kuan-Ching Li (Editors), Springer, 978-981-15-6353-9.
- 25.. Nomi Baruah, Arjun Gogoi, Shikhar Kr Sarma, Randeep Borah, *Utilizing Corpus Statistics for Assamese Word Sense Disambiguation*, In: pages- 271-283, Advances in Computing and Network Communications, Sabu M. Thampi, Erol Gelenbe, Mohammed Atiquz zaman, Vipin Chaudhary, Kuan-Ching Li(Editors), Springer, 978-981-33-6987-0.

Research Grants / Projects

1. Project Title: M@Zno (M= Ag, Ni) binary nanoparticles as Cu-free catalyst for click reaction- An alternative benign approach towards 1,2,3-triazoles synthesis.

Personal Investigator: Dr. Diganta Sarma

Co-PI: Dr. Kalyanjyoti Deori

Funding Agency: CSIR

Duration of scheme: 3 Years (Sept. 2021- Aug. 2024)

Amount: Rs 23 Lakhs

2. Project Title: Designing PEPPSI-type palladium N-heterocyclic carbene complexes and their immobilization onto support for multifunctional catalysis.

PI: Prof. Pankaj Das

Funding Agency: DST

Duration of scheme: 3 Years

Amount: Rs 37.66 Lakhs

3. Project Title: Identification of the bioactive molecule from *Acacia pennata* (L.) Willd. and deriving their plausible antidiarrheal potential

PI: Dr. Anshul Shakya;

Co-PI: Prof. S.K.Ghosh

Funding Agency: All India Council for Technical Education (AICTE)

Duration of the Project: 3 Years

Amount: Rs 20 Lakhs

4. Project Title: Design, synthesis and antimalarial evaluation of hybrid pyrazoline substituted 1,3,5-triazine derivatives.

PI: Dr. Hans Raj Bhatt

Funding Agency: All India Council for Technical Education (AICTE)

Duration of the Project: 3 Years

Amount: Rs 2127780.00

Patents

1. Patent Type: Australian Innovation Patent

Australian Application Number: 2021103912

Invention title: ‘A Polyherbal Formulation to Prevent Progression of Ulcerative Colitis’

Inventor(s): Wal, Pranay; Shakya, Anshul; Khera, Kanav; Dubey, Sonali; Kannoja, Pushpendra; Kushwaha, Swatantra K. S.; Rai, Awani K.

Effective date of patent: 2021-07-06

Expiry date: 2029-07-06

2. Patent Type: Australian Innovation Patent

Invention title: ‘A ROBOTIC SYSTEM FOR DISINFECTING AN AREA’

Inventor(s): A. Sharma, H.P. Mondal, D.C. Chainvar, S. Roy and R. Bose.

Patent Grant Details : 2021102592, June-2021.

Conferences/ Workshops Hosted

1. Department of Physics, Dibrugarh University hosted an online lecture as part of a colloquium series organized by Indian Physics Association (IPA).

Details of the event:

Date and Time: **8th May, 2021 (Saturday) at 5.00 pm**

Lecture Title: **Application-driven Basic Research for Atmanirbhar Bharat**

Speaker: **Prof. Samir Kumar Pal, S. N. Bose National Centre for Basic Sciences, Kolkata**

Youtube Link: <https://youtu.be/EIGp7Rdn5ks>

2. Department of Computer Science and Engineering, Dibrugarh University hosted the **RoboAnalyzer based Online Competition (ROC) 2021** as Virtual Summer Internship in collaboration with Tezpur University, Amrita Vishwa Vidyapeetham, Bengaluru Campus and IIT, Delhi.

Duration: **3 Months (May-July 2021)**

No of Participants: **152 (including two international participants)**

No of successfully completed group tasks: **15**

More information is available at <http://www.roboanalyzer.com/roc-2021.html>

3. Department of Petroleum Engineering, DUIET conducted e-Faculty Development programme on “**Advances in Hydrocarbon Exploration**” from 20th Sep’ – 24th Sep’ 2021.

.Number of participant: **42**

Sponsored by: **ATAL**

Awards and Recognitions received by Faculty Members

1. **Prof. Surajit Borkatakey** from Department of Mathematics, Dibrugarh University, was honored with **Academisthan's Best Teacher Award for the year 2021 in Senior Professor Category** among the North-Eastern states.
2. **Dr Bibhuti B. Kakoti** from Department of Pharmaceutical Sciences, Dibrugarh University, carried out the responsibilities as **Hon Secretary, IPA Assam State Branch and Programme Coordinator** at "One day workshop on Analytical cum semi-preparative HPLC Systems on 29th January, 2021" conducted by the Department of Pharmaceutical Sciences, Dibrugarh University in collaboration with IPA, Assam State Branch and Spinco Biotech Pvt. Ltd.Chennai.
3. **Dr Bibhuti B. Kakoti** from Department of Pharmaceutical Sciences, Dibrugarh University was awarded "A Publication of DRDO- Certificate of Excellence in Reviewing, 2020; Defence Life Science Journal" in recognition and appreciation of outstanding contribution made to the quality of the journal, by Defence R&D Organisation, Metcalfe House, Delhi, India on 8th April, 2021.
4. **Dr H. K. Sharma** from Department of Pharmaceutical Sciences, Dibrugarh University was nominated as the member of the P. G. syllabus committee and the sub-committee for Pharmaceutical Quality Assurance & Regulatory Affairs constituted by Pharmacy Council of India.

5. **Dr Ankur Bharali** from Department of Mathematics, Dibrugarh University was invited to deliver talks
- i. in Enrichment Lecture Series, organized by Dept. of Mathematics, **USTM, Meghalaya** on October 4, 2021.
 - ii. in the 5-day FDP on Artificial Intelligence under ATAL Academy, organized by **UCET, Vinoba Bhave University, Jharkhand** during 20-24 September, 2021.
 - iii. on "Some Results Related to Inverse Sum Indeg Index of Graphs" in 7th IFS and Contemporary Mathematics, held in **Turkey** during May 25-29, 2021 .
 - iv. in TEQIP workshop on Mathematics and its Applications in Engineering & Technology, organized by **Vinoba Bhave University, Jharkhand** during February 22-24, 2021.
 - v. in the workshop on Domination Theory and Topological Indices, organized by **Mangalore University** during February 4-6, 2021.

Awards and Recognitions received by research scholars

1. **Angshuman T. Borgogoi**, a PhD Scholar currently working with Dr ATT Mostako, Department of Physics, has **qualified for SET** in Physical Sciences.
2. **Bishwajit Boruah**, a PhD Scholar currently working with Dr Bulumoni Kalita, Department of Physics has qualified for **CSIR-UGC NET JRF (UGC) in Physical Sciences**.
3. **Dr Dibyajyoti Kakoti**, a PhD Scholar, Department of Physics, has been **awarded PhD** in Physics under the supervision of Dr. Pankaj Dutta . Dr Kakoti has also **qualified for SET** in Physical Sciences. And is currently working **as Assistant Professor (Ad-Hoc)** at the Department of Physics, Digboi College.
4. **Dr. Anirban Garg** , a PhD Scholar, Department of Chemistry, has been **awarded PhD** in Chemistry under the supervision of Dr. Diganta Sarma. Title of his PhD thesis is : **“Synthesis of 1,2,3-Triazole Containing Peptidic and Non-Peptidic Compounds and Evaluation of Their Antimicrobial Activity”**.

5. **Dr. Apurba Dutta** , a PhD Scholar, Department of Chemistry, has been **awarded PhD** in Chemistry under the supervision of Dr. Diganta Sarma. Title of his PhD thesis is: **Design, Synthesis and Antimicrobial Evaluation of Novel Quinazoline Analogues.**
6. **Priyanuj Krishnan Hazarika**, a PhD Scholar currently working with Dr Diganta Sarma, Department of Chemistry, has qualified in **GATE-2021.**
7. **Jasmin Sultana**, a PhD Scholar currently working with Dr Diganta Sarma, Department of Chemistry, has qualified in has qualified in **SLETNE-2021.**
8. **Roktopol Hazarika**, a PhD Scholar currently working with Dr Diganta Sarma, Department of Chemistry, has qualified in has qualified in **SLETNE-2021.**
9. **Bidyutjyoti Dutta**, a PhD Scholar currently working with Dr Diganta Sarma, Department of Chemistry, has qualified in has qualified in **SLETNE-2021.**
10. **Dr. Amitav Doley**, a PhD Scholar, Department of Mathematics, has been **awarded PhD** in Mathematics under the supervision of Dr. Ankur Bharali.
11. **Dr. Rupjit Saikia**, a PhD Scholar, Department of Mathematics, has been **awarded PhD** in Mathematics under the supervision of Dr. Palash Dutta.
12. **Gourangajit Borah**, a PhD Scholar currently working with Dr Palash Dutta, Department of Mathematics s has been granted **DST Inspire Fellowship (Level-2)** in 2021.
13. **Ms. Ngurzampuii Sailo**, a PhD Scholar currently working with Dr Bibhuti B. Kakoti, Department of Pharmaceutical Science, has been selected for “**National Fellowship and Scholarship for Higher Education for ST Students, 2020-2021**” under the Ministry of Tribal Affairs, Government of India on 13th August, 2021.

**FACULTY OF
EARTH SCIENCES AND ENERGY**

Papers published in Journals

1. Rakshit, R., Bezbaruah, D., Bharali, B., Borgohain, P. and Rakshit, K. 2021. Macro-mechanical characteristics and their control on the strength of sandstones of western Indo-Burmese Range, NE India. *Acta Geodyn. Geomater.* Vol. 18, No. 2(202), 241–252. DOI: 10.13168/AGG.2021.0017.

Abstract:

Mechanically strong sandstones consider as a potential construction material which can withstand modest load and not associated with any geologic fractures. This work is about understanding the macro-mechanical properties of sandstones by studying several petrographic parameters, which could provide evidence of their influence on mechanical strength. Here the authors were considered the Bhuban sandstones of western Indo-Burmese Ranges (IBR) of north-eastern India to investigate the above criteria. The result shows that sandstones have a mean grain size between 108 to 208 μm . Moderate to poorly sorted (ϕ scale ranges 0.56–1.5) grains show greater content of rounded constituents (43–68 %) with sphericity between 0.65–0.85; along with moderate packing properties (packing density 54–77 %; packing proximity 32–70 %). The grains join by mostly straight (20–54 %) and concavo-convex (13–45 %) contacts; with lesser point (5–13 %) and sutured contacts (8–44 %). Schmidt Hammer rebound values (R-values) were used to calculate and analyse the uniaxial confined stress (UCS); which again validated with UCS testing of core samples. The comparison between macro-mechanical parameters and the UCS shows interrelationship among rock constituents which hold the key to the mechanical strength of the rock. The presence of angular grains and semi-angular spherical grains diminish the macromechanical strength to some extent. Moreover, FETEM-EDX analysis confirms the microweathering of the angular grains, which have a deformed lattice setting. These findings show that macro-mechanical and micro-nano scale properties of sandstones influence the rock strength.

2. Bharali, B., Hussain, M.F., Borgohain, P., Bezbaruah, D., Vanthangliana, V., Rakshit, R. and Phukan, P.P. 2021. Reconstruction of Middle Miocene Surma Basin as Two Arcs Derived Sedimentary Model: Evidence from Provenance, Source Rock Weathering and Paleo- Environmental Conditions. *Geochemistry International*. Volume: Vol. 59, No. 3: 264–289, DOI: 10.1134/S0016702921030022.

Abstract:

Surma Basin in Northeast India is characterized by a thick Cenozoic sedimentary succession that initiated due to the collision between Indian and Burmese plates. Variability in the litho-association of a thick sedimentary column in this robust terrain represents the distribution and deposition of enormous sediments that supplied throughout the entire basin evolution, especially during the Middle Miocene. This makes Middle Bhuban sandstone as the best aspirant for this study. Miocene Bhuban sandstones collected from parts of Aizawl and Champhai Districts of Mizoram, NE India have been studied for the whole rock geochemistry to understand the nature of source rocks, probable source areas and paleoclimatic conditions. The geochemical behavior of studied sandstones represent a felsic nature (TiO₂/Zr: 15.03-37.09; La/Sc: 1.80-6.52, La/Co: 0.39-5.48, Th/Sc: 0.56-2.05; Cr/Th: 4.19-28; Al₂O₃/TiO₂: 13.13-28.09), fractionated granitoid provenance [(La/Lu)_N: 15.06-22.25; (La/Yb)_N: 14.09-19.96; (La/Sm)_N: 3.17-3.99; (Gd/Yb)_N: 2.00-2.84] and moderately weathered sediments (CIA: 65; CIW: 73; PIA: 69; WIP: 41; ICV: 0.87; Rb/Sr: 1.07). The deposition of these sediments took place in an oxic condition (sharp positive Ce anomaly) during a regressive phase with contribution from various granitoid plutons. Synthesizing the data available for different plutons around the Himalayan and Indo-Burmese Ranges (IBR), they show close similarity with Middle Bhuban geochemical signatures. Ladakh granite, Yangbajin granite and Jirong Granodiorite of Himalaya along with Wuntho-Mt. Popa and Banmauk granitoids are the most influential sources of the Surma sediments before the cessation of Paleo-Irrawaddy and then Paleo-Brahmaputra River courses. This is also evident by the paleo-current directions of sediments from various parts of the Surma Basin. Rise of Shillong plateau, Mikir massif and Naga hills in the north and IBR in the east caused the flow migration and lithological changes. Therefore, the present study ultimately invokes a significant supply of the sediments from the granitoids of neighbouring Indo-Burmese arc in the east in addition to their contribution from the Himalayan ranges in the north.

3. Phukan, R. 2021. Alkali-Surfactant-Gas/CO₂ (ASG) Flooding for Enhanced Oil Recovery: Screening of Chemical Slug. *International Journal of Applied Engineering Research*. Vol. 16, No. 5, 385-392.

Abstract:

The objective of the present study was to screen chemical formulations for the combined chemical-gas Enhanced Oil Recovery (EOR) process of Alkali-Surfactant-Gas (ASG) Flooding. Phase behavior tests are inexpensive, rapid and effective means to screen chemical formulations for a specific application. Phase behavior tests were performed with various combinations of surfactants, co-solvent (Isopropyl Alcohol), alkali (Na₂CO₃) and soft brine together with crude oil (310 API) of Upper Assam Basin at

reservoir temperature (70°C). Three types of surfactants were used: SDS (anionic), TX-100 (non-ionic) and a natural surfactant (Black Liquor). Foam stability tests were done to select suitable concentrations of surfactant for preparation of formulation. The foamability and stability of bulk foam increased with increasing surfactant concentration. Best oil recovery in chemical floods and increased foam stability is observed when a negative salinity gradient is imposed in injected fluids. The formation water of the reservoir under study has a salinity of 3800 ppm, so optimum salinity of around 3000 ppm was targeted for the chemical formulations. The optimum salinity was taken as the salinity of the solution where Winsor type III microemulsion was observed. Three best performing formulations were screened based on the results of phase behaviour and foam stability tests.

4. Robidas, B. and Gogoi, S.B. 2021. Investigation of flow behavior of crude oils with emphasis to upper Assam Basin, India. *Petroleum Research*. <https://doi.org/10.1016/j.ptlrs.2021.09.009>.

Abstract

This paper attempts to investigate the viscoelastic nature of eight Crude Oil (CO) samples from the Upper Assam Basin, India. Viscoelasticity was studied using Dynamic Mechanical Analysis (DMA) where shear stress was applied to the CO samples and the resulting displacement (shear strain) was measured. CO transportation through pipelines face serious problems due to their high pour (PP) point and viscosity. In this work, Dynamic Modulus (G^*) was calculated using which the storage and the loss modulus were determined to study the elastic and viscous nature of the samples at 30 °C as the average Pour Point (PP) of the CO samples was near 30 °C. So, especially during the extreme winter season in Assam, when the ambient temperature falls drastically, the lighter components come out from the liquid and precipitates in the inner wall of the pipeline which affects the flow through the pipeline. So, a better understanding of the flow behavior of CO is very important as this will help to identify whether flow improving methods are required or not. Here, in this work viscoelastic properties of the CO samples were investigated from where yield point was determined. Crossover points or the Yield Point (YP) of the samples were determined to understand the flow characteristics before and after the crossover point. All the CO samples were observed to be viscous after the yield point except for two CO samples. Yield stress and yield strain of the samples were calculated from the YP, which exhibited non-Newtonian behavior with maximum yield stress up to 35Pa. After reaching the YP, the CO samples showed the dominance of viscous nature over elastic nature except for two samples. Loss tangent or $\tan \theta$ was also calculated to validate the viscoelasticity of the samples. This study was

done to investigate the flow behavior of CO samples of the Upper Assam Basin for pipeline transportation.

5. Rajbongshi, A. and Gogoi, S.B. 2021. A review on anaerobic microorganisms isolated from oil reservoirs. *World Journal of Microbiology and Biotechnology*. Vol.37, No. 7:111.

Abstract:

The Role of microorganisms in the petroleum industry is wide-ranging. To understand the role of microorganisms in hydrocarbon transformation, identification of such microorganisms is vital, especially the ones capable of in situ degradation. Microorganisms play a pivotal role in the degradation of hydrocarbons and remediation of heavy metals. Anaerobic microorganisms such as Sulphate Reducing Bacteria (SRB), responsible for the production of hydrogen sulphide (H₂S) within the reservoir, reduces the oil quality by causing reservoir souring and reduction in oil viscosity. This paper reviews the diversity of SRB, methanogens, Nitrogen Reducing Bacteria (NRB), and fermentative bacteria present in oil reservoirs. It also reviews the extensive diversity of these microorganisms, their applications in petroleum industries, characteristics and adaptability to survive in different conditions, the potential to alter the petroleum hydrocarbons properties, the propensity to petroleum hydrocarbon degradation, and remediation of metals.

6. Haloi, S., Dutta, S.M., Gogoi, S.B., Mohan, R. and Medhi, T. 2021. Aggregation and adsorption behaviour of *Achromobacter* sp. TMB1 produced rhamnolipids on sandstone core in relation to Microbial enhanced oil recovery. *Journal of Petroleum Science and Engineering*. Vol.205, No.108831. <https://doi.org/10.1016/j.petrol.2021.108831>.

Abstract:

In this article, the adsorption characteristics of bacterial surface-active rhamnolipids produced by *Achromobacter* sp. TMB1 were studied on sandstone core collected from Upper Assam oil field, India with emphasis on adsorption equilibrium and kinetics. Studied rhamnolipid reduced the interfacial tension between aqueous phase and oil to 0.9 mN/m from 39.1 mN/m. Micelle formation and aggregation behaviour of the rhamnolipids were also evaluated along with their wettability alteration properties. Gibbs free energy and surface area per molecules of rhamnolipids were found to be -22.592 kJ/mol and 106.45 Å², respectively. The adsorption was confirmed through FTIR patterns of pure and rhamnolipid treated sand particles, which indicated the chemisorption mechanism of the process. Orcinol test was used to quantify the

biosurfactant adsorbed on sandstone. In batch experiments, temperature, pH, salinity and adsorbent dose effect on adsorption efficiency were found to be significant. Further, the observed adsorption data were fitted with different isotherm models and found better fits with Freundlich isotherm after determined parameters of each models. The isotherm exhibited monolayer adsorption behaviour on the substratum below the CMC concentration. Above CMC value, the adsorption process tends to be associated with the formation of monomeric micelle vesicle mechanism. Among four kinetic models, second-order model exhibited better predictions and was the most suitable kinetics model for rhamnolipids adsorption predictions. The adsorption equilibrium and kinetic behaviour of rhamnolipid onto sandstone corroborated chemisorption and involvement of functional groups during the process.

7. Gogoi, M., Sarmah, R.K., Goswami, T. K., Mahanta, B. N., Laishram, R., Saikia, H. and Oza, B. 2021. Petrography, clay mineralogy and geochemistry of Lower Gondwana sandstones of Western Arunachal Pradesh Himalayas, India. *Journal of Sedimentary Environments*. <https://doi.org/10.1007/s43217-021-00070-7>.

Abstract:

Extra-Peninsular Gondwana rocks of Arunachal Himalaya are an interbedded sequence between Sub-Himalayan Siwaliks and Lesser Himalayan Bomdila Group of rocks. This unit is restricted to the area between Sikkim and Arunachal Pradesh representing the only extra-peninsular Gondwana basin affected by the Himalayan orogeny and denotes a significantly different tectonic set up than other basins. This work aims to study the petrological and geochemical signatures of these Gondwana rocks and to decipher the provenance, tectonic setting, palaeoclimatic and weathering conditions in the period when these rocks were formed. The clay mineral identification and abundances also were studied based on relative intensities (I/I₁) of different clay minerals. Petrologically, and geochemically the sandstones are classified as wacke to arkose type. The tectonic discrimination diagrams indicate that the sediments are derived from craton interior to quartzose recycled orogen terranes with more contribution from low-rank metamorphic rocks. In addition, geochemical characteristics obtained from the tectonic discrimination plots point to a passive margin basin configuration. The dominance of illite and smectites indicate towards a palaeoalkaline environment of deposition for Gondwana sediments. Major oxide study reveals a humid palaeoenvironment and medium to intense chemical weathering of source rocks. The high ratio between Light Rare Earth Elements (LREE) and Heavy Rare Earth Elements (HREE) (average 3.72), (La/Yb)_N (average 9.01) and La/Th (average 2.29) values, together with negative Eu anomaly (Eu/Eu* is 0.44–0.90) also indicate a post-Archean granitic source rock for the detritus of Gondwana sandstones.

8. Goswami, T. K., Bezbaruah, D., Mahanta, B.N. and Sarmah, R.K. 2021: Structural framework, crustal shortening and Cenozoic exhumation in the eastern Himalaya: A review. *Physics and Chemistry of the Earth*. <https://doi.org/10.1016/j.pce.2021.103048>.

Abstract:

Significant variations (along strike) in deformation style, rate of crustal shortening, erosion and exhumation are observed in the eastern Himalayan orogen. We review the literature to understand the crustal shortening due to the collision of the Indian and Asian plates accommodated through major thrusts and shear zones. The Main Central Thrust (MCT) is a major thrust system along which hundreds of kilometres of crustal shortening have been estimated in eastern Himalaya. Recesses of MCT in the form of culmination zones are formed in Sikkim- Darjeeling, Bhutan and Arunachal Himalayas. Antiformal stacks in the hanging wall of MCT indicate faster exhumation compared to slow exhumation in the synform at the orogenic front. The folded nappes in eastern Himalaya depict the interplay of erosion and exhumation. We observe that the lateral variation in the orogen may also be attributed to transverse structures that divide the mountain range into sectors with dissimilar structural geometry. The strain variation reflected through crustal shortening along the orogen is accommodated by transverse structures like strike-slip faults. Many of these transverse structures are loci of major earthquakes that struck the region in the past. In the Sub-Himalaya, signatures such as changes of the river courses, upliftment of the terraces and active fault scarps indicate that the south directed post collisional compression is accommodated through the slip along the Himalayan Frontal Thrust (HFT) and its splays.

9. Baral, U., Ding, L., Goswami, T.K., Sarma, M., Jan, M Q, Wang, C., Muhammad Qasim, J. M. and Bezbaruah, d. 2021. Geochemical and geochronological studies of Abor volcanic rocks of eastern Himalaya. *Geological Journal*. DOI: 10.1002/gj.4268.

Abstract:

The Indian Plate began drifting northward after the Gondwana breakup and collided with the Eurasian Plate during the Early Cenozoic, resulting in the consequential development of the Himalayan–Tibetan Orogeny. Several microcontinents were rifted from Gondwana and amalgamated with the Indian Plate, resulting in magmatism along the continental margin. The Abor volcanic rocks (AVRs) in the eastern Himalaya represent one of such magmatism, the emplacement mechanism, and the timing of which is still a topic of debate. The AVR comprises mafic and silicic rocks; the present study concerns the petrography and geochemistry of the mafic rocks. U–Pb geochronology on three samples shows the weighted mean age of 130 ± 1 Ma, 143 ± 1.2 Ma, and 155 ± 16 Ma. Whole-rock geochemistry of eight samples shows Mg# of 45.48 to 57.7, except for one

sample with 37.4, variable contents of CaO (4.4–9.5 wt%), K₂O (0.1–2.6%), Lost on ignition (LOI) (0.9–3.6 wt%; average 2.4), and K₂O/Na₂O ratios (0.02–0.6 with a single one 1.0), Y/Nb (0.55–1.66, with one value of 2.44), and medium to high Zr/Nb (10.1–14.1) and Zr/Y (5.4–18.14). The Sr-isotopic results from 11 samples show that the initial ⁸⁷Sr/⁸⁶Sr ratios vary between 0.7049 and 0.7110, and εNd(t) values range from +1.176 to -2.250. Geochemical and isotopic data suggest that the studied AVR_s (mafic) are of subalkalinetholeiitic affinity. These volcanic rocks have continental intraplate characteristics and are sourced from the metasomatized mantle during the rifting event of the Indian subcontinent from Gondwana during Late Jurassic to Early Cretaceous.

10. Mahanta, B. N., Sekhose, K., Goswami, T.K., Vitso, V., Sarmah, R.K., Kumar, A. and Kumar, R. 2021. Depositional setup of the faunal coal balls from Bichom Formation of Lower Gondwana Group of Arunachal Himalaya: insights from EPMA and Raman Spectroscopy. *Journal of Sedimentary Environments*. <https://doi.org/10.1007/s43217-020-00042-3>.

Abstract:

An attempt is made to study the composition of the carbonate minerals and silica in the faunal coal balls of Lower Gondwana Group of rocks of Arunachal Himalaya using Electron Probe Micro Analyser (EPMA) and Raman Spectrometer (RS). It is observed that, the carbonates developed in the coal balls contain Fe, Mg and Mn which corresponds to the concentration of dolomite and indicates a relatively high salinity in the sedimentary environment or of the formation water. Raman spectrum of silica indicates the presence of hydroxylated nanometre sized α quartz- chalcedony in the coal balls. We construe the incorporation of electrolyte rich solution in the coal swamps near sea shore took place due to repeated influx of sea water in lagoonal condition facilitating precipitation of chalcedony in a restricted alkaline environment thus created.

11. Mazumdar, D. and Devi, A. 2021. Oilfield geothermal resources of the Upper Assam Petroliferous Basin, NE India. *Energy Geoscience*. Vol. 2:246-253.

Abstract:

Extracting geothermal energy from the oil-producing fields is an experimental venture globally. The exploitation and utilization of geothermal energy can partly reduce the larger dependence on conventional non-renewable energy sources like oil, gas, coal, and other fossil fuels, and has a bright prospect. The Upper Assam Basin is a mature petroliferous basin of NE India, where there are several hundred low production, high water cut, or abandoned oil and gas wells that can be retrofitted as geothermal wells instead of drilling new ones. This will help bridge the gap of growing energy demand and limited supplying energy-deficient state like Assam. Situated away from the active

plate boundaries and in lack of active volcanism, the Upper Assam Basin remains a low-to-medium enthalpy geothermal fluid regime. The deeper reservoir in this regard can, therefore, be the best candidate for the introspection of the potential geothermal energy reservoir reconnaissance. The selection of a deeper horizon considered in the present case has been the stratified reservoirs of the Lakadong-Therria (Lk-Th) Formation, Sylhet Group of the Lower Eocene age occurring at a variable depth of 3400 m to 4600 m. The Lk-Th Formation possesses a fair-quality reservoir with lateral continuity and favourable petrophysical properties. In this study, representative gamma-ray (GR) and resistivity (R) logs were examined to work out lithology, and bed boundary demarcation, etc. The total Formation thickness varies from 97 to 157 m; the individual sandbody thickness is up to 6 m. Other reservoir parameters, e.g., porosity (0.33 %), water saturation (0.57 to 0.95), geothermal gradient (2.71°C/100m to 3.92°C/100 m at 4300 m and 3608 m) respectively, and theoretical estimate of high heat flux in the range 70 to 100 mW/m²/s, are the necessary yardstick to measure the subsurface geothermal reserves. Efficient energy extraction will have the potential in facilitating energy utilization for industrial purposes, especially in tea processing units present nearby oilfields and also for power generation by the binary mechanism.

12. Saikia, J. and Saikia, S. 2021. Changing Trend of Forest Cover in the Pabha Reserve Forest in the Lakhimpur District of Assam, India. *Ecology, Environment and Conservation*. Vol. 27, No.1:172-177.

Abstract:

The change of the forest cover area into other land use and land cover types is known as forest cover depletion. Pabha Reserve Forest of Lakhimpur district has been experienced the same for the last few decades. This study has been conducted on the changing trend of forest cover of the said reserve forest for the years of 1977, 1987, 1997, 2007 and 2017. The Landsat-2 MSS data for 1977, Landsat-5 TM data for 1987, 1997 and 2007 and Landsat-8 OLI data for 2017 have been used to analyze the changing trend and supervised classification and has been used with the help of ERDAS Imagine 2014. Only 8.824 sq km of dense forest area was there in the year of 1977 out of the total geographical area 50 sq km of the Pabha Reserve Forest. That area has become 0 sq km during the year of 1997. The study reveals that the Pabha Reserve Forest has been depleted before the year of 1977. Only anthropogenic activities are responsible for the changing trend of the forest cover.

13. Neog, R., Acharjee, S. and Hazarika, J. 2021. Spatiotemporal analysis of road surface temperature (RST) and building wall temperature (BWT) and its relation to the traffic volume at Jorhat urban environment, India. *Environment, Development and Sustainability*. Vol. 23:10080–10092. <https://doi.org/10.1007/s10668-020-01047-8>.

Abstract:

The study analyzed the pattern of building wall temperature (BWT) and road surface temperature (RST) in both urban and suburban area and its relation to traffic volume at Jorhat municipal area. The surface temperature pattern is assessed using the FLIR TG-165 spot thermal imaging camera and HTC MT-4 IR thermometer, while traffic volume is investigated through schedule survey and video recording over the selected urban roads. The study revealed a positive correlation between traffic volumes with BWT and RST, though the correlation is quite stronger with RST. The higher positive relationship between traffic volume and RST has been noticed mostly in the shadowing part of the surface, whereas on the other hand, the relationship pattern of BWT with traffic volume is also found notice-ably higher at the shadowed part of the surface. In both analyses, the relationship between traffic with RST and BWT is identified as remarkably stronger at midday and afternoon period. The urban areas with maximum traffic congestion are identified as accountable for the higher BWT and RST.

14. Goswami U., Bezbaruah D. Springs of Pasighat, a valuable resource for the community: A hydrogeological study carried out using geoelectrical resistivity technique. *Journal of Earth system science* 130/3.
15. Deka Kalita K., Bezbaruah D. Disang and Barail sediments, their contact and palaeodepositional environment along Tuli _ Merangkong – Mokokchung area of Mokokchung district, Nagaland, north east India with reference to diverse palynofossil assemblages. *Journal Geological Society of India, Springer*, 97/ 9 /1049-1062.
16. Bezbaruah D. Evaluation of Active Tectonics and Geomorphic Indices in Siwalik Basin Around Dikrong River, Eastern Himalaya . *Journal of Scientific Research* , 65(03):11-22.

Published Articles

1. Kalpana Deka Kalita, *Dibrugarh University in human resource development for oil industries* in Sentinel, Daily News Paper.

Published Book Chapters

1. Dr. Sidhartha Kumar Lahiri , *Bed-bank relationship and flood characterisation in the Upper reach of the Brahmaputra Valley, Assam*. In Water Security and Sustainability, Notes in Civil Engineering 115, pages191-206, Editors: C. Bhuiyan, W. Flügel, S.K. Jain, Publisher: Springer Nature, Singapore, ISBN: 978-981-15-9805-0_16.

Research Grants/ Projects received

1. Dr. Dhrubajyoti Neog, Assistant Professor, Department of Petroleum Technology has received a project entitled “Reservoir temperature and its impact on crude oil recovery: A study on core samples of a part of the Upper Assam Basin and adjoining outcrops”.

Funding Agency: AICTE

Duration of the Project: 3 years

Sanctioned Amount: Rs. 1648500/-

Co-PI: Prof. Pradip Borgohain

2. Dr. Borkha Mech, Assistant Professor, Department of Petroleum Technology has received a project entitled “Development of a Model for Nutrient Utilization in Microbial Enhanced Oil Recovery Method (MEOR) in parts of Oil fields of Upper Assam.”

Funding Agency: AICTE(RPS-NER)

Duration of the Project: 3 years

Sanctioned Amount: Rs. 1875000/ -

Co-PI: Prof. Pradip Borgohain

3. Dr. Pradip Borgohain, Professor, Department of Petroleum Technology has completed a project entitled “Geological Mapping, Hydrocarbon Source Rock Potential and Depositional Model of the Barail & Disang Group of Rocks in parts of Fold-Thrust Belt area, Nagaland”.

Funding Agency: Centre of Excellence for Energy Studies (CoEES), OIL, Assam.

Duration of the Project: 3 years
Sanctioned Amount: Rs. 27,90,545/-
Co-PI: Dr. Devojit Bezbaruah

4. Dr. Ranjan Phukan, Assistant Professor, Department of Petroleum Technology has received a project entitled “Study on Colloidal Gas Aphron Wellbore Fluid Properties Generated by Different Surfactants”.

Funding Agency: Centre of Excellence for Energy Studies (CoEES), OIL, Assam.
Duration of the Project: 3 years
Sanctioned Amount: Rs. 25,00000/-

5. Title: Novel EOR technique for the depleted oil reservoirs of Upper Assam Basin with simultaneous CO₂ Capture and Sequestration.

Indian PI: Dr. (Mrs.) Subrata Borgohain Gogoi
UK PI: Professor Xianfeng FAN, School of Engineering, University of Edinburgh
Funding Agency: UGC-UKIERI Joint Research Programme (UKIERI-III) project No. F.No. 184-1/2018(IC); under UGC, Government of India
Duration of the project: 15.3.18 – 31.3.2021
Amount: ₹ 13,29,500/- by UGC, India (Indian Funding)

6. Title: Carbon neutrality through combined CO₂ capture and novel H₂ technology with production of non-conventional fuels for smart cities.

Indian Principal Investigator: Dr. (Mrs.) Subrata Borgohain Gogoi
Canadian PI: Professor Ibrahim Dincer, The University of Ontario, Institute of Technology, Canada
Funding Agency: DST - IC IMPACTS, Canada project No. DST/INT/CAN/P-02/2019; under Department of Science & Technology, Government of India, (International Bilateral Cooperation Division)
Duration of the project: 17.11.2020 – 17.11.2022
Amount: ₹ 25,18,994/- by DST, India (Indian Funding)

7. Title: Grant in aid for meeting for meeting the expenditure for solving water problem.

PI: Dr. (Mrs.) Subrata Borgohain Gogoi

Funding Agency: All India Council for Technical Education (AICTE), New Delhi, Special Scheme for North East States (NER)

Duration of the project: 2.5.2020 – 2.8.21

Amount: ₹ 9.6 Lakhs

8. Title: Grant in aid for meeting the expenditure for providing alternative power support from solar energy.

PI: Dr. (Mrs.) Subrata Borgohain Gogoi

Funding Agency: All India Council for Technical Education (AICTE), New Delhi, Special Scheme for North East States (NER)

Duration of the project: 2.5.2020 – 2.8.21

Amount: ₹ 16 Lakhs

9. Title: Surfactant assisted CO₂ EOR Process for the depleting oil fields of Upper Assam Basin.

PI: Dr. (Mrs.) Subrata Borgohain Gogoi

Funding Agency: All India Council for Technical Education (AICTE), New Delhi

Duration of the project: 2.5.19 – 2.5.21

Amount: ₹ 24 Lakh

10. Title: Formulation of an MEOR slug for Enhanced Oil Recovery of Upper Assam Basin

PI: Dr. Tapas Medhi

Co-PI: Dr. (Mrs.) Subrata Borgohain Gogoi

Funding Agency: Institute of Biotechnology & Geotechnonic Studies (INBIGS), A&AA Basin, ONGC, Cinnamora, Jorhat, Assam

Duration of the project: 12.10.18 – 13.10.21

Amount: ₹ 40.95 Lakhs

11. Dr. Shukla Acharjee, Assistant Professor, Centre for Studies in Geography has received NASANASA AERONET Project.

PI: Shukla Acharjee

Funding Agency: NASA, USA

Duration of the project: 10 years

Amount: 6.8 crore

Conference/Workshop hosted

1. Department of Petroleum Technology has hosted a Workshop on “Basics of Drilling Technology” in collaboration with Educave, held on 6th - 8th July, 2021 in online mode, number of participants 100 approx., organized by SPE Dibrugarh University student chapter.
2. Department of Petroleum Engineering, DUIET hosted an AICTE Training and Learning (ATAL) Academy sponsored and guided online Faculty Development Program (FDP) entitled “Advances in Hydrocarbon Exploration” in association with the, held on 20th to 24th September 2021.

Co-ordinators: Mr. Prasun Banik and Dr. Ranjan Phukan.

Number of registered participants: 42.

Number of sessions: 13 technical sessions and 1 session of mental wellness.

3. Centre for Studies in Geography hosted a five-day National Webinar entitled “Remote Sensing & GIS and its Applications at Dibrugarh University from 1st of Feb to 5th Feb, 2021.
Duration: 5 days
Convener: Shukla Acharjee
Number of Participants: 78
Number of Papers Presented: 5

Awards and Recognition

1. Dr. (Mrs.) Subrata Borgohain Gogoi, Professor, Department of Petroleum Technology, was invited as an Expert Member (Senate Nominee) for recruitment process for faculty positions at IIT-ISM, Dhanbad.
2. Dr. (Mrs.) Subrata Borgohain Gogoi, Professor, Department of Petroleum Technology, has received Guest of Honour at SAKSHAM 2021 from 16th Jan'21 to 15th Feb'21 at Indian Oil Corporation (AOD), Digboi dtd. 31.01.21.
3. Dr. Chandra Kumar Dutta, Assistant Professor, Centre for Studies in Geography, has been awarded Doctor of Philosophy (Ph. D.) in Geography from Nagaland University, Department of Geography, School of Sciences, Lumami on 25/08/2021.
4. Dr. Sidhratha Kuram Lahiri, Associate Professor, Department of Applied Geology, was invited as a resource person for two sessions of the workshop *Advances in Hydrocarbon Exploration* on 22nd of September, 2021.
5. Dr. Diganta Bhuyan, Associate Professor, Department of Applied Geology, was invited as the keynote speaker for the workshop *Stratigraphy and its Application* organized by Sibsagar College, Sivasagar on 24th of July, 2021.

6. Dr. Geetartha Dutta, Assistant Professor, Department of Applied Geology, was invited as a resource person for the *International Workshop on Machine Learning for Data Analysis* (Online workshop organized by Dibrugarh University in collaboration with Gargaon College) on 13th-22nd March, 2021.

Awards and Recognition received by group members

1. Mr. Mondip Sarma has been awarded Ph.D. degree by Dibrugarh University under the joined supervision of Prof. Tapos Kumar Goswami, Professor, Department of Applied Geology and Dr. Devojit Bezbaruah, Assistant Professor, Department of Applied Geology, Dibrugarh University. The title of his thesis is : ***Structures and Morphotectonic Evolution of Yingkiong and Siwalik Group of Rocks of East and Upper Siang Districts of Arunachal Pradesh.***
2. Mr. Monjil Rajkonwar has been awarded Ph.D. degree by Dibrugarh University under the joined supervision of Prof. Uttam Goswami, Professor, Department of Applied Geology and Dr. Devojit Bezbaruah, Assistant Professor, Department of Applied Geology, Dibrugarh University. The title of his thesis is : ***HYdrogeology of Springs in and Around Pasighat Area, East Siang District, Arunachal Pradesh.***

**FACULTY OF
BIOLOGICAL SCIENCES**

Papers published in Journals

1. Rajguru, T. Bora, D.S. and Modi, M.K. 2021. Identification of promising inhibitors for *Plasmodium haemoglobinase* Falcipain-2, using virtual screening, Molecular docking and MD simulation. Journal of molecular structure. <https://doi.org/10.1016/j.molstruc.2021.131427>.

Abstract:

Background:Falcipain-2 (FP-2), the major haemoglobinase of the human malaria parasite *Plasmodium falciparum* is currently gaining clinical significance as a drug target of choice in combating malaria. But due to resistance of the malaria parasite against well-known available drugs, the chemotherapy of malaria has become more complex and challenging. Prior attempts to develop peptide-based drugs against them have been futile due to their susceptibility to degradation by host enzymes. **Methods:**Within this context, computational methods namely High Through- put Screening using PyRx Virtual Screening software, Molecular Docking by docking software Autodock followed by Molecular Dynamics Simulations and PCA by GROMACS simulation software were used to select, from a pool of candidate molecules in a molecular database, a subset of compounds for experimental validation. One of the major goals is to increase the probabilities of identifying active compounds. **Results:** We have reported a computer-aided design of four new nonpeptidic inhibitors against FP-2. During the design, an initial virtual library of PubChem database was focused down to 800 drug-like compounds and finally, virtual screened and docked to identify four promising compounds which were further equilibrated by Molecular Dynamics Simulations. **Conclusion:** These can be further analyzed in-depth to develop antimalarial drugs to treat resistant strains of Plasmodium.

2. Mech, A., Choudhury, K. K. and Bora, D.S. 2021. Lipoxigenase - trypsin inhibitor activity axis induction in the host plants of muga silkworm, *Antheraea assamensis* Helfer by feeding. *J Ent Res.* <https://doi.org/10.1111/1748-5967.12543>

Abstract:

The muga silkworm, *Antheraea assamensis* Helfer bears great economic importance, producing golden yellow muga silk which is in global demand for both the textile and biomedical industries. The insect's larval stages are maintained in the field by farmers on its primary host plant *Perseabombycina*Kost in Assam located in the North-East part (25.57 ° N, 93.25 ° E) of India. If continuous feeding by *A. assamensis* is inducing any direct defense in *P. bombycina*, the aspect is not yet questioned. We used the activity of

lipoxygenases (LOX) and trypsin inhibitors as markers for determining defense responses in *P. bombycina* and *Litsea monopetala* Roxb, the two primary host plants of the silkworm due to insect feeding. The induction of anti-herbivore trypsin inhibitor by insect feeding was examined by studying their effect on the midgut trypsin activity of *A. assamensis* larvae. This is the first report showing that the LOX- trypsin inhibitor axis is differentially activated in the two host plants and greater induction of the defense response is exhibited in *P. bombycina*, the most commercially used host plant in muga silkworm rearing.

3. Hazarika, S., Bora, D.S. and Borthakur, B. 2021. Potentiality of novel strain of *Metarhiziumanisopliae* strain (DULS TTRA) against *Odontotermesobesus*, a pest of *Camellia sinensis* (L.) O.Kuntze. Indian Journal of Agricultural Research. Vol 55, No.2:217-221. Article Id: [A-5397](#) DOI: 10.18805/IJARE.A-5397.

Abstract:

Odontotermesobesus (Rambur) is an important termite pest of tea of North East India. The current study shows that a novel strain of *Metarhiziumanisopliae* (*Metarhiziumanisopliae* strain DULS TTRA, Accession no. KT 119358) a tea soil fungus is highly pathogenic to both worker and soldier caste of *Odontotermesobesus* in in-vitro condition. Efficacy of the experimental fungi further assessed by comparing with commercial formulation showed to have less LT50 and LC50 than the established virulent strain. We recommend the strain as a potential bio-control candidate against *Odontotermesobesus*.

4. Chutia, J. and Kardong, D. 2021. Current Status and Seasonal Distribution of Malacofaunal Assemblage in Poba Reserve Forest in Relation to Certain Physico-chemical Parameters. *Asian J. Biol. and Life Sc.* Vol. 10, No.1:93-100 DOI: 10.5530/ajbls.2021.10.15.

Abstract:

A field survey was conducted for two consecutive years in the aquatic bodies of Poba reserve forest (PRF) to assess the diversity, distribution and status of freshwater mollusc's species in relation to physico-chemical parameters of habitat water. Sample collection was carried out in 12 randomly selected sampling stations of the reserve forest using quadrat method (1m² size) for four consecutive seasons viz. pre-monsoon, monsoon, post-monsoon and winter. Physico-chemical analysis of the habitat water were carried out. Altogether 16 species of mollusc under class Gastropoda and Bivalvia were recorded contributing 45.95% and 54.04% respectively to the total population. Highest number of species was encountered in the winter season and an overall decline in species count was registered in the monsoon season. *Brotiacostula* was the most abundant species followed by *Tarebia lineata*. As per the IUCN 3.1 population trends for most of the recorded species were Unknown (UN) except for *Bellamya bengalensis*,

Parreysiacorrugata, *Parreysiafavidens*, and *Corbicula striatella*. *Pila globosa* was the only rare species in the local context. Certain physico-chemical factors of the habitat water have a profound effect on the distribution and abundance of the mollusc population of the studied area.

5. Chutia, J., Sonowal, J., Pegu, B.K. and Kardong, D. 2021. Evaluation of proximate and heavy metals in twelve edible freshwater macroinvertebrates of Poba reserve Forest Assam, India. *Biosci. Biotech. Res. Asia*. Vol. 17, No.4:819-829.

Abstract:

The present study focuses on proximate and mineral compositions on 12 freshwater edible macroinvertebrate species under phylum Arthropoda and Mollusca mostly preferred by the ethnic communities around the Poba reserve forest of Assam, India. The analysis revealed protein was the most abundant nutrient for all the species; followed by carbohydrates and fats. The highest protein content was in *Lobothelphusafungosa*, (50.50%), total carbohydrate fats. The highest protein content was in *Lobothelphusafungosa*, (50.50%), total carbohydrate moisture were highest in *Corbicula assamensis* (12.46%), *Sartorianaspinigera*(11.41%) and *Pila globosa* (63.72%) respectively. Among the minerals, Calcium, Copper, Iron, Manganese, and Zinc were recorded highest in *Bellamya bengalensis* (138.62 mg/100g) *Macrobrachiummassamensis* (2.73 mg/100g), *Sartorianaspinigera*(35.02 mg/100g), *Macrobrachiummassamensis* (11.42 mg/100g) and *Lethocerus indicus* (3.71 mg/100g) respectively. Heavy metals (Lead, Cadmium, Molybdenum and Mercury) were absent in all the species under study. The freshwater macroinvertebrates analyzed could form a baseline for future non-conventional food resources of considerable nutritive value.

6. Hazarika, M., Borah, N., Rostagi, G., Gogoi, D., Chetia, P. and Tamuly, C. 2021. Bioassay-guided isolation of potent α -glucosidase inhibitory compounds from the fruit of *Piper mullesua* Buch–Ham ex D Don. and their *in-silico* screening. *Natural Product Research* (Online first).

Abstract: Two bioactive compounds caffeic and sinapic acid were isolated from the fruit of the *Piper mullesua* Buch–Ham ex D Don using bioassay guided approach. These compounds were isolated from water fraction using column chromatography followed by semi preparative HPLC. These compounds showed very potent anti-diabetic and antioxidant activities. The molecular docking was carried out to predict the mode of interaction of the isolated compounds with α -glucosidase. The *in vitro* α -glucosidase inhibitory activity of caffeic and sinapic acid was determined, and their IC₅₀ values were found 0.67 and 0.82 μ g/ml, respectively. A QSAR equation was generated with an R² value

of 84.81%, which is suitable enough for predicting the IC₅₀ values of test molecules. The aforementioned finding confirms the isolated compounds show very significant anti-diabetic potential which is supported by the molecular docking and QSAR study. So, it has ample scope for drug development with further *in vivo* and clinical study.

7. Mahanta, S., Gogoi, B., Chetia, P., Tanti, B. and Handique, P.J. 2020. Identification of Active Phytochemical from Traditional Herbal Knowledgebase Targeting Pantothenate Synthetase for Anti-tuberculosis Therapy. *Letters in Drug Design & Discovery* (Online First)

Abstract: Increased numbers of reported cases of *Mycobacterium tuberculosis* (Mtb) resistance to the generally used antibiotics demand to identify novel therapeutic entities for better control of Tuberculosis. Most of the Structure-based Drug Discovery (SBDD) works reported earlier had screened compounds against a single drug target to avoid any off-target binding and related complications. Because of the development of Multi-Drug Resistant and Extensively Drug-Resistant strains of Mtb and looking into the incurable pathologies, targeting the right drug target with a promising ligand data set will result in effective therapeutics. Simultaneously, traditional knowledge-based drugs have earned little success in developing anti-tuberculosis drugs in recent studies. Combining the right-target approach and traditional herbal knowledge base, this *in-silico* drug discovery study was carried out where 1236 compounds from two plants, traditionally used for TB treatment, *Camellia sinensis*, *Ginkgo biloba* along with the antibacterial compounds of DrugBank Database have been screened against Pantothenate synthetase of Mtb, a well-known drug target for anti-TB therapeutics. Through this analytics, Epigallocatechin gallate (EGCG) of *Camellia sinensis* has been reported through *in silico* docking studies and subsequent Molecular Dynamics simulation, as a promising anti-TB candidate due to its affinity towards Pantothenate synthetase of Mtb. EGCG was subjected to ADME-Tox studies as well as 3D QSAR analysis for the detection of its drug-like properties and for the determination of IC₅₀ value. The EGCG showed the IC₅₀ value at 1404 nM, which is quite promising for a plant-origin compound. The selected ligand, EGCG, due to its promising affinity towards Pantothenate synthetase of Mtb with high drug-like properties, justifies its selection as a potential anti-tuberculosis compound.

8. Apurba Dutta, Priyanka Trivedi, Dipshikha Gogoi, Pankaj Chetia, Vinita Chaturvedi & Diganta Sarma (2021). Anti-TB evaluation of novel 2,3-dihydroquinazolin-4(1H)-ones and *in silico* studies of the active compounds. *Medicinal Chemistry Research*. 30:1366–1376

Abstract: *In vitro* anti-tubercular activity of a series of 15 novel 2,3-dihydroquinazolin-4(1H)-one analogues were evaluated against *Mycobacterium tuberculosis* H₃₇Ra (ATCC 25177 strain). Among the series, seven compounds showed moderate to good anti-TB activity with minimum inhibitory concentration (MIC) values ranging from 25.0–12.5 µg/mL. Further, *in silico* experiments were carried out to identify the probable ligand-protein interaction. Molecular docking of the target compounds into the active site of

enzymes 1DQY Antigen 85C from Mycobacterium Tuberculosis and 2NSD Enoyl Acyl Carrier Protein Reductase reveals notable information on the possible binding interactions.

9. Gogoi, B., Chowdhury, P., Goswami, N., Gogoi, N., Naiya, T., Chetia, P., Mahanta, S., Chetia, D., Tanti, B., Borah, P. and Handique, P.J. 2021. Identification of potential plant-based inhibitor against viral proteases of SARS-CoV-2 through molecular docking, MM-PBSA binding energy calculations and molecular dynamics simulation. *Molecular Diversity*. 25:1963-1977.

Abstract: The Coronavirus disease 2019 (COVID-19), caused by the novel coronavirus, SARS-CoV-2, has recently emerged as a pandemic. Here, an attempt has been made through in-silico high throughput screening to explore the antiviral compounds from traditionally used plants for antiviral treatments in India namely, Tea, Neem and Turmeric, as potential inhibitors of two widely studied viral proteases, main protease (Mpro) and papain-like protease (PLpro) of the SARS-CoV-2. Molecular docking study using BIOVIA Discovery Studio 2018 revealed, (-)-epicatechin-3-O-gallate (ECG), a tea polyphenol has a binding affinity toward both the selected receptors, with the lowest CDocker energy $-46.22 \text{ kcal mol}^{-1}$ for SARS-CoV-2 Mpro and CDocker energy $-44.72 \text{ kcal mol}^{-1}$ for SARS-CoV-2 PLpro, respectively. The SARS-CoV-2 Mpro complexed with (-)-epicatechin-3-O-gallate, which had shown the best binding affinity was subjected to molecular dynamics simulations to validate its binding affinity, during which, the root-mean-square-deviation values of SARS-CoV-2 Mpro-Co-crystal ligand (N3) and SARS-CoV-2 Mpro-(-)-epicatechin-3-O-gallate systems were found to be more stable than SARS-CoV-2 Mpro system. Further, (-)-epicatechin-3-O-gallate was subjected to QSAR analysis which predicted IC₅₀ of 0.3281 nM against SARS-CoV-2 Mpro. Overall, (-)-epicatechin-3-O-gallate showed a potential binding affinity with SARS-CoV-2 Mpro and could be proposed as a potential natural compound for COVID-19 treatment.

10. Sharma, M., Chetia, P., Puzari, M., Neog, N., Phukan, U. and Borah, A. 2021. Carbapenem resistance among common Enterobacteriaceae Clinical Isolates in part of North-East India. *Anti-Infective Agents*. Vol.19, No.4: e130621190844.

Abstract: Background: Enterobacteriaceae, the normal dwellers in the human intestine, are commonly associated with a variety of community-acquired and nosocomial infections. An emerging trend of antibiotic resistance among these strains is a notable issue globally; a more serious threat is the resistance against the available last resort antibiotics- the carbapenems.

Objective: The objective of our study was intended to determine the burden of resistance towards common antibiotic classes so as to address the gap of drug resistance prevalence data, among the Enterobacteriaceae isolates obtained from the health settings in this region.

Methodology: A cross-sectional study was done with an inclusion of clinical isolates collected from varied sources from health settings in upper Assam. The isolates were identified based on standard methods of morphology study and biochemical tests. The identified isolates were then subjected to antibiotic susceptibility testing by following the

Kirby-Bauer disc diffusion method, and the result was interpreted as per the CLSI guidelines. The resistance of the reported carbapenem-resistant isolates was confirmed by minimum inhibitory concentration (MIC) determination using a commercial E-strip kit.

Results: Among the enterobacterial isolates *Klebsiella spp.* accounted for the majority, followed by *Escherichia coli*, *Citrobacter spp.*, *Shigella spp.* and others. Multi-drug resistance (MDR) was noted among 67.6% isolates; however, carbapenem resistance was confirmed in 18.9% of the total Enterobacteriaceae isolates. Conclusion: Higher prevalence of resistance towards carbapenems, among the Enterobacteriaceae isolates of upper Assam seems to be an upcoming threat to the region, limiting the treatment options in the future.

11. Kar, B., Sharma, M., Peter, A., Chetia, P., Neog, B., Borah, A., Pati, S., Bhattacharya, D. 2021. Prevalence and molecular characterization of β -lactamase producers and fluoroquinolone resistant clinical isolates from North East India. *Journal of Infection and Public Health*.

Abstract:

Introduction

The rapid emergence and variations of antibiotic resistance among common gram negative bacteria cause a significant concern specially in India and all over the world because of high mortality and morbidity rates.

Methods

In our study, we screened 189 bacterial isolates from Assam Medical College & Hospital, Dibrugarh for antibiotic resistance pattern and tried to identify the resistant genes causing responsible for β -lactam and [fluoroquinolones](#) resistance.

Results

More than 80% and 45% strains were resistant to all the 3rd generation [cephalosporins](#), fluoroquinolones respectively. Among the 3rd generation cephalosporin resistant strains, 38% and 24% isolates were only [ESBL](#) and MBL producers respectively and 11% were reported to have both ESBL and MBL genes. The ESBL positive isolates have shown the dominance of CTX-M3 gene. VIM-1 gene was mostly reported in MBL producers. Our study probably for the first time reporting SIM-1 and SPM-1 MBL gene from India. Mutations in QRDR is found to be the primary cause of fluoroquinolone resistance along with efflux pump and PMQR presence.

Conclusion

The study represents the first detailed study on antibiotic resistance from NE India this could help to take control measures for the emerging antibiotic resistance in hospital and community based infections in North East India.

12. Neog, N., Phukan, U., Puzari, M., Sharma M. and Chetia, P. 2021. *Klebsiella oxytoca* and Emerging Nosocomial Infections. *Curr Microbiol* Vol. 78.

Abstract:

Klebsiella oxytoca is rising as a significant opportunistic pathogen causing nosocomial infections in neonates as well as adults. This pathogen's prevalence varies from 2 to 24%, but outbreaks of infections due to multidrug-resistant strains can be fatal in

immunocompromised individuals with comorbidities. *Klebsiella oxytoca* is responsible for a wide range of ailments from colitis to infective endocarditis, other than the common urinary and respiratory tract infections. The microbe's pathogenicity has been attributed to cytotoxins' production- Tilivalline and Tilimycin, in some intestinal disorders. *Klebsiella oxytoca* is reported to be resistant to a wide range of antibiotics. Here, we have tried to showcase a brief overview of the emergence of *Klebsiella oxytoca* in healthcare facilities and the nature of resistance in this species of *Klebsiella*.

13. Govindaraju, I., Chakraborty, I., Baruah, V. J., Sarmah, B., Mahato, K.K. and Mazumder, N. 2021. Structure and Morphological Properties of Starch Macromolecule Using Biophysical Techniques." *Starch-Stärke*. Vol.73, No. 1-2: 2000030.

Abstract: Starch is an abundant plant polysaccharide that occurs naturally and the main source of carbohydrate and fuel in the human diet. Several biochemical and physicochemical studies have been performed to understand the molecular structure of starch of which microscopy, spectroscopy, and thermal analysis are the most popular. The ultrastructure and birefringence of starch granules have been observed using optical microscopy and polarization microscopy. Scanning electron microscopy (SEM) and X-ray diffraction (XRD) have been used for spatially resolved micro to nanostructures as well as surface topography and crystallinity in the starch granules. Fourier Transform Infrared (FTIR) spectroscopy has been utilized to elucidate the chemical composition and the changes that occur in its chemical compositions on various modifications. Differential scanning calorimetry (DSC) has also been used to study the thermal characteristics of starch. This review deals with starch characterization using optical microscopy including polarization microscopy, SEM, XRD, FTIR, and DSC to understand the structural and functional characteristics of starch subjected to different processing conditions.

14. Govindaraju, I., Zhuo, G., Chakraborty, I., Melanthota, S.K., Mal, S.S., Sarmah, B., Baruah, V. J., Mahato, K.K. and Mazumder, N. 2021. Investigation of structural and physico-chemical properties of rice starch with varied amylose content: A combined microscopy, spectroscopy, and thermal study." *Food Hydrocolloids*. Vol.122 No, 1: 107093.

Abstract: Starch from a given botanical source can vary considerably in terms of physicochemical properties in its native and hydrolyzed forms. The current study investigated the structural and functional characteristics of starch from ten indigenous rice varieties endemic to Northeast India. In vitro enzymatic hydrolysis was used to reveal the dextrose equivalent profile of each type of starch. GezepSali and BetgutiSali respectively exhibited the highest and lowest starch hydrolysis. Among the ten rice varieties, amylose content varied between 7.50 and 28.58%. Optical and scanning electron microscopy (SEM) revealed the polyhedral shape of the native starch granules and deformation of the shape upon enzymatic hydrolysis. Second harmonic generation (SHG) microscopy and X-ray diffraction (XRD) analysis confirmed the presence of and variations in starch crystallinity. XRD revealed spectral peaks characteristic of A-type starch crystals in the native form. The elevated intensity of XRD peaks in hydrolyzed

starch granules confirmed the occurrence of amylose hydrolysis rather than hydrolysis in amylopectin regions. Fourier transform infrared (FTIR) spectra revealed the common stretching and bending of bonds in all native starches; however, changes were observed in the fingerprint region (1080, 1000, 926 cm^{-1}) of hydrolyzed starch granules, which indicates the amylolysis of the amylose region and disturbances in the ordered arrangement in the crystalline part. Differential scanning calorimeter (DSC) endotherms revealed the highest and lowest gelatinization peak temperatures in Harfoni (78 °C) and TulosiSali (41 °C) rice cultivars, respectively. The findings in this study can help to optimize the usage of rice starch in food and non-food industries. Furthermore, understanding the control points of starch digestion and genetically tailoring rice grains with different digestibility could be beneficial for nutraceutical applications.

15. Gogoi, N., Gogoi, A., Neog, B., Baruah, D. and Saikia, P. 2021. Phylogenetic Analysis and Genetic Diversity of *Garcinia* Species Using ITS Region and ISSR Markers. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*. Vol. 91, No.4:1-9

Abstract: Characterization of germplasm is an important pathway between the conservation and utilization of genetic resources in various breeding programs. Genetic variability and genetic relationships were assessed among the 42 genotypes of *Garcinia* L. of Upper Assam, using the ISSR-DNA markers. A total of 42 random decamer oligonucleotides of PKBT and UBC series were examined to generate the ISSR profiling, out of which 16 primers produced reproducible and scorable bands. A total of 142 amplicons was obtained, with 91.56% of polymorphic bands. Monomorphic band percentage was calculated and found to be 8.48% with 0.65 of PIC value and EMR, MI values were calculated and found to be 7.90 and 5.52, respectively. Genetic similarity matrix, based on Jaccard's coefficient ranged from 0.30 to 0.97 indicating to be least. A dendrogram constructed by the unweighted pair group method with arithmetic average formed four distinct clusters. ITS1 regions were found to be efficient barcode for the assessment of phylogenetic relationships between *Garcinia* genotypes. The present investigation recommends the usefulness of ISSR technology for the study of genetic similarity among different genotypes of *Garcinia* L.

16. Saikia, P., Neog, B., Gogoi, N. and Baruah, D. 2021. Assessment of the Genetic Diversity of Joha Rice Germplasms by using Simple Sequence Repeat Markers. *Indian Journal of Agricultural Research*. 1-7. DOI: 10.18805/IJAR.A-5689.

Abstract:

Background: Joha Rice are aromatic rice landraces, having small to medium grain size, indigenous to Assam, India. Due to the introduction of high yielding hybrid varieties, many endemic rice landraces including Joha Rice, are in a verge of extinction, as these can only be conserved and maintained by repetitive cultivation. As there is a conflict of local names for these landraces, many landraces with similar morphological characters have been reported from various parts. Simple sequence repeat (SSR) markers with

longer perfect repeats have earlier proved successful and essential in studying the genetic diversity among rice cultivars. The present study is aimed to evaluate the genetic relationship among fifteen (15) aromatic Joha rice landraces endemic to Upper Brahmaputra Valley, Assam.

Methods: In the present investigation, different landraces of Joha rice were surveyed during 2016-2019. 15 landraces were selected, based on their morphological characters and local data. The collected germplasm of Joha rice was grown in the experimental plots and DNA from young, healthy leaves were isolated which were further used for determination of genetic diversity using SSR markers. Thirty-eight SSR markers were used to evaluate the genetic relationship among the fifteen aromatic rice landraces.

Result: A total of 110 polymorphic alleles were detected by 34 markers across all the landraces, with an average of 3.25 per locus. The Polymorphic Information Content (PIC) ranged from 0.24 to 0.83, with an average of 0.5 for each marker. The marker RM154, RM454 and RM489 produced maximum six alleles showing PIC value of 0.82, 0.82 and 0.83, indicating a high polymorphism. UPGMA cluster analysis using Jaccard's similarity index produced a dendrogram clustering the rice landraces in three major groups and five subgroups. Group II, which consisted of five sub-groups and 12 landraces, showed diverse genotypes. These landraces showed significant genetic similarities.

17. Sonowal, J., Puzari, M. and Kardong, D. (2021). Diversity of freshwater mollusc from Upper Brahmaputra Basin of Assam, India. *Journal of Threatened Taxa*. Vol.13, No. 5: 18237–18246.

Abstract: A field survey was conducted for three consecutive years, 2015–17 to assess the diversity of freshwater molluscs (Gastropoda and Bivalvia) of the upper Brahmaputra Basin in Assam, India. Altogether, 18 gastropods and 27 bivalve species representing nine families were recorded from 17 sampling stations comprising small to large tributaries and wetlands in the food-plains covering a total geographical area of approximately 3,500km². A large fraction (15.55%) of the collected mollusc species are new records from the upper Brahmaputra Basin of Assam. Rarity in the occurrence of freshwater mollusc was confirmed with singleton and doubleton species accounting for 6.66% and unique species accounting for 35.55% of the total species recorded. It was observed that most of the mollusc species of the upper Brahmaputra Basin are either in the 'Least Concern' or 'Data Deficient' category of the IUCN Red List; except for *Lymnaea ovalior* (Annandale & Prasad, 1921) and *Sphaerium austeni* Prasad, 1921 assessed as 'Vulnerable' and 'Near Threatened', respectively. A significant trend in the diversity in terms of species richness and composition was observed across the sampling stations of the northern basin and southern basin of the river Brahmaputra.

18. Sonowal, J., Chetia, P. and Kardong, D. 2021. Phylogenetic analysis of Indian freshwater pond mussels *Lamellidenscorrianus* and *L. phenchooganjensis* (Bivalvia: Unionidae) from the upper Brahmaputra Basin of Assam, India. *Biosciences Biotechnology Research Asia*. Vol.18, No.1:197-206.

Abstract: To update the present knowledge of freshwater molluscs, a phylogenetic analysis of two species of Indian pond mussels was carried out using amplified sequence of 18S rRNA gene. From the phylogenetic study of 18S rRNA gene sequencing, it was found that the *Lamellidenscorrianus* and *L. phenchooganjensis* are phylogenetically closely related to 18S rRNA gene sequences of other freshwater bivalve mussels belonging to the family Unionidae of order Unionida. Like other members of the Unionidae family, the two *Lamellidens* spp. showed monophyletic evolutionary lineage and shared a common ancestor. The result obtained from the phylogenetic analysis of *Lamellidens* spp. was significant as the 18S rRNA gene sequence of *L. phenchooganjensis* was submitted for the first time in the global nucleotide database (Genbank, NCBI). Similarly, the 18S rRNA gene sequence of *L. corrianus* was also submitted to the database for the first time from this region having unique ecological niche. Therefore, the present study on phylogenetic analysis is a contribution to the global database of 18S rRNA gene sequences of freshwater mollusc, particularly from this part of the region.

Published Books

(Please provide information about the book title, authors, publisher, ISBN. If possible, you are also requested to submit a brief note about the book.)

1. National Service Scheme and Youth Development. (ISBN: 978-93-84589-25-7)

(As per Dibrugarh University CBCS syllabus for B.A./B.Sc./ B.Com. 3rd semester students for the Skill Enhancement Course NSS-01)

Authors: Dr. Devid Kardong, Mr. Padmeswar Katoni, Dr. Bijay Kr. Changmai, Mr. Keshavananda Haloi

Publisher: Union Book Publication, Paltanbazar, Guwahati-01

Published Book Chapters

1. Purnima Das, L. K. Hazarika, D. Bora (2021): *Study on mass production of Beauveria bassiana (Bals.) Vuill. For the management of rice hispa, Diadarma armigera (Olivier)* in Cutting Edge Research in Agricultural Sciences. Vol.11, Chapter 9. BP. International. ISBN. 978-93-91215-31-6.
2. Rupamoni Thakur, Aditya Gogoi and Devid Kardong (2021): *Analyzing the Proteolytic and Anticoagulant Properties of Mesua ferrea leaf extract* in Research in Life Sciences: pp: 195-207.
3. Jyotish Sonowal and Devid Kardong: *Soleiasoleniformis (Benson, 1836): An Endemic Freshwater Mollusc of Assam* in Glimpses of Biological Research in Upper Brahmaputra Basin in Assam (2021): pp-134-142; ISBN: 978 81 946922 01; Eastern Book House, Guwahati (Assam), India.
4. Jitu Chutia and DevidKardong: *A Study on Edible Aquatic Macroinvertebrates of Poba Reserve Forest of Jonai, Assam. Glimpses of Biological Research in Upper Brahmaputra Basin in Assam (2021).*in pp: 169--177; ISBN: 978 81 946922 01; Eastern Book House, Guwahati (Assam), India.
5. Akermi S., Jayant S., Ghosh A., Sharma A., Sinha S., Johari S (2021): *Viroinformatics for viral diseases: tools and databases* in K. Raza & N. Dey (Eds.). Translational Bioinformatics in Healthcare and Medicine. ISBN: 978-0323898249 (Vol. 13, pp. 171-181), AcademicPress (Elsevier, SCOPUS Indexed).
6. Baishnab S., Sinha S., Ghosh A., Sharma A., Johari S (2021). *Toxin Databases and Healthcare Applications* in K. Raza & N. Dey (Eds.). Translational Bioinformatics Applications in Healthcare (pp. 133-143). CRC Press. ISBN: 978-1003146988 (Taylor & Francis; SCOPUS Indexed).
7. Akermi S., Sinha S., Johari S., Jayant S, Nigam A (2021). *Computational Intelligence Methods for the Diagnosis of COVID-19.* In K.Raza (Ed.). Studies in Computational Intelligence: Computational Intelligence Methods in COVID-19: Surveillance, Prevention, Prediction and Diagnosis (pp. 207-223). Springer Nature. ISBN: 978-9811585340 (SCOPUS Indexed).

8. Das, A., Pathak, U., Rajkhowa, S., Jha, A. N. (2021). ***Plasmodium falciparum: Experimental and Theoretical Approaches in Last 20 Years***. In A. J. Rodriguez-Morales of Current Topics and Emerging Issues in Malaria Elimination (97-117). London, United Kingdom: Intech Open.
9. Rajkhowa, S., Hazarika, Z., Jha, A.N. (2021). ***Systems biology and bioinformatics approaches in Leishmaniasis***. In F. R. Formiga, Inamuddin, P. Severino of Applications of Nanobiotechnology for Neglected Tropical Diseases (509-548). London, United Kingdom: Elsevier Academic Press.
10. Bristy Borgohain, Prerona Gogoi, Pranit Saikia (2021). ***Scenerio of Indigenous Rice Germplasm and its Heritage in Assam- A Review***,117-124, Society, Economy and politics of Nort East India, Dr. Surajit Saikia, Nilutpal Chutia, Yuvaraj Gogoi, Gargaon College Publication Cell and Purbayon Publication, ISBN: 9789390919680.
11. Darathi Deori and Jyotish Sonowal (2021). ***A Preliminary Investigation of Odonates in Kurukani Forest Village, Sivasagar District, Assam, India***. In Latest Trends in Zoology and Entomology Sciences, Subha Ganguly (Editor) Volume – 12, pp. 35-44, AkiNik Publications.

Research Grants/Projects received

1. Ms. Minakshi Puzari, Assistant Professor, Department of Life Sciences has received seed money of Rs. 25,000/- from Dibrugarh University for study of butterfly diversity in the Dibrugarh University Campus.
2. Dr. Munmi Borkataky, Assistant Professor, Department of Life Sciences has received seed money of Rs. 25,000/- from Dibrugarh University for Cataloguing and Identifying the Bryophyte Diversity of Dibrugarh University Campus.

Conference/ Workshop hosted

1. Department of Life Sciences hosted DST-SERB Sponsored Hands-On workshop on “Techniques in research for insects of public health importance”, 19-20 March, 2021. No. of participants: 20.

Awards and Recognition

1. Dr. D.S. Bora, Professor, Department of Life Sciences was invited to deliver a speech on “Insect-Plant Interaction” in Lecture series held by Department of Zoology, Gauhati University on 3rd August,2021.
2. Dr. S. Sinha, Assistant Professor,Centre for Biotechnology and Bioinformatics was invited as Eminent Speaker in National Workshop on Remote Access to Lab: Lab on Screen organized by Jorhat Kendriya Mahavidyalaya from 27th July to 1st August 2021 in collaboration with Jorhat Engineering College, University of Jammu and Chitkara University, Himachal Pradesh.

Awards and Recognition received by group members

1. Number of Ph. D.awarded under the supervision of Dr. D.S. Bora, Professor, Department of Life Sciences: 4(Four).

**FACULTY OF
COMMERCE AND
MANAGEMENT SCIENCE**

DEPARTMENT OF COMMERCE

Dr. Pranjal Bezborah

Journal Papers

1. Samrat Bharadwaj & Dr. Pranjal Bezborah. “Decoding Consumer Psychology toward Dietary Supplements: A Mediation Analysis between Freebies and Brand Loyalty”, Journal of Food Products Marketing, 2021, Vol. 27, No. 4, 173-187.

Abstract: The present study ponders a significant type of non-monetary form of sales promotion called freebies. It refers to offering a gift of some worth to the customer along with the product purchased. While prior studies focused primarily on monetary forms of sales promotion, a very minimal number of works were conducted on its counterpart. The study bridges the gap between non-monetary sales promotion and brand loyalty in India and inspects into Generation Z consumer behavior toward dietary supplements. It checks whether a freebie campaign influences perceived quality, customer perceived value and purchase intentions. It also investigates the role of the variables as mediators and inspects whether they play any role between freebies and brand loyalty. Intercept method of data collection is applied for the survey across 388 health-conscious respondents. Regression and mediation analysis present that freebie influence the variables positively and partial mediation exists between the causal and outcome variable.

Keywords: Freebies, dietary supplements, perceived quality, purchase intentions and brand loyalty.

Published Book Chapters

1. Pranjal Bezborah, “Soft Skill and Personality Development”, Banalata, Dibrugarh ISBN: 978-93-89865-52-3.
2. Pranjal Bezborah, “Safal Jiwanar Dukuri Mantra” (An anthology of forty mantras for a successful life in Assamese), Naksha Books, Dibrugarh, ISBN: 978-81-939447-0-7.

Published Articles

Weekly column on ‘Youth Motivation’ published in the Assamese daily, ‘Asom Aditya’. Till the time of submission of this data, 34 (thirty-four) columns have been published.

Dr. Seema S Singha

Journal Papers

1. Dr. Seema S Singha and Vidisha Saikia. “Role of National Rural Livelihoods Mission (NRLM) Towards Participation of Rural Women in SHGS of Dibrugarh and Nagaon District of Assam”, SPJMR: Surajpunj Journal for Multidisciplinary Research, an ISO: 7021-2008 certified Journal, ISSN:2394-2866, Vol-11, Issue:2, February.2021.

Abstract: Women have tremendous energies to start new economic activities given the right opportunities. They have developed abundant self –confidence and self –esteem through self-help group movement not only to overcome economic poverty but also social and gender issues which can be tackled effectively through this process. Under the initiative of the Ministry of Rural Development, the formation of self-help group with the association of state government and various commercial banks; the formation of SHGs has been picking up in the state in such a way that it becomes a part of almost all section of poorer people of the state. The NRLM takes initiative to coordinate the various income generating activities through the different components of it. The main components under this mission are like-social inclusion, social mobilisation, financial inclusion, skill and capacities building of SHG members etc. SHG is recognised as an approach for the rural poorer because of its ability to help its members through organizing themselves into groups and ability to increase their social and economic empowerment apart from capacity building to stay and live in a society. The objective of the paper is to know about the various components of NRLM leading towards economic independence of the rural

women, the participation of women members through the SHGs/VOs and to find out the problems faced by the beneficiaries & NRLM officials in the study area.

Keywords: Self-help groups (SHGs), Village Organization (VO), Cluster Level Federation (CLF), Social Mobilisation (SM), Institution Building (IB), Capacity Building, Financial Inclusion (FI), Livelihoods (LH), Social Development (SD) and Social Inclusion (SI).

2. Rijumoni Kalita and Dr. Seema S Singha. "Re-skilling of Employees: A case study of upper Assam Drilling division of Irrigation Department, Jorhat, Assam", International Journal of Human Resource Management (IJHRM). Vol.-10, Issue- 1, NAAS Rating: 2.84, Dec-January. 2021

Abstract: Re-skilling is concerned with training programmes either for the employees of the organisations or members of a family. It deals with development of new set of conceptual, human, and technical skills of the employees of an organisation. Re-skilling of the existing employees of an organisation or the upcoming youth is essential for making employable in a better organisation than earlier.

In the context of re-skilling of the employees towards the growth and development of the organisation, the present study is based on the analysis of only five (5) factors: need of re-skilling training programme, adoption of re-skilling training method, soft skill training, value addition and upgradation of knowledge in a form of a case study in the Upper Assam Drilling Division (UADD).

The objectives of the study are (i) to study the select factors influencing the re-skilling training programme; (ii) to investigate the attitude of the employees towards re-skilling training programme; and (iii) to suggest some new re-skilling training programme for updating the workforce of the division.

Keywords: Re-skilling, attitude, knowledge, upgradation, value-addition, soft-skill.

Published Book Chapters

1. Pallavi Kashyap and Dr. Seema S Singha. “Role of Key Players in Tourism of Sivasagar District”, Dynamic Ideas: Multi-Disciplinary Edited Research Book, Rudra Publications, ISBN: 978-93-91333-16-4, 2021.

Abstract: Tourism industry has gained wide popularity and profitability in the world recently. It is one of the fastest growing service industries and economically very important in the present-day situation. It has immense scope for the generation of income and employment. The district of Sivasagar in Assam has immense potentiality for the development of tourism. It is the treasure house of the natural beauty with flora and fauna, tea gardens, historical monuments, pilgrimage canters, culture, festivals etc. All these together has the potential to make the study area, Sivasagar one of the most sought-after destinations for the tourists. The study is an effort to highlight the role of the key players for successful tourism in the study area. It is an attempt to focus on the various issues revealing the status of tourism in the study area.

Keywords: Tourism, key players, Sivasagar

Dr. Kumud Goswami

Journal Papers

1. Tapash Kashyap and Prof. Kumud Chandra Goswami. “Deposit Mobilisation and Credit Creation by Indian Banks: A Study of State Bank of India and ICICI Bank”, International Journal of Advances in Engineering and Management, Vol 3 Issue 9 (September, 2021), Peer reviewed.

Abstract: The development of the economy of a country largely depends on how well the financial sector is performing. The financial sector comprises of a huge network of various institutions working together, out of which, the banking sector is the most active. The primary functions of banks involve accepting deposits and granting loans. The performance of the banks depends on how effectively they are able to perform their primary functions. As such, the

evaluation of the performance of banks in respect of deposit mobilization and credit creation need is very important. Keeping that in mind, an attempt has been made in this paper to study the deposit mobilization and credit creation of Indian public sector banks. For the purpose of the study, two banks, namely, State Bank of India and ICICI Bank from the public sector and private sector respectively have been selected. For the analysis of the data, the Compound Annual Growth Rate has been computed with the help of the Log-Lin Method and trend analysis has been done using the Least Square Method. The credit deposit ratio has also been calculated. The study period is from 2007-08 to 2019-20. It has been observed from the study that State Bank of India has a much higher quantum of resources but ICICI Bank is more efficient in the utilization of the resources.

Keywords: Banks, performance, deposit, mobilization and credit creation.

2. Tapash Kashyap and Prof. Kumud Chandra Goswami. “A Study on The Adoption of Digital Wallet”, Shodh Sanchar Bulletin, Period: January-March 2021 Issue, UGC Care listed, ISSN: 2229 3620, Vol: 11.

CENTRE FOR MANAGEMENT STUDIES

Dr. Himadri Barman

Journal Papers

1. Dr. Himadri Barman & Subhalaxmi Sharma. “Impact of Social Media on Choice of Tourist Destinations by University Students”, Journal of Tourism and Development, Volume 35 (Scopus Indexed).

Abstract: Social media is a buzzword and its impact on human behaviour is being widely studied. This paper is based on a study carried out to understand the impact of social media on the choice of tourist destinations by University students. The study is very clear on the fact that social media does have a considerable impact on the choice of tourist destinations among the University students. Though not conclusive, a couple of demographic variables are important in the context of the impact of social media on the choice of tourist destinations as found from the detailed investigation of selected demographic variables.

Keywords:Dibrugarh, social media, students, tourist destinations, university.

2.Dr. Himadri Barman. “Use of Social Media by Top Indian Business Schools And Engineering Institutes – A Comparative Study”, Himadri Barman,Vanijya, Volume 29.

Abstract: It has been observed that in the recent years, social media have become an important public relations and promotion tool for all types of organizations including the academic institutions. This paper looks at the use of social media by top business schools and engineering institutes of India. Secondary data has been collected from the social media profiles of the top business schools and engineering institutes of India as per the 2019 NIRF Ranking. A simple Social Media Ranking (SMR) has been devised which is used to make comparisons between institutional ranking and SMR. The comparisons are done separately for business schools as well as engineering institutes. A comparison is also done between business schools and engineering institutes. The study finds that there is a positive correlation between institutional ranking and social media ranking for both business schools and engineering institutes but business schools beats engineering institutes in the use of social media.

Keywords: Facebook, instagram, twitter, higher educational Institutes, social media, ranking and NIRF.

Pransu Raj Kaushik

Published Articles

1. Pransu Raj Kaushik. “COVID-19: Is it time we seriously consider open book exams?”
Published in: EastMojo, the digital news magazine, May 23, 2021.

Article brief:The article was written keeping in mind the challenges thrown by Covid 19 in the realm of academics and was an explanatory piece about accepting newer methods of teaching and learning, more so, the open book system.

**FACULTY OF
SOCIAL SCIENCES**

Papers Published in Journals:

- **Obja Borah Hazarika**, ‘Paid and unpaid work during the Covid-19 pandemic: a study of the gendered division of domestic responsibilities during lockdown’, *Journal of Gender Studies*, Volume 30, 2021 - Issue 4, doi.org/10.1080/09589236.2020.1863202,

Abstract: The Covid-19 pandemic and the strategies implemented to deal with it have had economic and societal repercussions all over the world. In India, a nationwide lockdown was initiated which continued in a diluted form as we were conducting the interviews for the paper in July 2020. The lockdown brought activities outside the home to a standstill and people were expected to stay indoors in order to ensure social distancing and break the chain of infection. The lockdown sparked its own problems and triggered discussions on issues including economic hardship and domestic violence. The question of how domestic responsibilities are shared among adults in families has also come to the forefront of debate. As hired part-time help was discontinued under lockdown, parents who had hitherto outsourced childcare and housework were suddenly left to fend for themselves. This article attempts to explore the manner in which such unpaid domestic responsibilities, especially childcare, were shared between parents in middle-class homes. The gendered nature of this division of housework and care work, and its varied implications on the paid work and careers of mothers and fathers, is the focus of inquiry.

- **Obja Borah Hazarika**, ‘Gunotsav Examiners’ Reflections: The Many Dimensions of Evaluating ‘Quality’ Education’, *Economic and Political Weekly*, May 8, 2021, LVI (19). 58-64. ISSN: 0012-9976.

Abstract: Following the “Gunotsav–A Quality Initiative” exercise undertaken by the Government of Assam in 2017 and 2018 to assess the quality of its government schools in the state, the views

of the external examiners involved in the assessment of various schools are presented. While quality cannot be quantified, reflections of examiners from exercises such as Gunotsav help in situating the education offered by government schools in the particular socio-economic contexts of Assam, apart from underscoring the range of challenges faced by such schools.

- **Kaustubh Deka**, ‘The River of Life: Brahmaputra as a Narrative of Identity, Existence and Claims in Assam’, *ANVIKSA*, March, 2021, ISSN 2348-067X, pp. 52-7
- **Amrita Pritam Gogoi**, ‘Ormakalum, Maravikalum, MunnottullaKakveppukalaum: Nepalile Maoist People’s PorattathilePenGuerrillakal (Remembering, Forgetting, and Taking the Step Forward: Women Guerrillas from Maoist People’s War of Nepal’, *Sanghaditha*, ISSN 2319-9741, Volume 21, Issue 3, January 2021.

Abstract: In the Maoist People’s War (MPW) of Nepal (February 1996 - April 1996), fought under the leadership of the Communist Party of Nepal (Maoist) with the objective of emancipating the people from feudal, patriarchal, caste, class and gendered discriminatory practices, it is claimed that women composed of 30-40 percent of its total cadres. Women flowed into the movement for ideological and personal reasons. Some joined out of the pain and the will to avenge discriminatory gendered practices at home and society, others were moved by the ideology, and yet some joined out of family affiliation to the Maoists Party and the cause. Based on ethnographic field work this paper explores the post-war lives of the female ex-combatants of the war. It identifies the forms of female subjectivity through diverse forms of memory practices.

Published Book:

- **Obja Borah Hazarika**, *Paradigms of paradiplomacy in Northeast India: Assam's Cross-border Concerns and Engagements*, DVS, 2021, ISBN: 978-93-85839-47-4

Abstract: This book has been written as an attempt to study whether paradiplomacy as a concept and practice can be attributed to the states of the Northeast of India, particularly Assam, given the multiple challenges which are prevalent in this region. It was taken up as the main objective in this study as existing scholarship on this subject primarily focuses on the other constituent units of India which are situated in different geo-political, geo-strategic and geo-economic contexts compared to the Northeast. This book has sought to explore other ways in which the states of the Northeast, especially Assam has been attempting to influence policies which have cross-border overtones and implications as a way to broaden the scope of research pertaining to the Northeast. The topics covered in this book attempt to go beyond concentrating solely on the Act East Policy, security issues or the landlocked nature of the region and focus on other ways of viewing the agency of these constituent units. Apart from exploring aspects of economic paradiplomacy, it examines the manner in which the states of the Northeast have tried to challenge the centre on certain issues such as the Citizenship Amendment Act, and the Land Boundary Agreement with Bangladesh.

- **Monoj Kumar Nath**, *The Muslim Question in Assam and Northeast India*, Routledge (Taylor & Francis Group). Global edition: March 31, 2021. ISBN-10: 0367429675. ISBN-13: 978-0367429676. South Asia Edition: Sept 2021. ISBN: 9781032125312.

Published Book Chapters:

- **Kaustabh Deka**, *Of imported SUVs and buying 'the Last Supper' in Milan : 'New middle class' and its crisis of hegemony in India's Northeast* in 'Beyond Consumption India's New Middle Class in the Neo-Liberal Times', Ed. Manish K Jha, Pushpendra, Routledge, London and New York, 2021, ISBN : 9781003098416, PP. 154-170
- **Kaustabh Deka**, *The Testament of the Pen: literature and the 'unsilencing' in India's Northeast: Looking at the case of some Assamese literature*. In 'Unmasking Silence: Voices Heard and Unheard'. Ed. Mukuta Borah. Jaipur: Aadi Publications, 2021. Pgs. 20-35. ISBN: 976-61-952501-3-4.
- **Borun Dey**, "State-Civil Society Relations" (Unit 11 of the course BPSC133 Comparative Government and Politics for Political Science under School of Social Sciences) in the IGNOU Self Learning Material published by Indira Gandhi National Open University, New Delhi, 2021

Research Grant/ Projects received:

- **Nasmeem F. Akhtar**

Title of the Project: ‘The Risk of Being at Home: Listening to the Voices and Narratives of the Battered- An Analysis of the Factors and Legal Implications of Domestic Violence in Dibrugarh, Assam’

P.I.: Nasmeem F. Akhtar

Funding Agency: National Commission for Women, New Delhi

Duration of the project: 12 months

Amount: Rs. 12, 20,000

- **Debajanee Bora**

Title of the Project: “No Space For Work”

Consultants: Debajanee Bora & Barnali Das

Funding Agency: Zubaan, an Independent Feminist Publishing House, New Delhi

Duration of the project: September 2021- January 2022

Amount: Rs. 5, 52,000

- **Barnali Das**

Title of the Project: “No Space For Work”

Consultants: Debajanee Bora & Barnali Das

Funding Agency: Zubaan, an Independent Feminist Publishing House, New Delhi

Duration of the project: September 2021- January 2022

Amount: Rs. 5, 52,000

Awards and Recognition:

- Debajanee Bora, Resource person in the National Panel Discussion on ‘Gender Concerns in Governance’ organised by Graphic Era Deemed to be University, Dehradun on 15 April, 2021.
- Barnali Das, Doctorate Degree awarded by the University of Hyderabad in March, 2021.

**FACULTY OF
HUMANITIES AND LAW**

DEPARTMENT OF ASSAMESE

Prof. Nirajana Mahanta Bezborah

Published Books:

1. Title: Sonajurir Kathakata.

Publisher: Naksa Books, Dibrugarh.

ISBN: 978-81-939447-2-1.

Brief note about the book: A novel on the changes as well as the challenges of the rural Assamese life during 60s and 70s of the last century.

2. Title: Konobai To...

Author: Bishnu Prabhakar (Hindi).

Translator: Nirajana Mahanta Bezborah.

Publisher: Naksha Books, Dibrugarh,

ISBN: 978-93-5445-192-8.

Brief note about the book: A translated novel on multiple social issues of Indian life in the mid-20th century.

3. Title : Byaktitwa, Sukumar Kaushal Aru Yogayog.

Publisher: Assam Book Trust, Guwahati.

ISBN: 978-93-89196-40-5.

Brief note about the book: A Book on Personality development, soft skills and general as well as literary communication.

Prof. Pallavi Deka Buzarboruah

Published Books:

1. **Title:** Tulanamulak Sahitya aaru Paridheeya Kshetra.

Editor: Prof. Pallavi Deka Buzarboruah.

Publisher: All Dhemaji District Student's Union, 2021.

ISBN: 978-81-94.

2. **Title:** Gabeshana Padhwatibijyan.

Editor: Prof. Pallavi Deka Buzarboruah.

Publisher: Banlata, Dibrugarh-1, 2nd edition

ISBN: 93-82056-42-3.

Prof. Satyakam Borthakur

Journal Papers:

1. **Title:** Monosa kobi Monkoror porichoy aru pratibhar punar bislekhon.

Journal Name: ANVIKSHA (a bilingual refereed journal of language, literature and culture).

Publisher: Registrar , Dibrugarh University, ISSN

ISSN: 2348-067X

Dr. Darpanjit Konwar

Published Books :

1. **Title :** Sahitya: Dristikon Aru Bichar.

Editor: Dr. Pranjit Bora, Dr. Darpanjit Konwar (Associate Editor).

Publisher: Department of Assamese, Dibrugarh University.

ISBN: 978-81-947995-9-7 .

Brief note about the book: A collection of articles on literary theory and criticism.

DEPARTMENT OF ENGLISH

1. Dr. Lakhipriya Gogoi

Journal Papers

- “Domesticity and Everyday Life of Women in Late Colonial Assam: A Reading of Two Women’s Autobiographical Narratives”, *The Mirror* Vol VII.

Abstract:- The paper studies the representation of the domestic and everyday life of women in late colonial Assam in two women’s autobiographies from Assam *Tinikuri Dah Basarar Smriti* by Rajabala Das and *Eri Aha Dinbor* by Nalinibala Devi. Domesticity and everyday life have always contested zones in studying the community of women across the globe. The patriarchal projection of women as subjects of home and the structuring of their familial duties have been debated at large. It is much more interesting when women themselves offer images of these sites as participants and at times as resisting agents. The texts chosen for study conform to such a picture where the speakers besides providing a glimpse of the collective everyday life of women in late colonial Assam argue that access to education have brought a drastic change to the practice of these sites

Published Book Chapters

- “Teaching Postcoloniality Through *The Grass is Singing*”, pp. 153-169, *English Teachers’ Accounts: Essays on the Teacher, the Text and the Indian Classroom*. Edited by Nandana Dutta, Routledge London and New York, 978-0-367-61056-2.
- “A Study of Selected Women’s Autobiography from Assam as Explorations of the Domestic and Everyday Life”, pp. 45-63, *Interface: Language, Ecology and Gender in Northeast India*. Edited by Sabreen Ahmed, Exceller Books, 978-93-90746-25-5.

2. Dr. Lakshminath Kagyung

Journal Papers

- “Rhetoric and the Art of Persuasion: A Study of Power Politics in Chinua Achebe’s *Arrow of God* and *A Man of the People*” in UGC-CARE listed journal “Drishti: the Sight”, Volume X, Issue I, (May, 2021 – October, 2021), pp. 103-106, ISSN 2319-8281.

Abstract:- Rhetoric is the art of using language for persuasive/ effective speaking or writing. Persuasion may be defined as the process of convincing or influencing someone to believe or do something. And power politics may be understood as political action by a group or an individual to consolidate their influence and power. It is the general conception that one who has rhetorical skills has the edge over those who lack it in the politics of power. This paper would attempt to examine the validity of such a proposition. Chinua Achebe’s novels *Arrow of God* and *A Man of the People* would be studied to analyse the relationship that exists between rhetoric and power politics. The paper argues that rhetoric and the art of persuasion provide an advantageous position to an individual or group in the politics of power; however, they alone are not sufficient tools to retain or subvert the power equation. The methodology used in the paper involves a critical reading of the two novels, *Arrow of God* and *A Man of the People*. African indigenous ideas on rhetoric and power, and Foucault’s ideas on discourse and power would be taken as the theoretical frame of references to study the proposed theme of research. Also, Althusser’s idea of State Apparatuses shall be instrumental in analysing the subject of study.

Keywords: Rhetoric, persuasion, power-politics, power, discourse, state apparatuses.

- “Striking a Balance between the Male and the Female Principles: A Reading of Achebe’s *Things Fall Apart* and *Anthills of the Savannah*” in UGC-CARE listed journal *DUJES* (Dibrugarh University Journal of English Studies), Volume 29, June 2021 Issue, pp. 518-527, ISSN (Online) 2581-7833/ ISSN (Print) 0975-5659. *DUJES* is the annual journal of the Department of English, Dibrugarh University, Dibrugarh-786004, Assam.

Abstract:- Through a reading of Achebe's *Things Fall Apart* (1958) and *Anthills of the Savannah* (1987), this paper attempts to examine the Igbo society's attitude towards gender relations. The paper would study the gender stereotypes and the existing hierarchy in the Igbo society to assess the position of the Igbo women. An attempt is made to examine the provisions for checks and balances of power in the traditional Igbo society to see how it affects the genders. The paper would discuss the changes that have come to Igbo society's attitude towards gender relations by tracing the trajectory from *Things Fall Apart* to *Anthills of the Savannah*. Finally, an attempt would be made to examine the representation of women in Achebe's novels. The paper emphasises the importance of maintaining a balance between the male and the female principles and posits that the inability to maintain a balance between the two principles led to the tragedy/ downfall of Okonkwo in *Things Fall Apart*. The traditional Igbo society depicted in *Things Fall Apart* is overtly androcentric; however, the paper contends that society designed its norms and systems to balance the male and the female principles. Okonkwo could not appreciate and comprehend the balance of his culture, and that led to his downfall. The paper argues that Achebe understands and realises the importance of the balance between the male and the female principles for the proper functioning and development of the Igbo society and that he is not gendered/ biased in his representation of women characters in his novels. The methodology used in the paper involves a close reading of the primary texts using African indigenous ideas on power and gender relations as the theoretical frame of references. The paper would also take recourse to Buchi Emecheta's ideas on gender relations for a clearer understanding of the subject of research.

Keywords : Gender-relations, gender-stereotypes, hierarchy, power, androcentric and representation.

3. Deeptangshu Das

Awards and Recognition

- Awarded Doctoral Fellowship by the University of Denver (Colorado, USA) to pursue Ph.D in the Department of Religious Studies, w.e.f 1 Sep 2021.
- Serving as Research Center Assistant at the Anderson Academic Commons (University of Denver Library) to facilitate learning and research w.e.f 15 Sep 2021.

4. Dr. Basil N. Darlong Diengdoh

Published Book Chapters

- “The Socio-Cultural Underpinnings of Democracy in the Khasi Hills of Meghalaya: Reframing the Past to Understand the Present” in *Communities, Institutions and Histories of India’s Northeast*, edited by Charisma K. Lepcha and Uttam Lal, pp. 205–221, Routledge; ISBN: 9781032158389 (hbk) ISBN: 9781003245865 (ebk); DOI: 10.4324/9781003245865.

CENTRE FOR STUDIES IN PHILOSOPHY

1. Dr. Kirtinath Kalita

Published Articles

- “B. R. Ambedkar: Examining the Philosophy of Hinduism”, pp. 112 – 120, *Darshanam*, ISBN: 978-93-84048-20-4.

2. Manashree Chetia

Published Book Chapters

“Chapter Title: Philosophy of Sankaradeva’s Neo-Vaisnavism: A Philosophical Enquiry ” in *Literature, Culture and Society: Multidisciplinary Perspectives* edited by Abul Foyes Md Malik and Dipak Kumar Doley, pp. 391 to 403, ISBN: 978-81-950935-5-7.

CENTRE FOR JURIDICAL STUDIES

Dr Aparajita Dutta

Journal Papers

- “Rights of Women Prisoners in India”, B. Aadhar Peer-Reviewed Refereed & Indexed Multidisciplinary International Research Journal, Issue No-(CCLXVI) 276 (G) Women’s Empowerment Issues and Challenges, ISSN No-2278-9308, March 2021.

Abstract:- The Constitution of India gives the status of equality to the women in India in every facet of life. The duty of the State is to protect the rights of the women and to fulfil the requirements of all international conventions regarding the rights and dignity of the women. In spite of presence of laws women in prisons are facing lots of problem even the basic human rights are being overlooked. It creates hitches to them in the prison which entails special consideration and it is becoming a need of the hour. The foremost purpose of this research paper is to highpoint the problems of the women prisoners, the cause of defilement of the human rights of the women prisoners, and to suggest the necessary changes in the present law.

Keywords:- Dignified life, Women prisoner, Prisons, Human Rights and Custodial torture.

- “Dr. Babasaheb Ambedkar an Architect of India”, *Aayushi International Interdisciplinary Research Journal*, Dr. Babasaheb Ambedkar an Architect of India, Special issue No 84 volume no I ISSN:2349-638X, April 2021, pp. 7-11.

Abstract:- The Constitution of India is a dynamic document. It grows with the growth of the society and should ensemble the changing needs of the dynamic society . Dr. B. R. Ambedkar was an architect of the Constitution of India. His perception of social justice stands for liberty, equality and fraternity of all human beings. He stood for a social

system that is based on accurate relations between members of the society. He strappingly believed that political independence cannot initiate either social harmony or national amalgamation in the absence of social justice and individual dignity. Being a democratic socialist, he proliferated that fundamental rights have little meaning to people in the absence of social democracy in society. The main focus of this research paper is to analyze the contribution and involvement of Dr. Baba Saheb Ambedkar in making of the Constitution of India.

Keywords:- Dignified life, Dr. B. R. Ambedkar, societal restructuring.

- “Dr Babasaheb Ambedkar & Untouchability”, Dr Aparajita Dutta, Ayesha Khatun, *Aayushi International Interdisciplinary Research Journal*, Dr. Babasaheb Ambedkar an Architect of India, Special issue No 84 volume no I ISSN:2349-638X, April 2021, pp. 452-457.

Abstract:- Untouchability is a curse to the social fabric of secular India. It is not merely the inability to touch a human being of a certain caste or sub-caste, rather it is an attitude of a part of people of the whole society that reflects a deeper psychological process of thought and belief which is invisible to the naked eye, transformed into various physical acts, behaviours and practices. Babasaheb Dr. Ambedkar devoted his entire life in uplifting the exploited. He was the first man who demanded for the treatment of the man as the man. He himself had been the part of the society who got ill-treated at every step and stage. He made several provisions in the Constitution for the upliftment of the Dalits. He was the principal architect of the Indian Constitution. This Paper will analyse his contributions against Untouchability.

- “Major Problems of Older Women in India: An Analysis”, Dr Aparajita Dutta, Anthony Toppo, B. Aadhar Peer-Reviewed Refereed & Indexed Multidisciplinary International Research Journal, Issue No-(CCXCL)291(G) Women’s Empowerment Issues and Challenges, ISSN No-2278-9308, April 2021.

Abstract:- Dignity is associated with human life. Ageing in humans denotes a multidimensional process of bodily, spiritual, and societal transformation. Law is trying to protect women and children in a very effective way. The population of older persons

is becoming a great concern of lawmakers of every civilized country of the world. The unadorned realism of the ageing situation in India is that there are more than 77 million older people in India nowadays, and the number is increasing day by day. It is a bitter truth that both older men and women face discernment, but the difficulties faced by older women are basically diverse from those of older men. The prime concern of this research paper is to categorize the problems faced by older women in India, the challenges confronted by the older people and to suggest some ways to create awareness to older women regarding human rights. This paper will also emphasized the strategies and ideas to happenstance the future situation of the aged population.

Keywords: Older women, human rights, problems of old age, strategy

Published Books

- *Juvenile Justice System in India*, University Book House (P) Ltd., ISBN 178-81-946448-2-8, First Edition 2021.

FACULTY OF EDUCATION

Papers Published in Journals:

- Mitali Sonowal and Mun Kalita, 'Construction and standardization of metacognitive awareness scale (MAS)' in *HUMANITIES AND SOCIAL SCIENCE STUDIES*, ISSN: 2319829X , Vol. 10 (1), 2021.

Abstract: The current study attempts to construct and standardize a Metacognitive Awareness Scale (MAS) for Under Graduate Students. The Metacognitive Awareness Scale (MAS) consisted of 54 items, ranging from ' Strongly agree' to 'Strongly Disagree', covering two dimensions (1) Knowledge about Cognition: (Declarative, Procedural and Conditional Knowledge), (2) Control and Regulation of Cognition: (Planning strategies, Information strategies, Monitoring Strategies, Evaluation Strategies, Volitional Control, and Debugging Strategies). The investigator constructed the scale in two languages, i.e., in English and Assamese language. The reliabilities of the scale are: ($r = 0.80$) and Cronbach's alpha ($\alpha = 0.94$). The reliabilities of the Assamese version of the scale are ($r = 0.76$) and Cronbach's alpha ($\alpha = 0.93$). To determine the validity of the Metacognitive Awareness Scale, the investigator showed the Metacognitive Awareness Scale to several experts i.e., 12 members of the Doctoral Research Committee of the Department of Education, Dibrugarh University, Assam, for seeking judgment regarding the constructs' coverage. Moreover, concurrent validity is also found out by comparing the Metacognitive Awareness Scale (MAS) with Metacognitive Awareness Inventory (MAI) developed and standardized by Schraw and Dennison (1994). Therefore, the coefficient of validity of the English version of the scale is 0.61. Hence, the investigator as a part of doctoral research study, constructed and standardized a Metacognitive Awareness Scale (MAS) for Under Graduate Students.

Published Book Chapter:

- Shrutidhara Mahanta, Open Higher Education in Assam: Prospects and Challenges, In *Open Higher Education in the 21st Century*, eds. Ritimoni Bordoloi & Prasenjit Das, Publisher: Nova Science Publishers, Inc. NEW YORK
ISBN: ISBN:978-1-53619-644-3. Pages: 313-338.,

Abstract: Open and Distance Learning (ODL) has received attention from the educational and other stakeholders like never before. In this chapter, an attempt is made to provide a short overview of the prospects and challenges of open higher education in an Indian state like Assam, which is geographically very remote, compared to many developed states of India. In order to do so, some important functional aspects of the ODL institutions of Assam namely—KKHSOU, GUIDOL, DODL, DU and CDOE, TU are taken into account. The findings of the study indicate that compared to the single mode or full-fledged open universities, the dual mode universities face more challenges. Another important finding is that even though the regulatory agency for ODL in India i.e., DEB, UGC has taken timely measures to ensure and maintain quality of the Indian ODL system as a whole, there emerges certain laps between the regulatory agency and the ODL institutions. This in a way defeats the very purpose of establishing an ODL institution in the country. The findings of this study will provide important insights to the stakeholders of open higher education to take up relevant steps with regard to the policy implementations of ODL in India as well as in a state like Assam.

