**DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE (DMACS),
SRI SATHYA SAI INSTITUTE OF HIGHER LEARNING (SSSIHL)
AND
CENTER FOR COLLABORATIVE STUDIES IN MATHEMATICAL BIOLOGY(CCSMB),
ILLINOIS STATE UNIVERSITY(ISU)**

INDO-US CONFERENCE - II
ON
THE SCIENCE OF MATHEMATICAL MODELING, AND DECISION-MAKING:

A CHANGING TRAJECTORY INTO THE FUTURE, FROM PAST TO POST COVID-19 PANDEMIC

- **FOCUS — TO DISCUSS THE CHALLENGES AND OPPORTUNITIES IN MATHEMATICAL MODELING MOVING FORWARD POST COVID-19 PANDEMIC.**

Dates OCTOBER 28th - 30th, 2021

CONFERENCE REPORT

Purpose

This Indo-US workshop/conference series was started in 2018 with support from SSSIHL, India and NSF, USA.

(https://www.facebook.com/600836523399696/posts/1162532183896791/) (https://www.nsf.gov/awardsearch/showAward?AWD_ID=1840884).

The main focus of this conference is to discuss challenges and opportunities in mathematical modeling moving forward Post COVID-19 Pandemic. The participants are expected to actively interact with leading scientists from the USA and India and will get to know how the science of mathematical modeling and decision-making has been transformed due to the unprecedented COVID-19 crisis from educational challenges and science communications to professional opportunities.

Day 1 – 28 October, 2021

The three-day **Indo-US conference - II on The Science of Mathematical Modeling and Decision Making: A Changing Trajectory into The Future, From Past to Post COVID-19 Pandemic** commenced on 29, October 2021, with the lighting the lamp session by Dr. K S Sreedharan, Dr. Pallav Kumar Baruah and Dr. B. V. K. Bharadwaj from the Department of Mathematics and Computer Science (DMACS), Sri Sathya Sai Institute of Higher Learning (SSSIHL) which was followed by Vedam chanting.

Dr. Krishna Kiran Vamsi Dasu, Assistant Professor, DMACS, SSSIHL, **Convenor** for the Indo-US conference – II, then presented the welcome remarks in which he emphasized on the purpose of research and the view that the founder chancellor Bhagawan Sri Sathya Sai Baba had about research – research must be of practical use and must promote well-being. It must not be done merely to gain name and fame in the academic circles. Dr Vamsi then remarked that interdisciplinary research is the guiding force for all the research that is done at SSSIHL.

Dr. Anuj Mubayi, Associate Director, Advanced Modeling Group, PRECISIONheor, **Co-Convenor** for the Indo-US conference – II, then set the goals of the conference which were - discussing the challenges associated with existing modeling, data collection and forecasting techniques and the shifting trends in opportunities for new generation of scientists post COVID-19. He also delved upon the evolution of mathematical modeling where he talked about the focus on data collection and emphasis of measurement errors and also incorporating aspects of cost constraints (health economics) and impact of human behaviour into models.

Dr. C B Sanjeevi

Dr. Carani Sanjeevi, Honourable Vice Chancellor, Sri Sathya Sai Institute of Higher Learning, in his inaugural address tried to answer some of the fundamental questions regarding COVID – 19 such as **can vaccines end COVID-19 pandemic? Is a single vaccine enough? Is combined vaccine effective than the standalone vaccines? Will a 3rd dose be required?** In addition, he also compared the efficacy of vaccines and explained the rationale behind taking two vaccine doses. He also elaborated on the activities and research that is done in the university.

Prof. Gautam Menon | Ashoka University

Dr. Gautam Menon, a Professor of Physics and Biology at Ashoka University, Haryana gave a keynote address on the title **Models for COVID – 19: What they can (cannot) do** in which he detailed the work being undertaken at the Ashoka University in modeling the epidemic Covid 19 in India. After a statistical look into the effect of the pandemic in India, he discussed a complex epidemiological model called the SIR model which is a good estimate of the actual statistics of the infected reproductive population in the 1st wave of the pandemic.With a background of the effects of the rising 2nd wave, he gave a detailed outlook of the importance of Vaccination Protocols wherein two different Optimal testing strategies namely RAT (Rapid Antigen test) and RT-PCR were discussed in specific. While addressing the future of Disease modeling, he introduced BHARATSIM, an Agent-based model proposed to give an overall idea about the possible trends of the pandemic in the future given the precautions and restrictions in force. As a concluding note, although there might be a predicted less possibility of the 3rd wave, if the ongoing restrictions aren't efficient enough, this probability might increase.

Sudha Seshayyan

The plenary address was given by **Dr. Sudha Seshayyan**, Vice-Chancellor, Tamil Nadu Dr. MGR Medical University, Chennai, on the topic **Progressive Significance of Projection Studies**. She started the talk by revisiting the basics of Mathematical epidemiology and how more and more intuition has happened in the field. She went on to describe the term projection and added that with the advancements in mathematical epidemiology and related fields it's been easier to study the transmission dynamics of COVID-19 as compared to the pandemics of the past like the Influenza. She spent some time discussing the history and evolution of forecasting, modeling, and projections. Names of eminent contributors like John Graunt, Daniel Bernoulli, Sir Ronald Ross, and Hilda Hudson were mentioned. Special importance was given to the works of Kermack and Mckendrick and their SIR model (Susceptible, Infected and Removed). Another model that was discussed briefly was the Reed-Frost model that spoke of infection rate by generations. Other discussed models included the SIS model, SIRD model, MSEIR model, and so on. A few variability factors were mentioned after this.She went on to say why epidemic forecasting will become tougher in the future and also why it is getting better with time. Reasons why epidemic forecasting and predictive models will become more significant, were also mentioned. She ended her talk by advising those who are involved in modeling to include a variety of factors, out of her own experience from studies, for accurate results.

Dr. Srinivas, Dr.MGR Medical University

Dr. G. Srinivas, Professor and Head, Dept. of Epidemiology, The Tamil Nadu Dr M. G. R Medical University, delivered a keynote address on **India's Response to the Current Pandemic (COVID-19) and Miniature experience of The TN Dr. M. G. R Medical University in Forecasting the COVID-19 Outbreak through SIRD Modelling**. His talk consisted of a detailed account of the sequential phases of the spread and mitigation of different epidemics, focusing on the COVID-19 pandemic and India's efforts in comparison with other countries to minimize nation-wide and world-wide damage. He spoke about the SIS and SIR models and discussed the main factors that influence the R-naught value of a contagious disease. Then, he displayed COVID-19 case data across several months in Chennai and explained the general dynamics of the R_0 value. He then discussed projections made based on that data using an SIRD model and spoke about measures that must be implemented to retain herd immunity. He concluded on a positive note that the pandemic above all was a learning experience.

The afternoon session started with a keynote address (from India) by **Dr. Dharmendra Tripathi,** Associate Professor in Department of Mathematics, NIT Uttarakhand on the topic **Virus Transport in Fluid Medium: Mathematical Modelling**. The presentation included a detailed explanation of how airborne transmission of respiratory viruses takes place along with other transmission routes. A schematic representation of the progression of the infection and potential adjuvant interventions was also covered. The transportation of viruses in fluid flow was explained using a mathematical model. He concluded with the observation that further research was indeed required to focus on including the biological aspects of viruses,study the rheological effects on transmission of viruses within a non-Newtonian background flow, and the thermal effects on the transmission of viruses.

Following which was a paper presentation session chaired by **Dr BSRV Prasad, Vellore Institute of Technology, Vellore,** which included the following presentations:

Presenter	Title of the topic
Mr. Joseph John Fernandes, University of Mumbai, Maharashtra	Classroom Tenacious Pyrotechnics Empowers Creative Divyangjan transformation to Genius Divya + jan in this Pandemic
Ms.Monalisa Anand, BITS-Pilani, Goa	Modelling Perspective on Diabetes Mellitus with Tuberculosis
Mr. Karthik A, BITS-Pilani, Hyderabad	A Mathematical Model for Blood Flow Accounting for Haematological Disorders
Mr. M U Jayanth Sastri, AMET University, Chennai	Triangular Fuzzy Numbers and its Applications in COVID-19 Pandemic

Subhas Khajanchi

Dr. Subhas Khajanchi, Assistant Professor in the Department of Mathematics, Presidency University, Kolkata, then gave a keynote address on the topic **How A Simple Mathematical Model Encapsulates The Dynamics Of Infectious Diseases**. The presentation given by Dr Subhas helped the participants to understand how mathematical models can help us to analyse and predict outbreaks. Moreover, it familiarized the participants with terms such as R_o, "Flatten the Curve", etc. and how we can use models to design public health policy.

The evening session began with the keynote address by **Dr. Olcay Akman**, professor of mathematics at Illinois State University, Normal, titled **On the parameter estimation in Compartmental Models Under Frailty.** The talk aimed at emphasising that heterogeneity is an important variable to be taken into account for the interpretation of epidemic data and how such inclusion can help in a systematic understanding of the population's makeup and its effect on the spread of infection. Dr Akman started his talk with one of the drawbacks of the classical SIR model wherein the entire population is assumed to be homogenous and as a result, we have constant parameter values. However, this does not represent reality as the parameters are subject to unobserved heterogeneity that interact with the frailty of the subjects. Frailty in simple terms can be understood as a random factor(unobserved) that modifies multiplicatively the hazard function of an individual or a group of individuals.

In the next part of his talk, Dr. Akman explained frailty using the SEIR model by dividing the population into two classes of susceptibles, as a result of which we would have two different infection rates and two different recovery rates and remarked that frailty is implemented in the model as a multiplicative coefficient. In addition, with an example, it was explained that if heterogeneity is not taken into account, then in the aggregate the hazard rate may appear to decline even if group-specific hazards are flat.

Guowei Wei

The second keynote address of the evening was delivered by **Dr. Guo-Wei Wei**, a Michigan State University Foundation Professor. His talk was on **Forecasting vaccine breakthrough SARS-CoV-2 variants.** Prof. Wei started off by showing the complex process of the SARS-Cov -2 virus and highlighted the importance of identifying the importance of picking out that one crucial step in this complex cycle from where progress could be made. He then spoke on what governs the trans-evolution of the virus and also showed the Genome-Math-AI experimental modelling of protein-protein binding affinity changes following mutations. He concluded by showcasing how he along with his team were able to come up with natural selection as a mechanism governing CoV-2 evolution and being able to predict the existing RBD mutations using algebraic topology and deep learning.

Edwin Michael

The next speaker was **Dr. Edwin Michael**, Professor, Public Health, University of South Florida. speaking on the topic **Forecasting the future paths of COVID-19 pandemic using adaptive data-driven simulation.** He started his talk by emphasizing on the point that we need to develop models that are agile and account for heterogeneity in the system with available data. He then showed a model in which new components could be added with the evolution of the system (in this case, the pandemic). He explained various aspects of his model such as mobility data, vaccination data and Continuous Integration which automatically checks for new data and processes it to be inputted into the model. He discussed the different paths the pandemic can take: one is that if the current social measures and vaccination were to continue and immunity is long term, the number of cases will drop and the pandemic will eventually fade away (since herd immunity will be achieved very soon, according to his model). He also mentioned that herd immunity is important to know the different paths the pandemic can take. Second is the case where the natural and vaccine-conferred immunity wanes away: resurgence of waves will take place. Third case is when there are more transmissible new variants. The solution for the second and third cases is booster doses as booster doses suppress new waves. He concluded his talk with a summary of his presentation and a few questions.

Lance Waller

The final talk of the day was an interesting keynote address on **Using what you have: Infectious disease surveillance with limited data and time** by **Dr. Lance A. Waller**, Professor, Department of Biostatistics and Bioinformatics, Emory University, Atlanta. He approached the concept of Public Health Surveillance through a comprehensive set of questions and constraints and went on to explain the concepts of sensitivity, specificity and prevalence using a simple Bayes' theorem homework problem and illustrative diagrams. He concluded by briefly discussing key points to good testing of infectious diseases.

Day 2 – 29 October, 2021

The second day started with an enlightening **Research Musings Session(with Reference to COVID-19)** by **Dr. Krishna Kiran Vamsi Dasu**, Asst. Professor, and **Ananth V S**, Doctoral Research Scholar, Dept. of Mathematics and Computer Science, SSSIHL.

Dr. D. K. K. Vamsi, SSSIHL

Dr. Vamsi spoke about the **Modelling studies undertaken by the SSSIHL focusing on the COVID-19 Pandemic**. He introduced the parameters and equations involved to model the within-host dynamics of the virus by describing its pathogenesis in detail. Then, using data (peak viremia and fraction of uninfected cells) from literature he validated the system of equations. He then proved the existence and uniqueness of the model as the solution of the system of equations. He concluded his talk after performing stability analysis of the model by varying specific parameters and measuring changes in the system.

Sri Ananth V S,SSSIHL

Mr. Ananth V S spoke on the **Optimal Control Studies at Within-Host level on COVID-19**. He introduced drug intervention parameters into the same system of equations used before and proved the existence of an optimal control solution. He then illustrated numerical simulations using that solution to observe viral load and infected cells after which he concluded by discussing an optimal drug regimen for the disease**.**

Sri Bishal Chhetri, SSSIHL

Mr. Bishal Chhetri, Doctoral Research Scholars, DMACS, SSSIHL gave a talk on **Time Optimal Control Studies for Within Host Dynamics and Role of Vaccination at Population Level.** His work focused on formulating an optimal control problem to obtain optimal vaccination and treatment strategies that minimise infection also being cost effective, keeping different age groups in mind. The major conclusions obtained were COVID -19 could be cured in finite minimal time,with optimal adjustment of dosage of antiviral and second line drugs minimising adverse effects of drugs. One of the major conclusions was that vaccination alone is insufficient in controlling the spread of COVID -19.

Sri D Bhanu Prakash,SSSIHL

Mr. Bhanu Prakash D, Doctoral Research Scholars, DMACS, SSSIHL gave a talk on **Multiscale Modelling Study of COVID – 19.** His work was motivated to evaluate the effectiveness and value of health interventions for such pandemic situations. Multiscale Models synthesize information from at least two scales, it would be a handy tool for health intervention research. Major conclusions were that the stability of the multiscale model depends on the amount of viral load in infected. The study suggests that in case of resource limitation social distancing would be effective.

Dr. N Uday Kiran, SSSIHL

The next talk was by **Dr. N Uday Kiran**, Associate Professor in the Department of Mathematics and Computer Science, Sri Sathya Sai Institute of Higher Learning. **The talk aimed to acquaint the participants with the Department of Mathematics and Computer Science (DMACS).** During the talk, Dr Uday Kiran gave an overview of diverse research interests of the department which include AI, ML, DL, disease modelling, high-performance computing, computer vision, information security, risk management. He then spoke about the genesis of the department and how the founder chancellor Bhagawan Sri Sathya Sai Baba took a special interest in the department. He then covered various aspects of the department including teaching methodology, extension activities in the villages, the achievements of the faculty and alumni, various collaborators, adjunct professors and MoU's signed by the department with various organisations such as Grey Scientific Labs, CodeTantra, Yousee.com, Maestro, to drive the research goals.
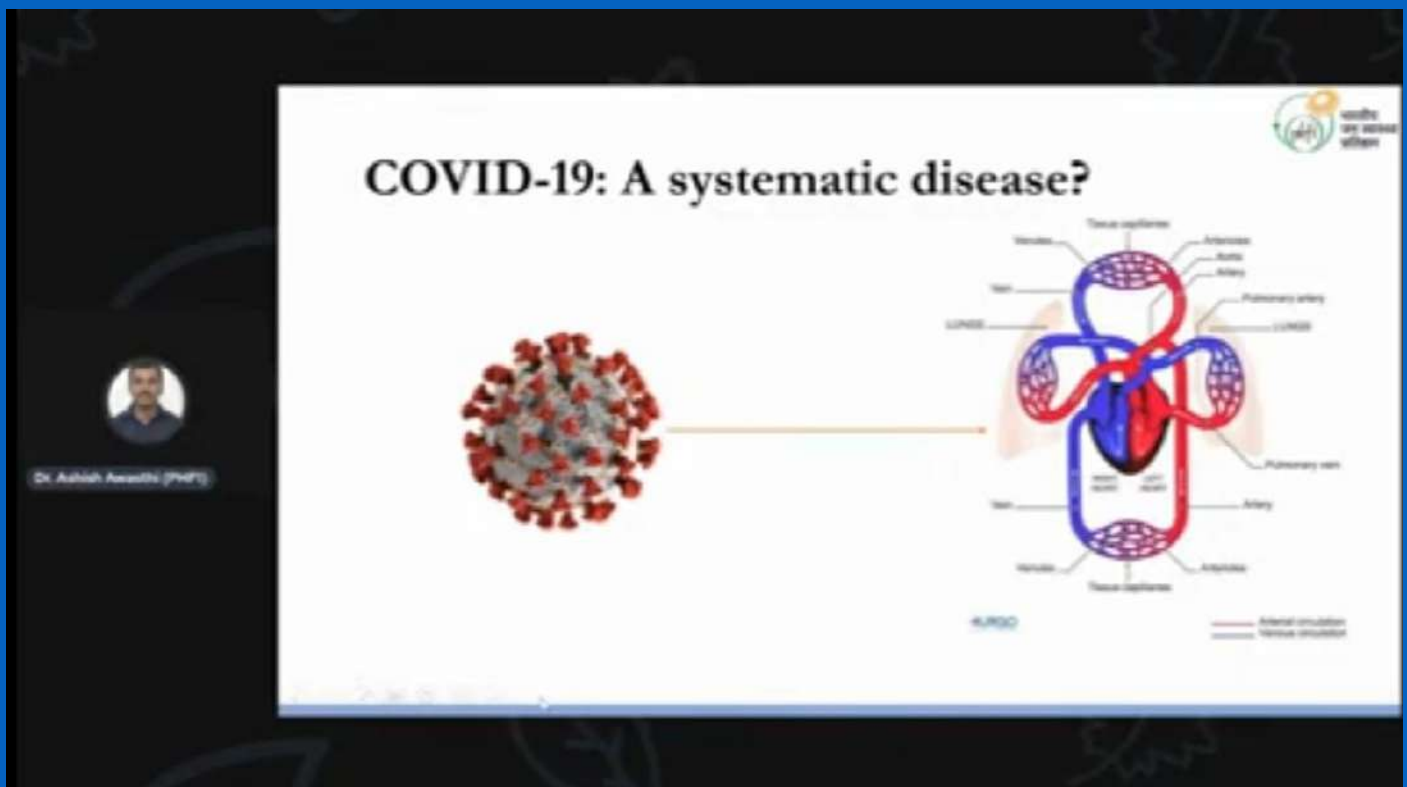
The post lunch session of Day-2 started off with a keynote address by **Dr. Ashish Awasti**, Assistant Professor (INSPIRE faculty). The talk was on **cardiovascular risk prediction from a cross-sectional survey in India and its importance in COVID-19 modelling.** Emphasised on starting off with the right assumptions before preparing the model. Dr. Ashish then spoke on how cardiovascular disease is the major cause of mortality in the country and how it differed from state to state, rural and urban and even based on individual lifestyle. He concluded by saying how cardiovascular disease and its associated factors affected the outcome of COVID-19 in various ways.

Jai Prakash Tripathi

Then, **Dr. Jai Prakash Tripathi**, Assistant Professor, Dept. of Mathematics, Central University of Rajasthan, gave a keynote address on **An Epidemic Model using Non-pharmaceutical Interventions (NPIs)**. He spoke on the assessment of NPIs in reducing the COVID-19 pandemic in India and predicting its course with various combinations of NPIs. He went on to explain a modified SEIQR epidemic model using compartments to categorize population and derive several mathematical results to illustrate the need for control measures such as lockdown and quarantine. He concluded his talk by illustrating different graphs to test the model.

The evening session started with a Panel discussion titled **The Hard Lessons from modeling COVID-19 Dynamics & Health Policies** which was moderated by **Dr. Anuj Mubayi** and **Dr. B V K Bharadwaj**, SSSIHL, Andhra Pradesh. After the introduction of the moderators, the session witnessed a five-minute talk from each of the panellists followed by a Question-and-Answer session. Each of the panel members, from diverse backgrounds, discussed briefly the work being carried out in their respective institutions. A brief overview of the presentations is given below:

1) **Dr. Ravishankar, Chief Scientist at CDRI**
At CDRI, successful clinical trials of the antiviral drug Umifenovir were achieved and the process technology was transferred to the industry.

2) **Dr. Kavita Kachroo, Dept of Health Economics and Outcomes Research division, KIHT**
Innovations like I Lab, O2 Home, Safe Zone, Low-cost portable ventilator, and Oxy Wheel helped in providing vital health needs and awareness at the doorstep of the needy even in remote places all over the nation.

3) **Dr. Brain Wahl, Epidemiologist, John Hopkins University**
Research in formulating vaccination strategies, testing the effectiveness of both the doses of vaccine and making key decisions in reopening of schools given the pandemic situation in different districts of the nation.

4) Dr. Jianhong Wu, York University, Toronto

Mainly works on using dynamic models and bifurcation analysis to conduct scenario analysis and researches to inform stochastic optimization resources and outcomes. Forecasting of epidemic trends for different levels of government like the Federal Government of Canada. Their new focus includes the integration of neural networks and dynamic models so that model parameters can be estimated in real-time.

5) Mac Hymann

A lot of interesting points came up in the Q and A session. The question about which model is to be chosen by the policymakers given that there are a lot of models with conflicting predictions was answered by Dr. MacHyman, Tulane University, USA.

The key points of the answer were that decision-makers must relate the forecast to the underlying assumptions of the model and there must not be any efforts to oversell the model. Dr. Jianhong Wu answered the same question and the key points that he made were that the validation of the model was also necessary and not just the prediction but also what data to pick is also to be known.

The next question that was posed to Dr. Kavita Kachroo was whether there are models that link behavioural change to the lifetime value of the treatment or if not, then how can previous models be used to incorporate this behavioural component. The main points of the answer were that due to illiteracy in India and other causes there is a lot of missing data and there is also a lot of fieldwork that is necessary so it is really difficult to find a model that can be applied on the ground. Prof Ravishankar replied to the question about delivering solutions amidst the loss of information and hidden information in the field by saying

that the overall tendency is a little more relaxed when long-term effects are compared to saving lives immediately. But, the deliverance of solutions is impacted by heterogeneity in terms of behaviour, political or geographical divide, and so on.

Quite naturally, the discussion shifted to understanding the importance of heterogeneity. Dr. Brian said in this regard that there is heterogeneity within models and heterogeneity of models themselves and thus there is a need for an ensemble model.

The concluding remarks from each of the members after the discussion were very insightful. A few of them are:

- It was important to strengthen the data collection process and make data available in real-time.
- We must not only be prepared with the tools but must also be aware of where to use them.
- Digitization will definitely help in making data available in real-time
- It is also necessary to build a repository of Indian Indigenous data.
- Sharing models is also necessary for the community for their betterment.
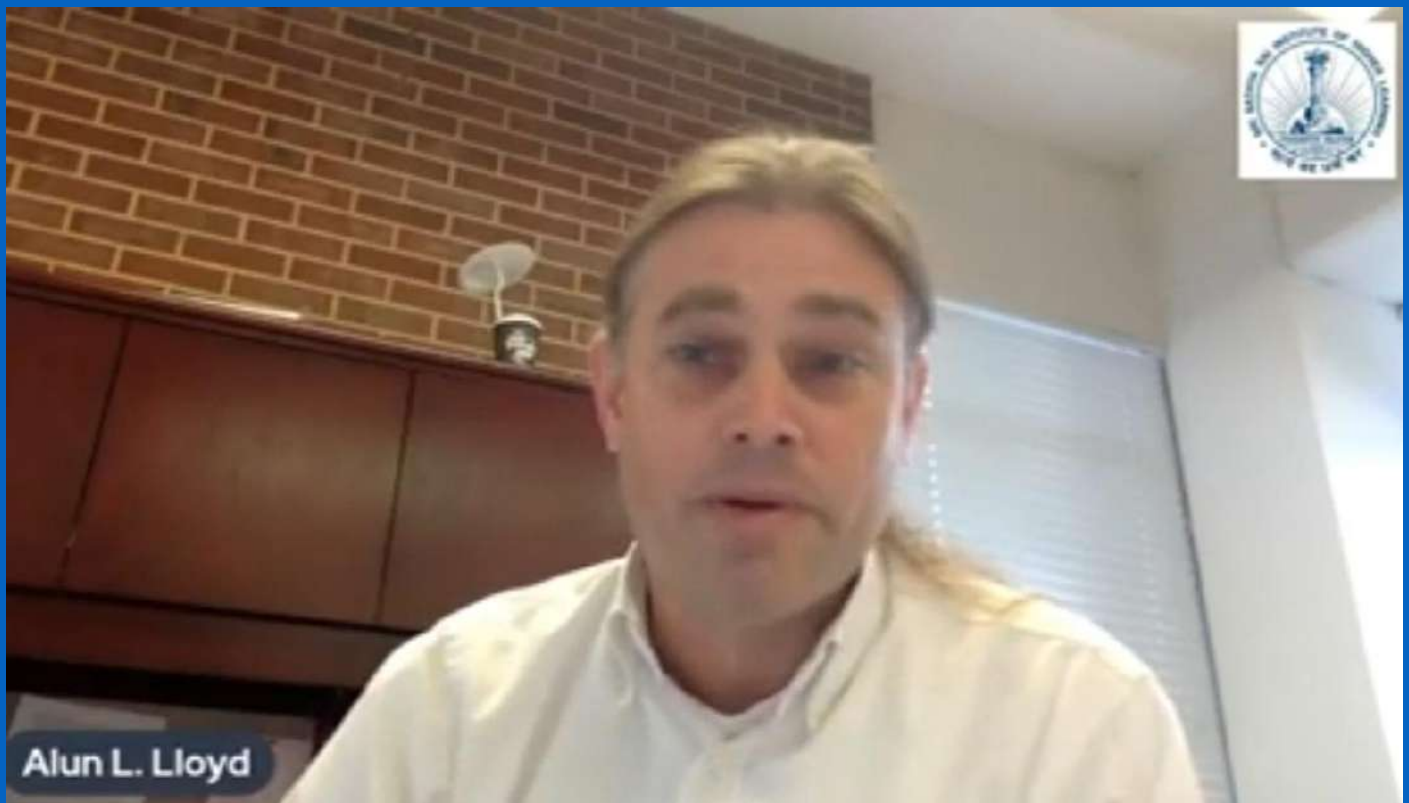
Alun L. Lloyd

The final presentation of the day was by **Dr. Alun Lloyd**, a keynote address (from USA). Dr. Alun Lloyd is a Drexel Professor of Mathematics and Director of the Biomathematics Graduate Program at North Carolina State University. The title of his talk was **Contact Tracing for Controlling COVID-19 Outbreaks**. He started with an introduction to Forward Contact Tracing (Standard Approach) and raised the question of whether digital approaches can be incorporated or not. The proposal made by him was of Bidirectional Contact Tracing and a branching-process model of it was produced. The importance of Heterogeneity in contacts was also covered. The presentation concluded with the observations that Digital approaches are not a silver bullet unless there is near-universal adoption and use and a bidirectional approach can greatly increase the effectiveness of contact tracing.

Day 3 – 30 October, 2021

Dr. Sudipa Chauhan, Assistant Professor at Amity Institute of Applied Sciences, spoke on **Mathematical Modelling of a few aspects in Economy.** She elaborated on the Investment Saving-Liquidity Preference Money Supply Model explaining the IS and LM curves in detail. She went on to explain the effect of COVID pandemic on the World Economy. She concluded by discussing the impact COVID had on Aggregate Demand and GDP.

Sri Satya Sai Baba Mudigonda,SSSIHL

The next speaker, Mr. Sathya Sai Mudigonda, Senior Tech Actuarial Consultant and a visiting faculty at SSSIHL, spoke on **The Study of Correlation between pre and post COVID-19 claims using CANN Modelsapplied on Ayushman Bharath.** He explained the current landscape (pre COVID-19) and its uniqueness from the point of view of Actuarial and Data Science.Then, he elaborated on the Actuarial Modelling and the assessment of fraud during the pandemic. He concluded by explaining his work in progress in this domain.

The next speaker for the morning session was **Dr. B V Ratish Kumar**, Professor in Dept. of Mathematics and Statistics at IIT Kanpur. He spoke on **Modelling the potential indoor airborne transmission of SARS-CoV-2 using a two-phase flow**. This he did by creating a like for like replica of a conference room and the environment in it in a general scenario. Using this replica various simulations of transmission of particles modelled using DPM were carried out bringing various parameters like ventilation, social distancing, surface contacting and wearing of masks into play. The results of these simulations showed a clear advantage in wearing masks.

Dr Malay Banerjee, IIT Kanpur

Next, **Dr. Malay Banerjee**, Professor, Dept. of Mathematics and Statistics, IIT Kanpur, gave a keynote address on **Two-group epidemic model of COVID-19 with varying infectivity**. He spoke in detail on the Extended SEIQR type model for the COVID-19 pandemic and its associated data analysis. He then divided the population based on behaviour after relaxation of control measures and constructed the Two-group epidemic model. He tested it with COVID-19 case data from Spain and went on to explain the effects of vaccination incorporated in the model. He concluded by discussing a few improvements to the model.

Dr. Vijay Bhagat from Central Leprosy Teaching Research Institute in Chennai gave the keynote address on the subject **Evolution of disease and the Importance of Medical evidence in the context of his ongoing research work towards COVID-19**. To get a better understanding of the current situation of COVID-19, he explained the various impacts that HIV has on the human body and the potential prey of the virus with simple examples. He also explained the uniqueness of the virus on each body which might depend on the person's occupation, habits, livelihood, etc. He highlighted the importance of Mathematical models in Randomized control trials (RCT), which involves injecting a particular drug into a selected body, Meta-analysis of its actions, and systematic review. After a brief discussion on the use of specific drugs, he concluded by mentioning that building evidence on public health over a large population is the best intervention.

The next speaker was **Dr. Maíra Aguiar**, Mathematical and Theoretical Biology Group, Basque Centre of Applied Mathematics, Basque Country, Spain. She spoke on the topic: **Modeling COVID-19 in the Basque country: From Introduction to Control measure response**. She started her talk by giving a brief introduction to the COVID-19 pandemic. She then talked about modeling the COVID-19 situation in the Basque Country where the stochastic SHARUCD - type model was used. She discussed various aspects of her model such as parameter estimation, effects of control measures, etc.Her ongoing work consists of economic evaluation of public health disease control measures, waning immunity or even immunity escape due to COVID variants, impact of different vaccines based on their efficacy, etc.

Surabhi Pandey, IIPH-PHFI, Delhi

Next, there was a paper presentation session chaired by **Dr. Surabhi Pandey, Indian Institute of Public Health, Delhi.**

Presenter	Title of the topic
Dr. Arkaprovo Ghosal, BITS Pilani, Rajasthan	Computational Model using a novel continuum approach coupled with PINNs to understand spread of infection in enclosed spaces
Dr. Pudi Nageshu, Kalam Institute of Health Technology, Andhra Pradesh	Health Technology Assessment on Neonatal CPAP: A Systematic Review, Meta-analysis and Economic evaluation
Mr. Naba Kumar Goswami, Triumphant Institute Management Education, Karnataka	Effect of Awareness Programs by Media on the COVID-19 Outbreaks: A Mathematical Model

Roxana Lopez Cruz

The first speaker for the evening session was **Dr. Roxana Lopez Cruz**, a full-time professor at Universidad Nacional Mayor de San Marcos, Peru who talked on **the importance of media coverage of infectious diseases and its importance in demystifying the myths about COVID – 19 infections**. She then talked about her research work in which she considered non - pharmaceutical control to reduce the spread of the disease which is important to understand the dynamics of epidemic disease transmission and understand the parameters of greater interest which help the policy makers in targeting prevention resources for maximum effectiveness.

A keynote address on the topic **Building Capacity for Sustained collaboration and a study on optimal dynamic strategies of COVID-19 transmission in Close-contact facilities** was delivered by **Dr. Aditi Ghosh**, Texas A&M University, Commerce. She started by talking about herself, her research interests, and the projects she has been working on including those on liver injury, dynamics of prion proliferation, and so on.

In her talk, she focused on the transmission dynamics of COVID-19 on closed contact facilities. She mentioned that a few of the reasons that contributed to the transmission of the disease were urbanization and the asymptotic nature of the disease. In her model, she had captured the super spreading events and the environmental transmission in a closed setting. The data from a long-term care facility in King Country, Washington was studied to build the model.

Maia Martcheva

Next, A talk titled **Parameter Identifiability and Optimal Control of a SARS-CoV-2 Model early in the Pandemic** was delivered by **Dr. Maia Martcheva**, professor of mathematics, University of Florida. She started by outlining her talk and mentioned the origin and effects of SARS-CoV-2 briefly. Data from the US about the number of deaths due to COVID-19, transmission rate, etc. was presented.She continued by stating how mathematical models have been used and how the complexity of such models has increased along with the insights from them.She described the variables of her model that used US data from the early pandemic (March 3, 2020- April 26, 2020). After this, she moved on to parameter estimation for her model. She defined the term structural identifiability and the methods used to do so in her model. It was stated that Monte Carlo simulation was used in her model for practical identifiability of parameters. The data had 3 outbreak waves and the model "pretty faithfully" captured all 3 waves. After this, she discussed the optimal control model and what factors were taken into account for the same.

Padhu Seshaiyer

The final presentation of the day was a keynote address (from the USA) by **Dr. Padmanabhan Seshiyer**. He is a tenured Professor of Mathematical Sciences at George Mason University and serves as the Director of the STEM Accelerator Program in the College of Science as well as the Director of COMPLETE (Centre for Outreach in Mathematics Professional Learning and Education Technology) at George Mason University in Fairfax, Virginia. The topic of his presentation was **Fostering Inclusive Modeling and Data Practices in a COVID-19 era**. He started by explaining the spread of the virus with the help of an application of Computational Mathematics. Then, he went on to explain the importance of **Modelling for Context** by giving the example of mapping of an epidemic in London and showed how the concept can be used for Social Network Analysis (using Graph Theory). Moreover, he also explained **Modeling Through a Continuum** wherein the approach was based on Continuum Mechanics. The next topic discussed by him was **Modeling for Impact** wherein he also discussed the sustainable development goals of the United Nations. The next topic was **Modeling for Long Term Care** with applications to Epidemiology and Long-Term Care Facility for COVID-19. Finally, an innovation to Entrepreneurship (Zika-Gangs-Opioids-Wearables).
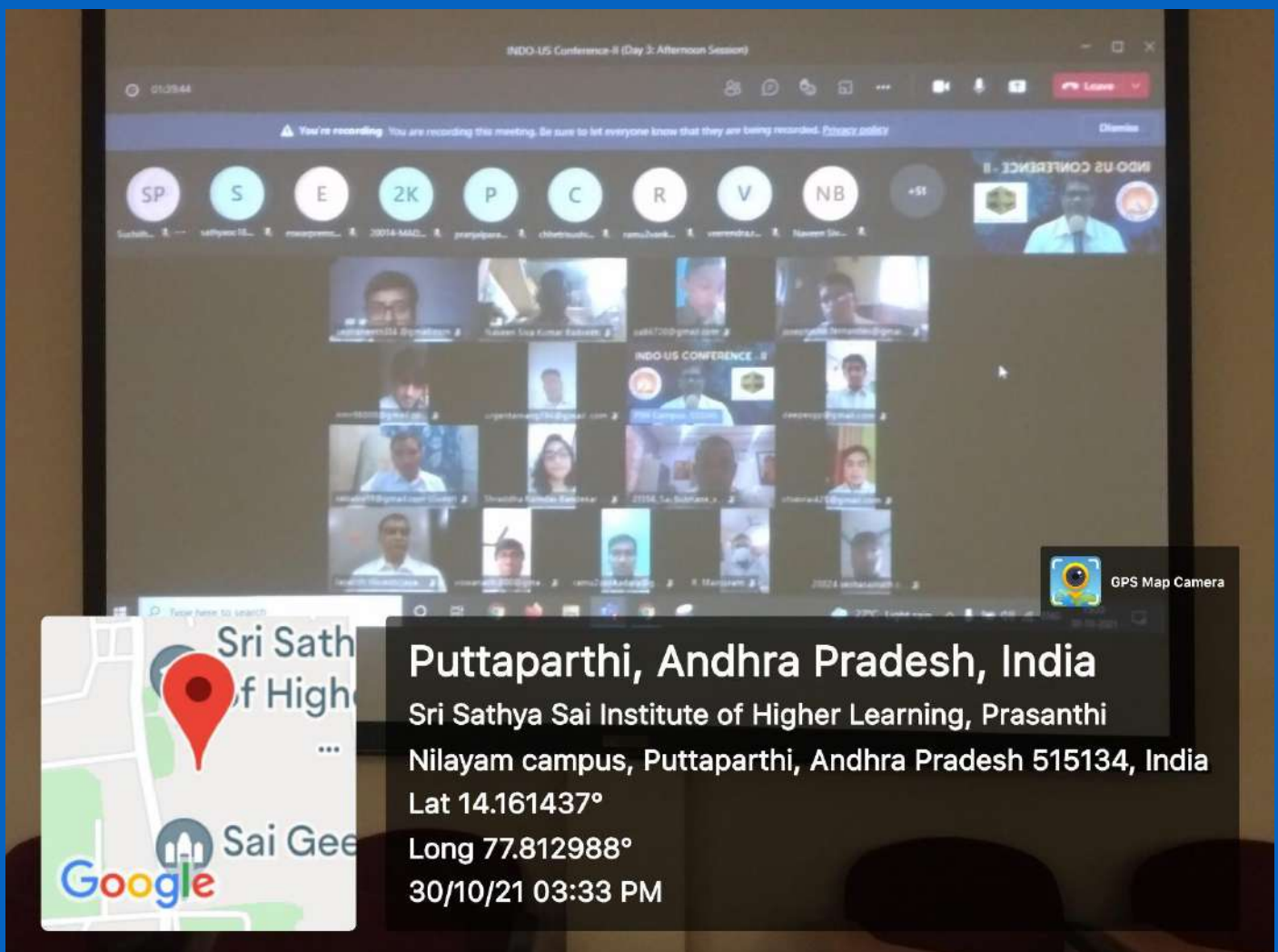
The three-day conference ended with valedictory and vote of thanks following which was a feedback session.

Other data

Many eminent scholars from various countries such as **India**, **USA, Spain, Canada** and **Peru** attended the 3-day long Indo-US Conference on The Science of Mathematical Modelling and Decision Making: A Changing Trajectory Into The Future, From Past to Post COVID-19 Pandemic.

The conference witnessed speakers from the following institutions:

Ashoka University, Sonepat
The TamilNadu Dr MGR Medical University, Chennai
NIT Uttarakhand, Uttarakhand
Vellore Institute of Technology, Vellore
Presidency University, West Bengal
Illinois State University, Normal, Illinois
Michigan State University, Michigan
University of South Florida, Tampa
Emory University, Georgia
Public Health Foundation of India, Delhi
University of Rajasthan, Rajasthan
Tulane University, New Orleans, Louisiana
Kalam Institute of Health Technology, AP
CSIR-Central Drug Research Institute, UP
John Hopkins, USA
York University, Toronto, Canada
North Carolina State University, North Carolina
Amity University, Noida
IIT Kanpur, Kanpur
Central Leprosy Teaching and Research Institute, Chennai
Indian Institute of Public Health, Delhi
Basque Centre for Applied Mathematics, Chennai
Universidad Nacional Mayor de San Marcos, Peru
Texas A&M University, Commerce
University of Florida, Gainesville
George Mason University, Fairfax, Virginia

The conference witnessed participants from the following institutions:

ABV-IIITM Gwalior
ADITYA ENGINEERING COLLEGE

Alagappa University
AMET UNIVERSITY (DEEMED TO BE UNIVERSITY)
Amity University Haryana
Amity University, Noida, India
Anna University
Asian Institute of Public Health
Basque Center for Applied Mathematics
BCAM
BGSB University
Birla Institute of Technology and Science
BIT Sindri Dhanbad Jharkhand
BITS Pilani
BITS PILANI GOA
BITS Pilani, Hyderabad Campus
BML Munjal University
BSA Crescent Institute of Science &Technology ,Chennai
Central University of Rajasthan, India
Christ University
CLTRI
DAYANAND COLLEGE, AJMER
G.B. Pant University of agriculture and technology Pantnagar
Gayatri Vidya Parishad College of Engineering (Autonomous)
GRID Council
Haldia Institute of Technology
IIEST, SHIBPUR
IIPH DELHI
IIPH-D
IISER Kolkata
IIT Gandhinagar
IIT JODHPUR
Indian Institute of Engineering Science And Technology, Shibpur, Howrah
Indian Institute of Public Heath-Delhi

Indian Institute of Technology Mandi Himachal Pradesh
Indian Statistical Institute, Kolkata
Institute of Atmospheric Physics, CAS
Jadavpur University, Kolkata
Jamia Hamdard, Delhi
JC DAV COLLEGE DASUYA, PUNJAB, INDIA
JIWAJI UNIVERSITY
JNTU ANANTPUR
JNTUK UNIVERSITY COLLEGE OF ENGINEERING VIZIANGARAM
JNTUK, KAKINADA
Kalam Institute of Health Technology
KarlsruherInstitutfürTechnologie
Karnatak University Dharwad
Karpagam Academy of Higher Education, Deemed to be University, Coimbatore, Tamil Nadu.
M.O.P Vaishnav College for Women, Chennai
Malda College
Mangalore University
Manipal university, Jaipur
Mizoram University
Mumbai School of Economics and Public Policy
National Institute of Technology Andhra Pradesh
NIT WARANGAL
Ohio State University
Osmania University
OSME ODISHA
Pillai's College of Engineering, New Panvel, Affiliated to Mumbai University
POKHARA UNIVERSITY
Presidency College, Chennai.
Presidency University Kolkata
Pt. J.L.N Govt. College

Pt. Ravishankar Shukla University, Raipur, Chhattisgarh, India
PTRSU,Raipur(C.G.)
Punjab university
RAMANAND ARYA DAV COLLEGE,MUMBAI
Sacred Heart College (Autonomous), Tirupattur, Tamil Nadu, India.
Sanjay Gandhi Postgraduate Institute of Medical Sciences
Shiv Harsh Kisan P.G. College, Basti
Sree Balaji Medical College and Hospital
Sri Ramshawroop Memorial University Lucknow Uttar Pradesh India
Sri Sathya Sai Institute Of Higher Learning
Thapar Univerity
The University of the West Indies, Mona
Tohoku University
Triumphant Institute Management Education
Universidad Nacional Mayor de San Marcos
UNIVERSITY OF BURDWAN
University of Calcutta
University of Dhaka
University of Lucknow
UNIVERSITY OF MUMBAI
University of North Bengal, Siliguri
Vellore Institute of Technology, Chennai
Vinoba Bhave University
Virginia Tech

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Occupation distribution of the participants

Legend:
- Graduate student
- Postdocs
- Faculty
- Industry
- Research Scholar
- PhD Scholar
- Research scholar
- Researcher

1/4

37.8%   17.6%
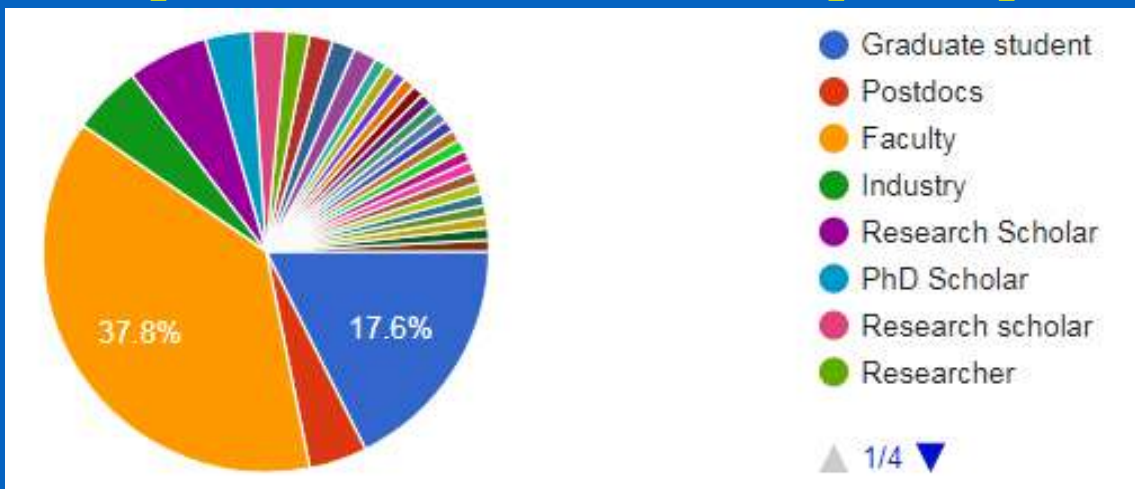
Source of information about conference to the participants

Legend:
- WEBSITE
- ADVERTISEMENT
- INTERNET SEARCH
- SOCIAL NETWORKING SITES
- LinkedIn
- Friends
- Through mail from SSSIHL
- email

1/4

50.5%   11.9%   11%
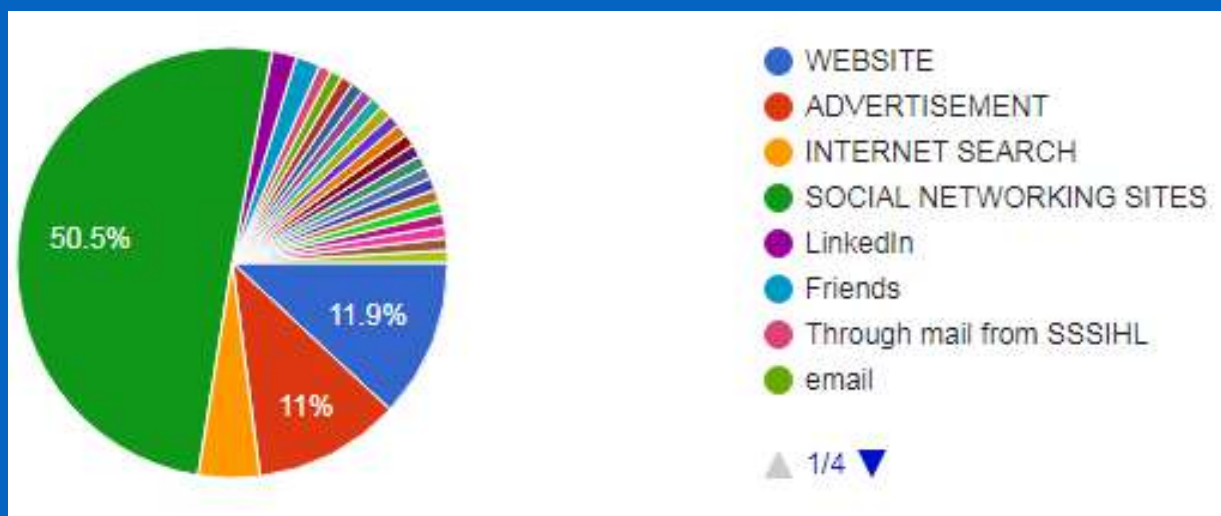
Gender distribution of participants

Legend:
- Male
- Female

36.4%   63.6%
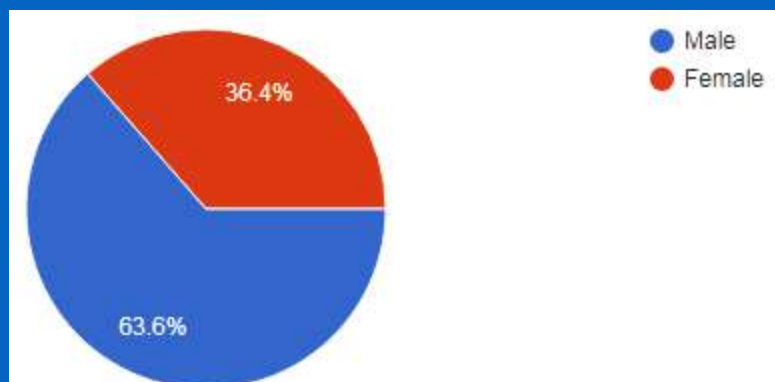
Feedback from the participants

On the last day of the conference feedback (covering various aspects of the conference such as speakers, educational content) was taken from all the participants both in Google forms as well as through video conferencing in order to understand how the conference was received by the participants and more importantly to improve the experience for the participants in future events.The feedback session witnessed a lot of overwhelming positive response from the participants.

The chart below summarizes the overall satisfaction of the participants rated on a scale of 5.

SATISFACTION OF PARTICPANTS FOR OVERALL CONFERENCE RATED ON A SCALE OF 5
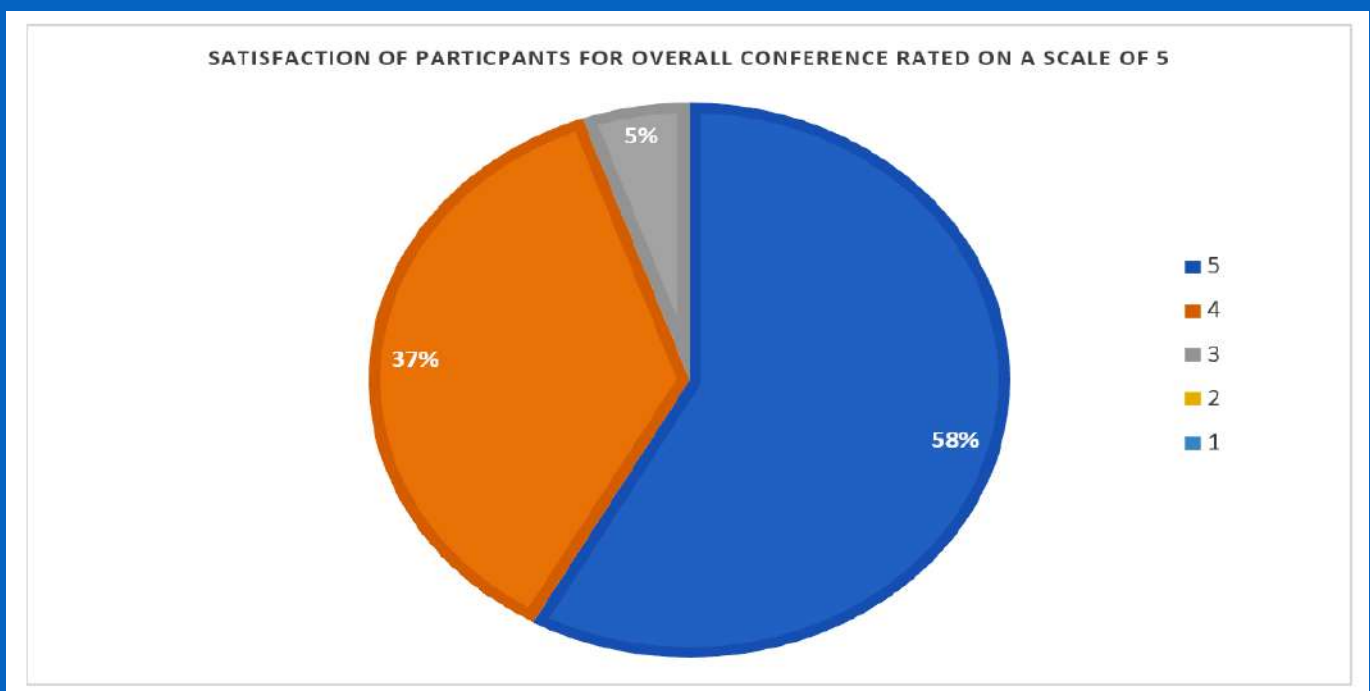
Feedback of the participants with respect to the appeal of the speaker's content was also taken on a scale of 5 which is summarized in the chart below.

SATISFACTION OF PARTICPANTS FOR SPEAKER'S TALKS' RATED ON A SCALE OF 5
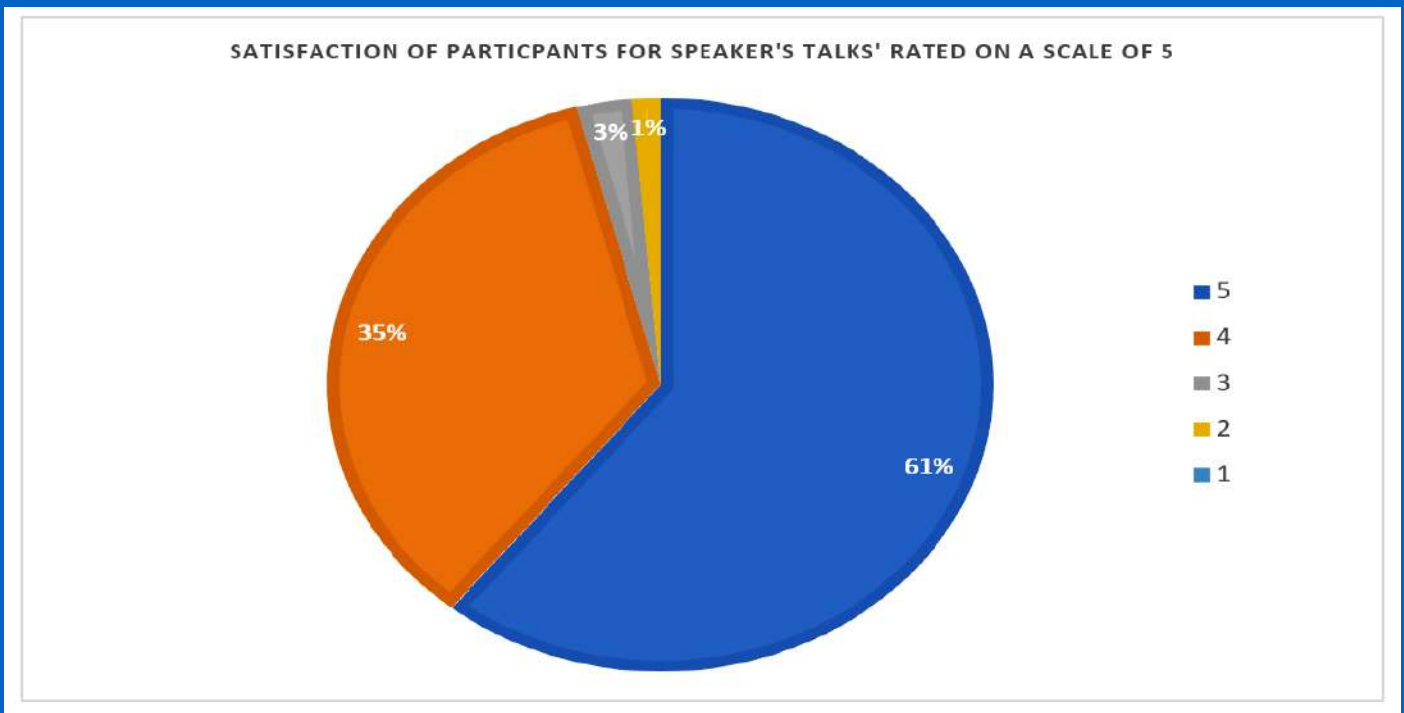
Besides feedback of aspects such as educational content, duration of the sessions and the time allocated for discussion during sessions is taken from the participants who were asked to rate outstanding, average or poor for all of the above-mentioned aspects. The participants' opinions were recorded and are depicted in the bar chart below.

Please indicate your satisfaction with the following aspects of the conference on the basis of
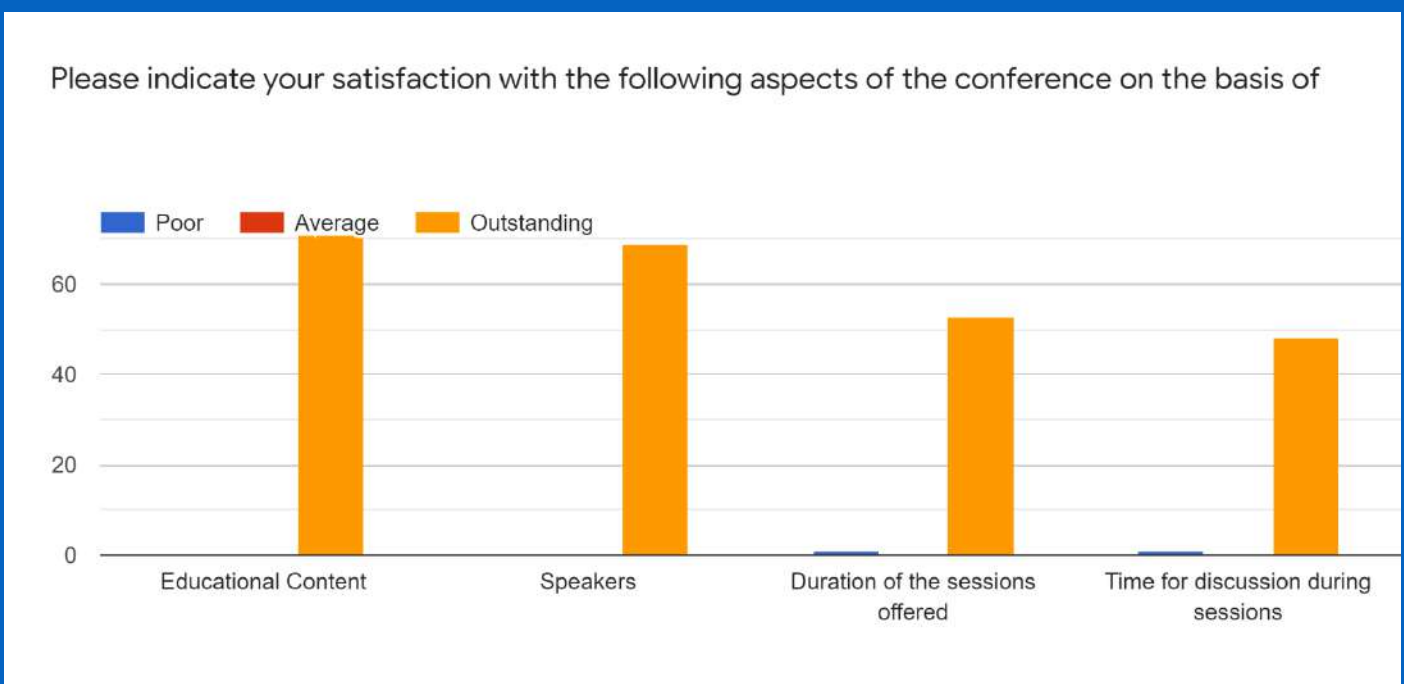
Additional comments from the participants

"Very informative and inspiring conference, Hope we have many more such sessions."

"The sessions were really amazing in terms of the content that was offered and topics that were covered."

"Excellently organized, amazing coordination, immaculate adherence to time schedule."

"I was expecting a plethora of experts presenting their views on diverse topics yet having a common goal and I must say, that I was very happy with the speakers and their outlooks presented."

"So many speakers with a lot of content-this conference offered much more than i could handle, it exceeded all my expectations."

To sum up, the Indo-US Conference-II which is a second event in the India-US Workshop/Conference series started way back in 2018 at SSSIHL, witnessed 30 keynote speakers from various countries such as India, USA, Spain, Canada and Peru. The conference had almost 150 participants spread across India. All the talks were enriching and were very well received and enjoyed by the audience of the conference making the conference a grand Success.

PHOTO GALLERY
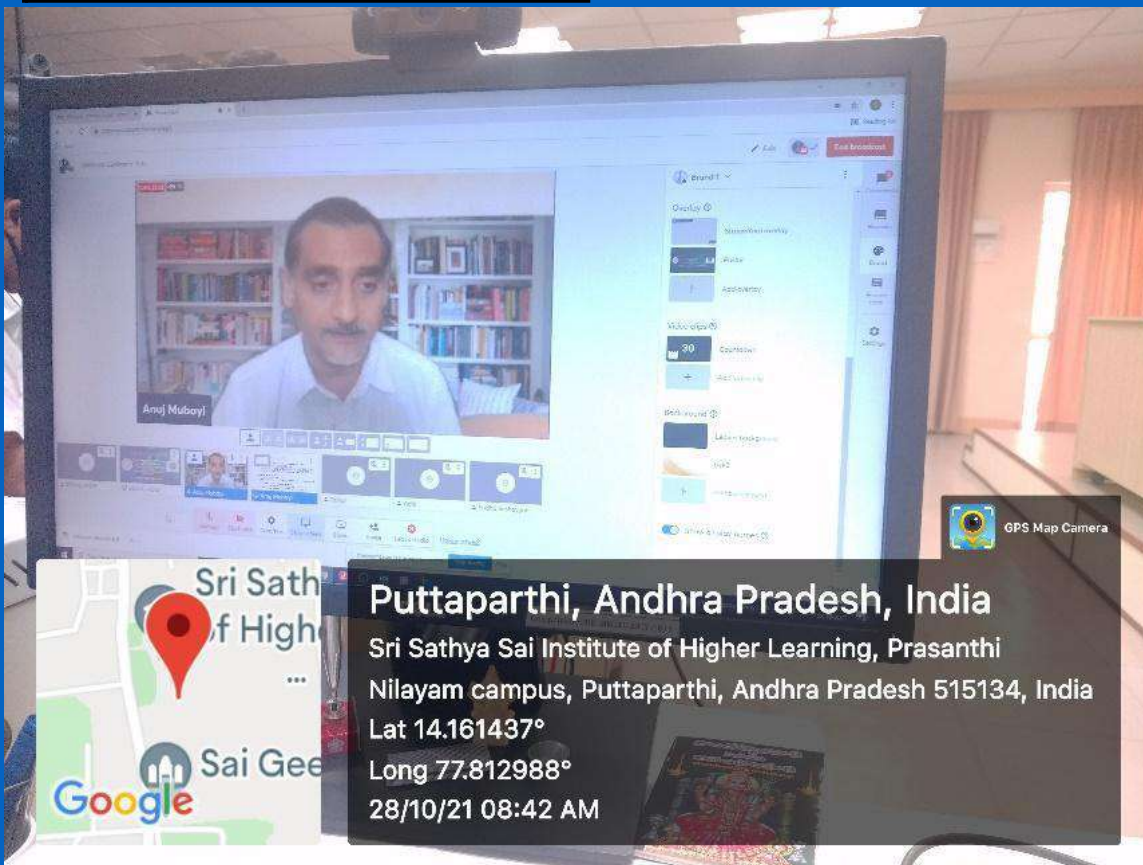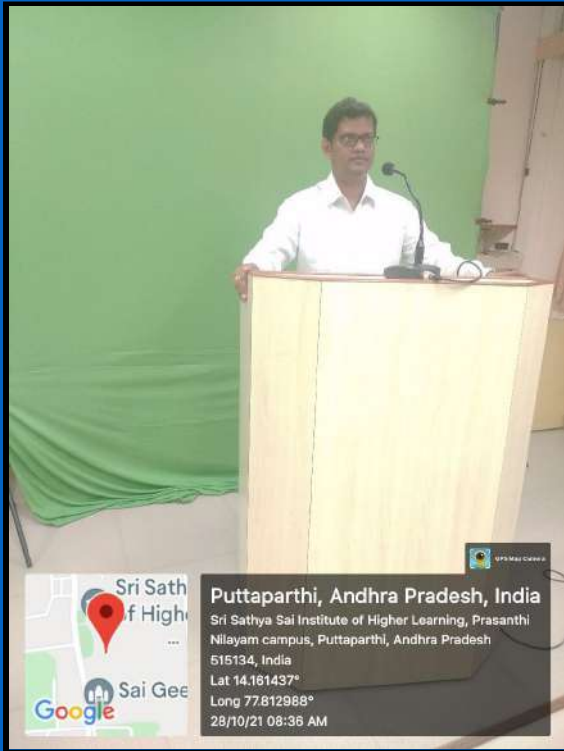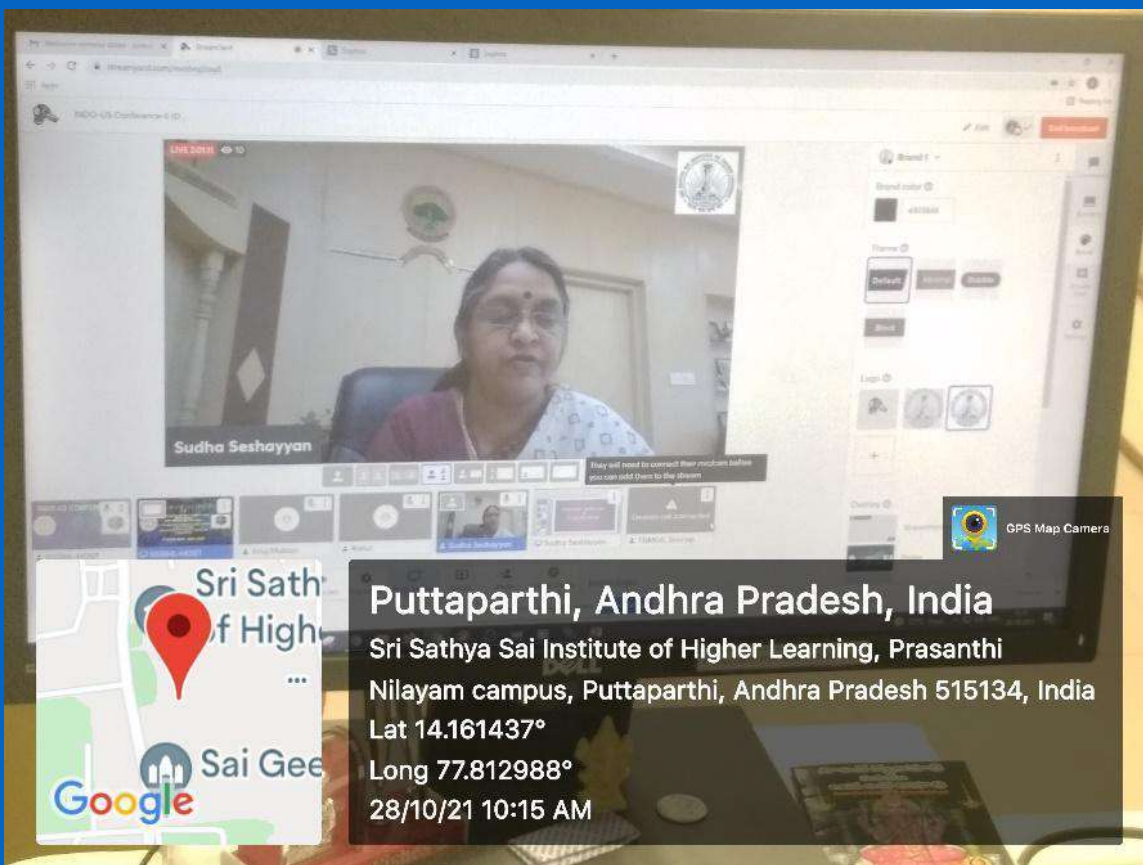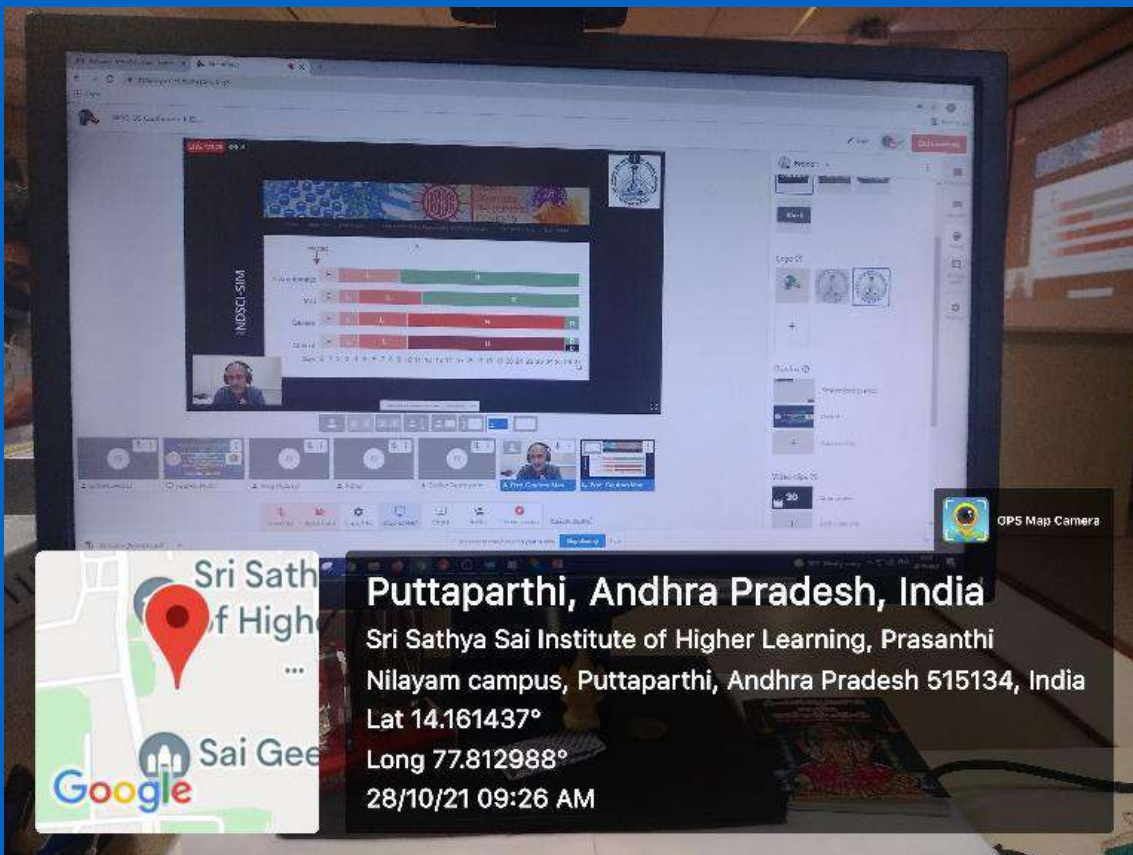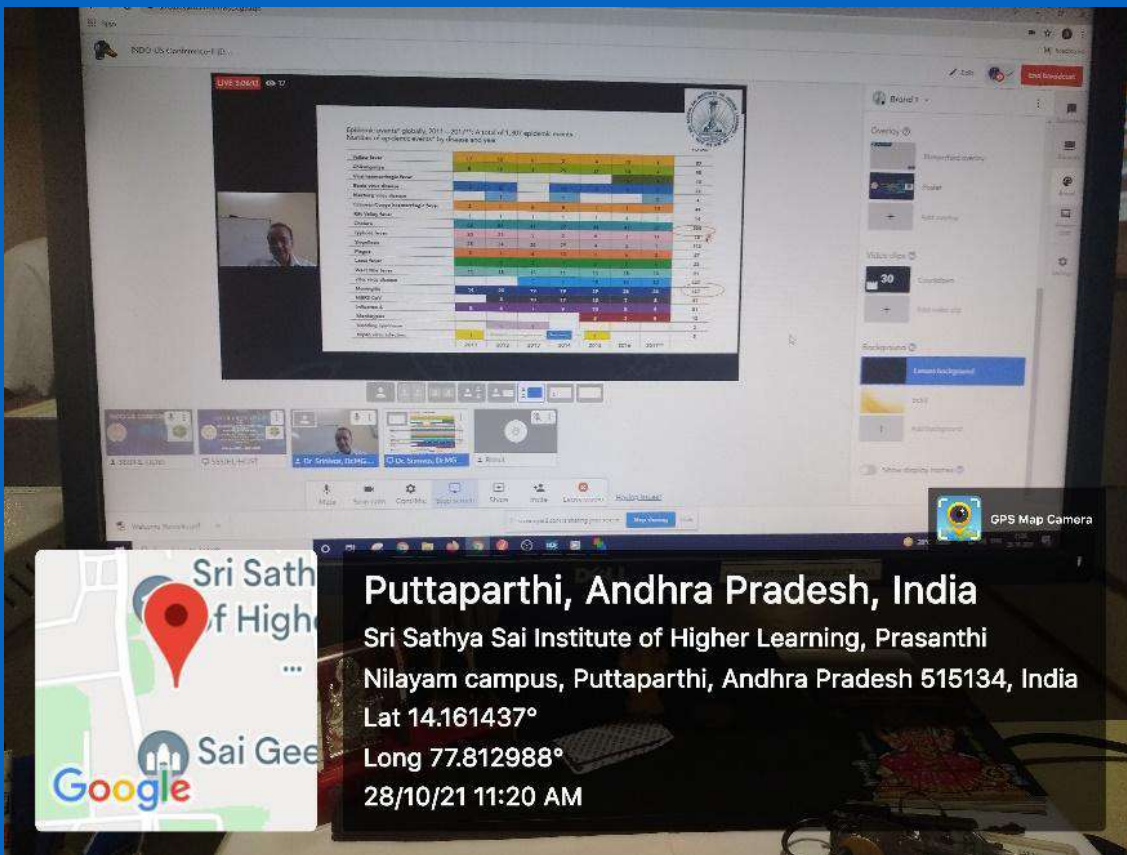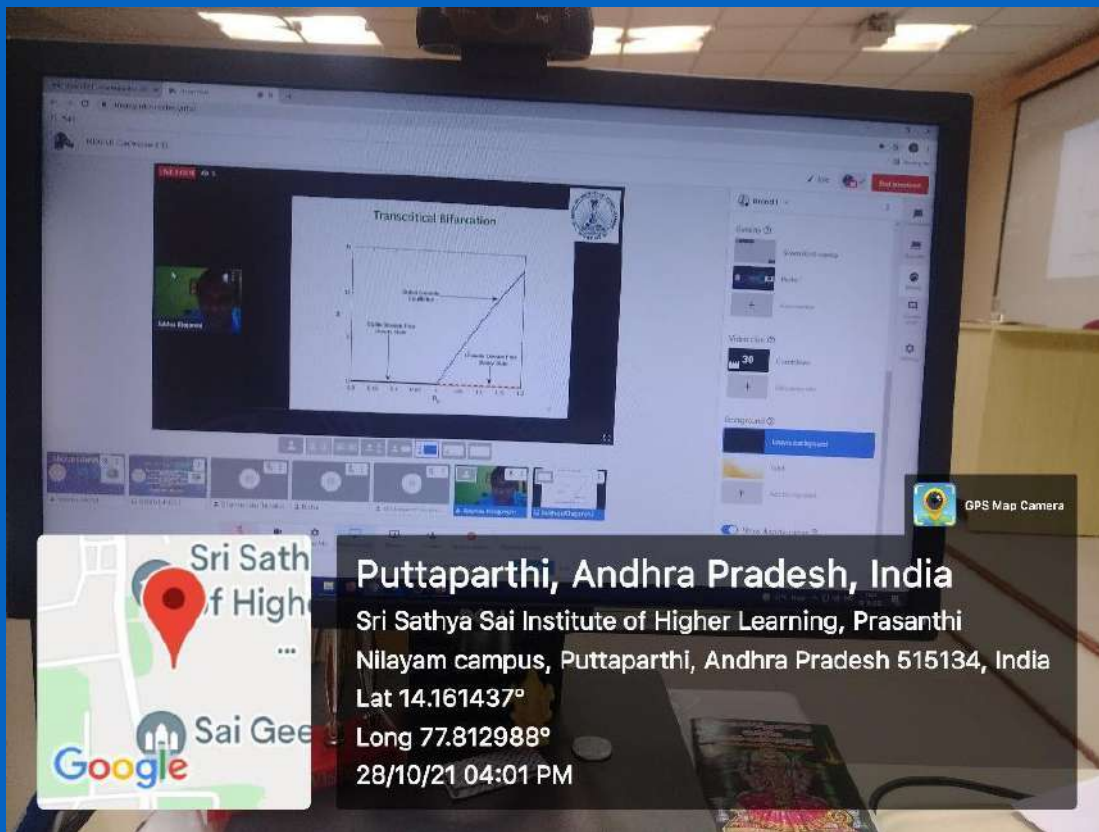
Puttaparthi, Andhra Pradesh, India
Sri Sathya Sai Institute of Higher Learning, Prasanthi
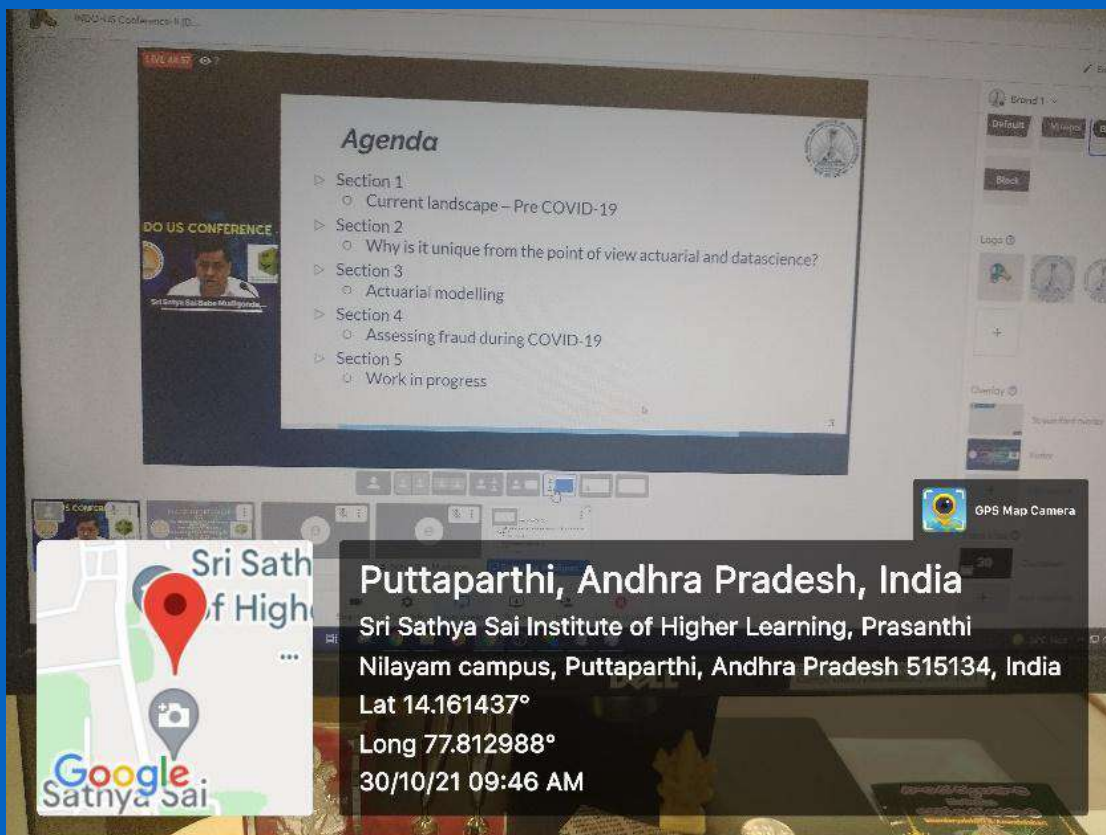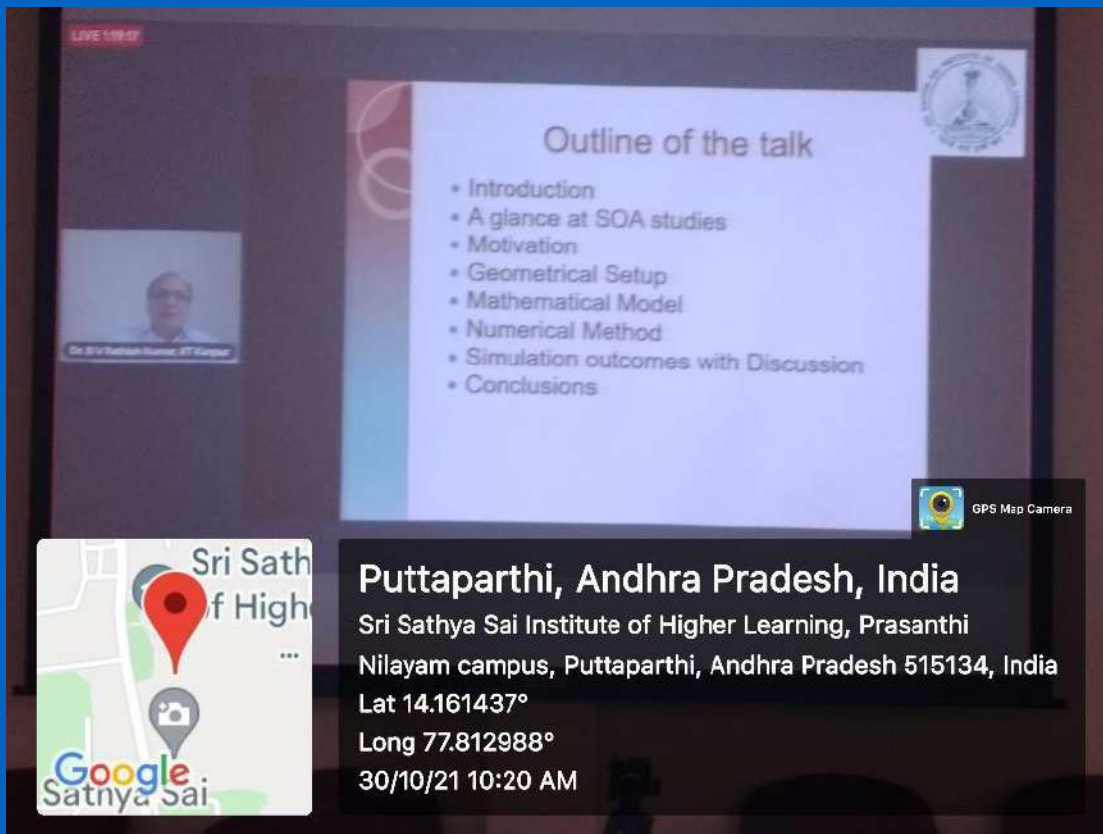Nilayam campus, Puttaparthi, Andhra Pradesh 515134, India
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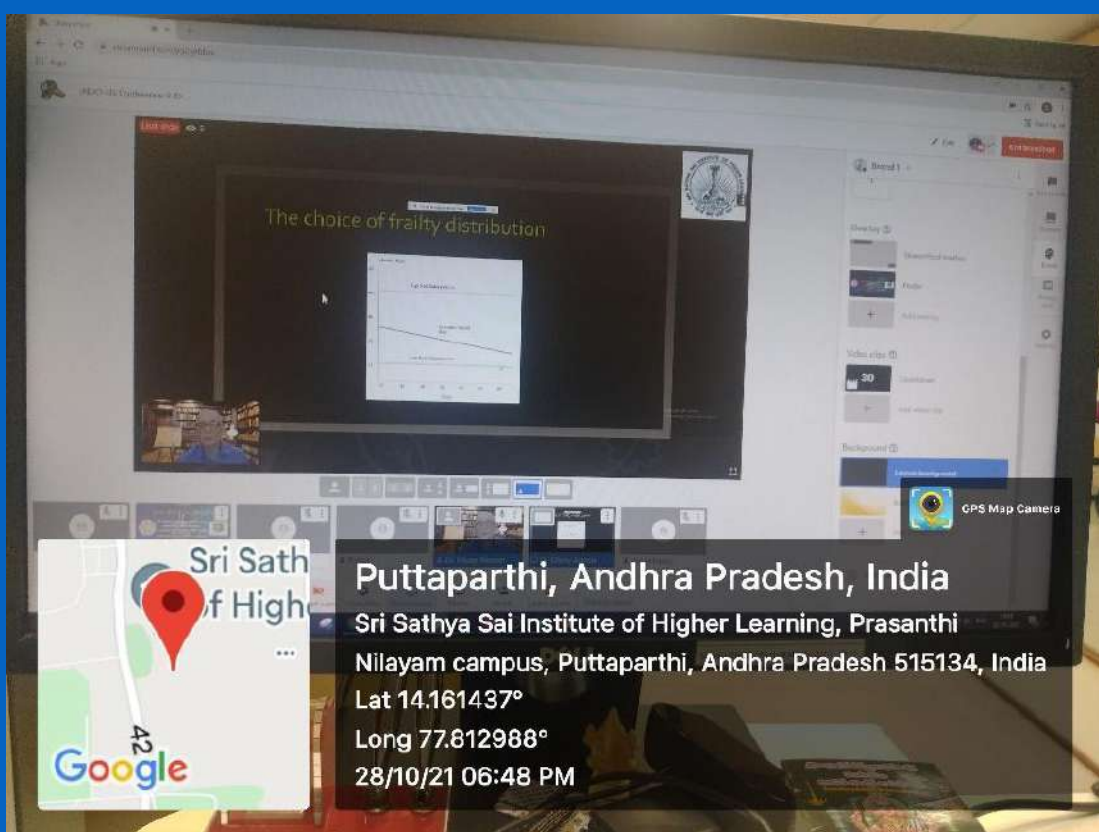
Puttaparthi, Andhra Pradesh, India
Sri Sathya Sai Institute of Higher Learning, Prasanthi
Nilayam campus, Puttaparthi, Andhra Pradesh 515134, India
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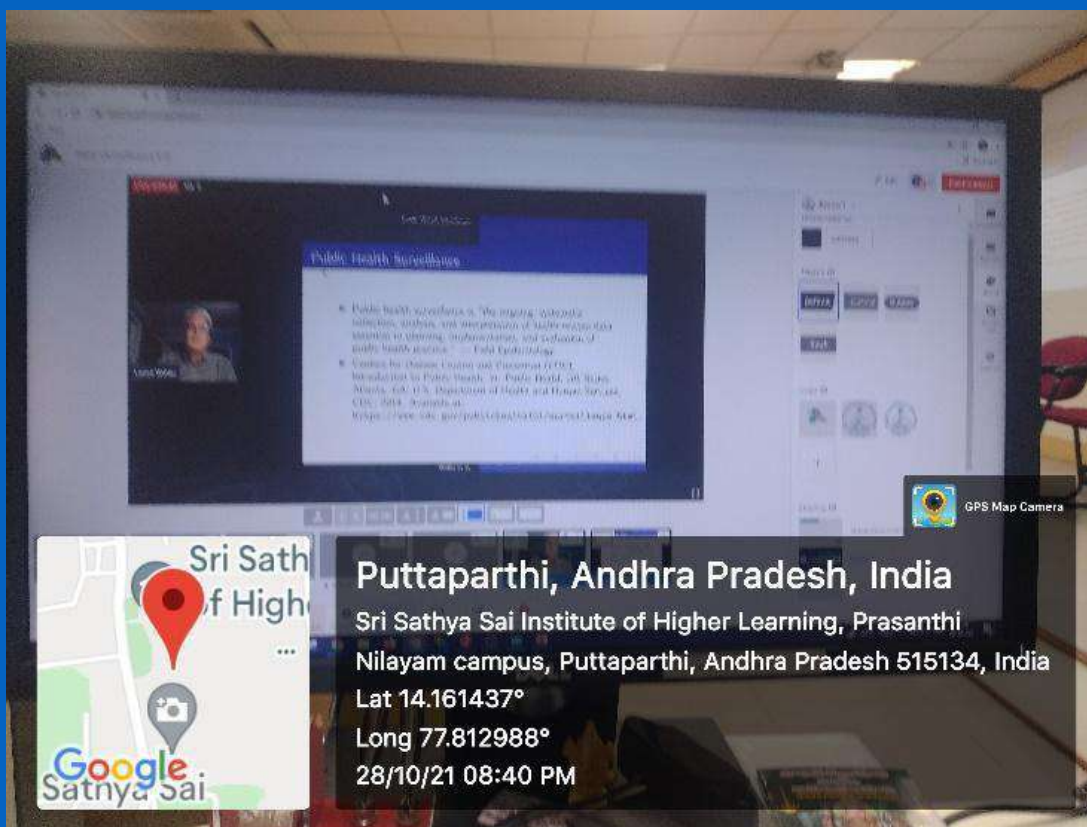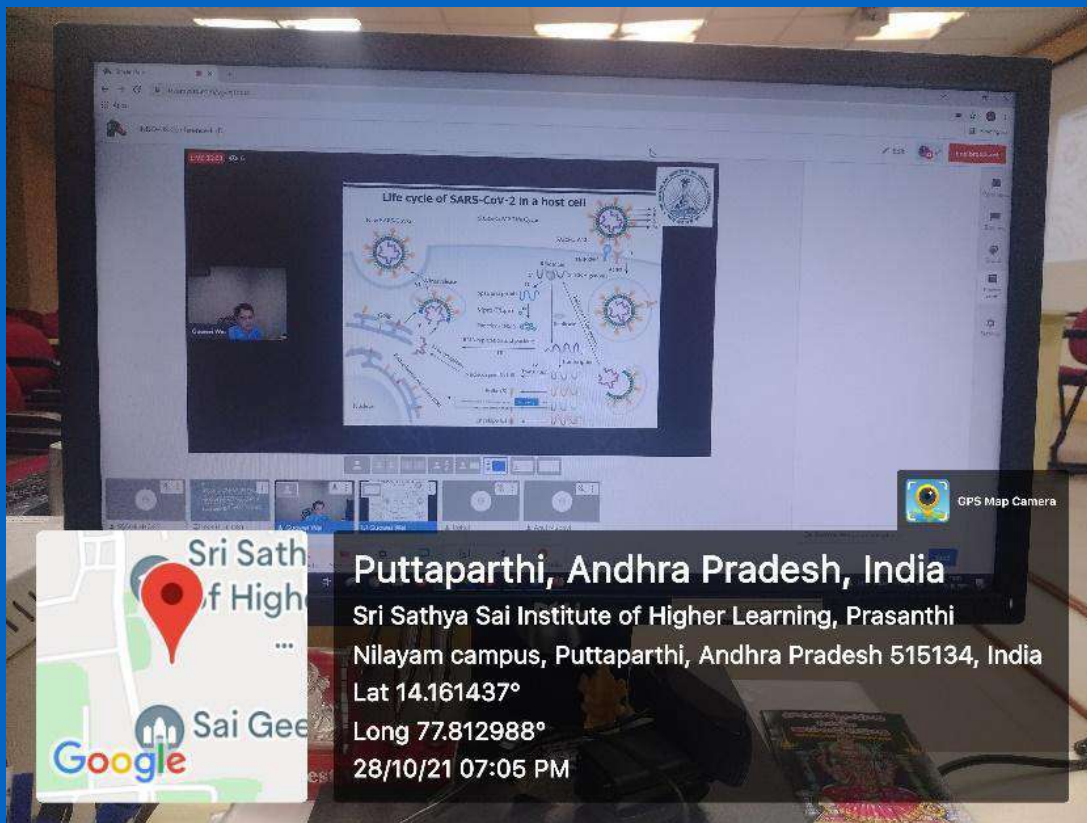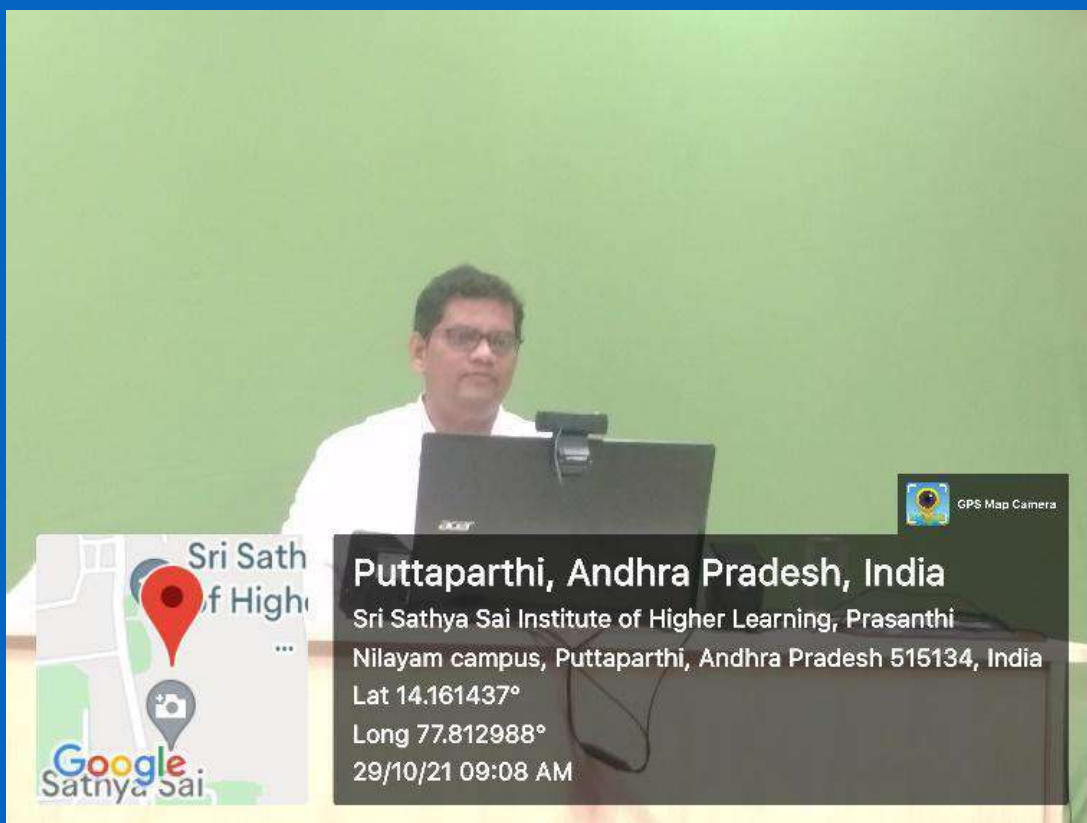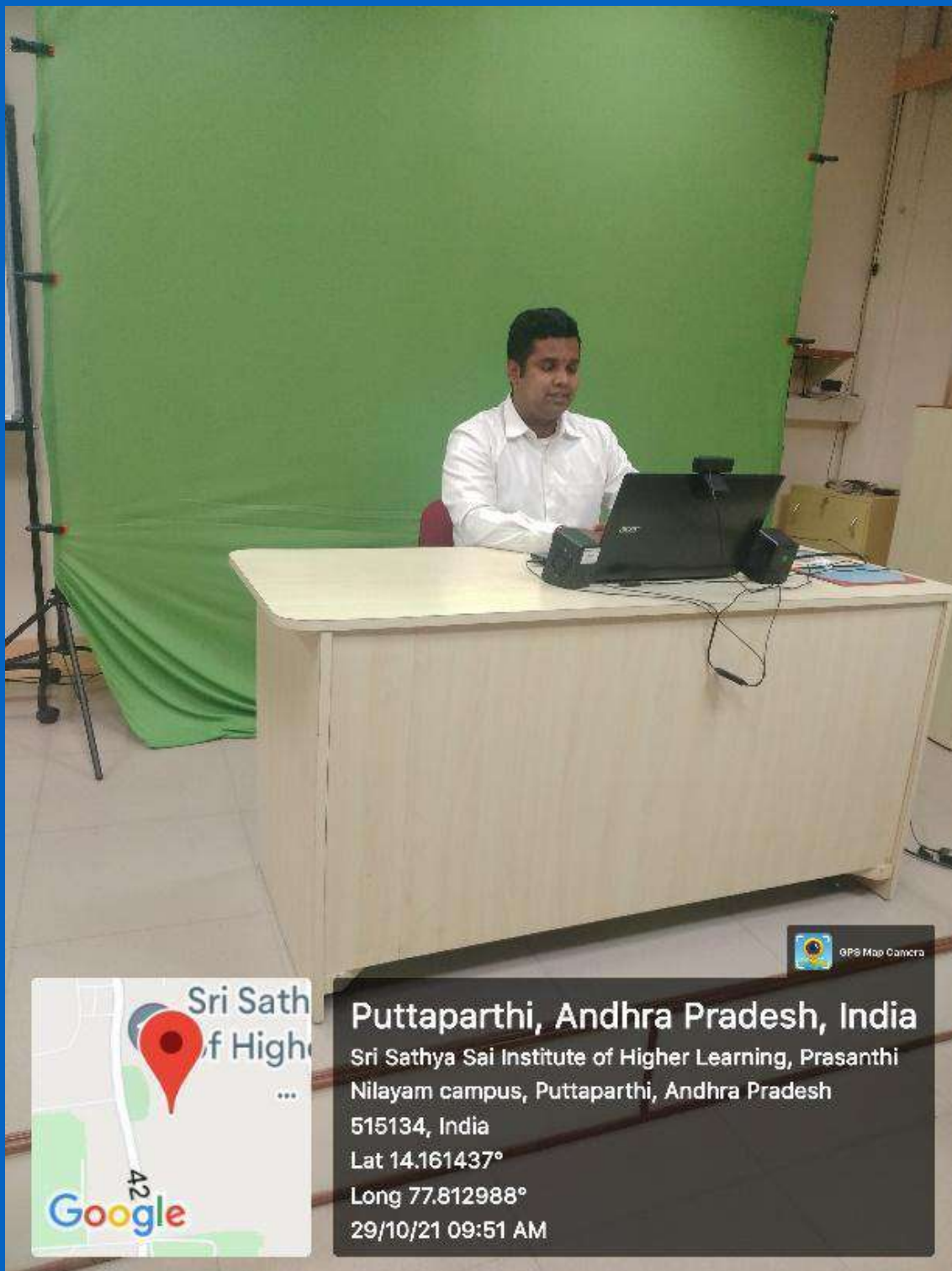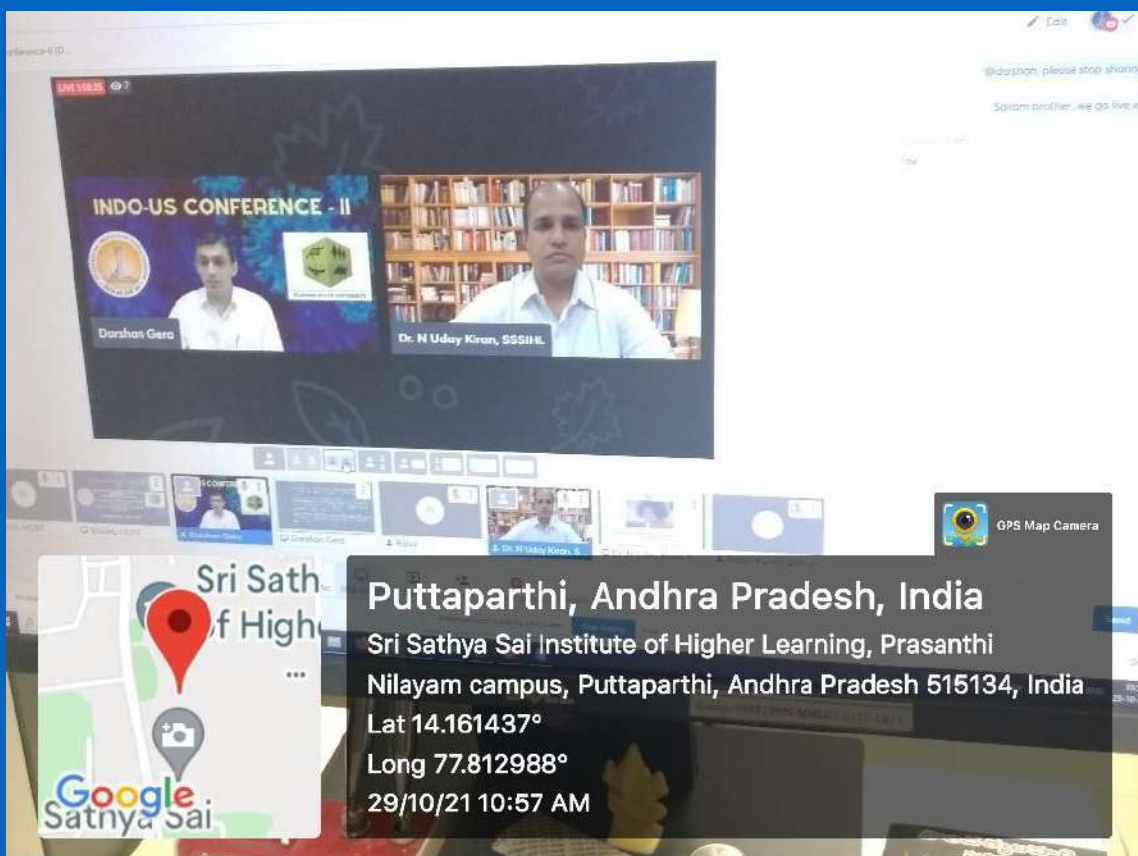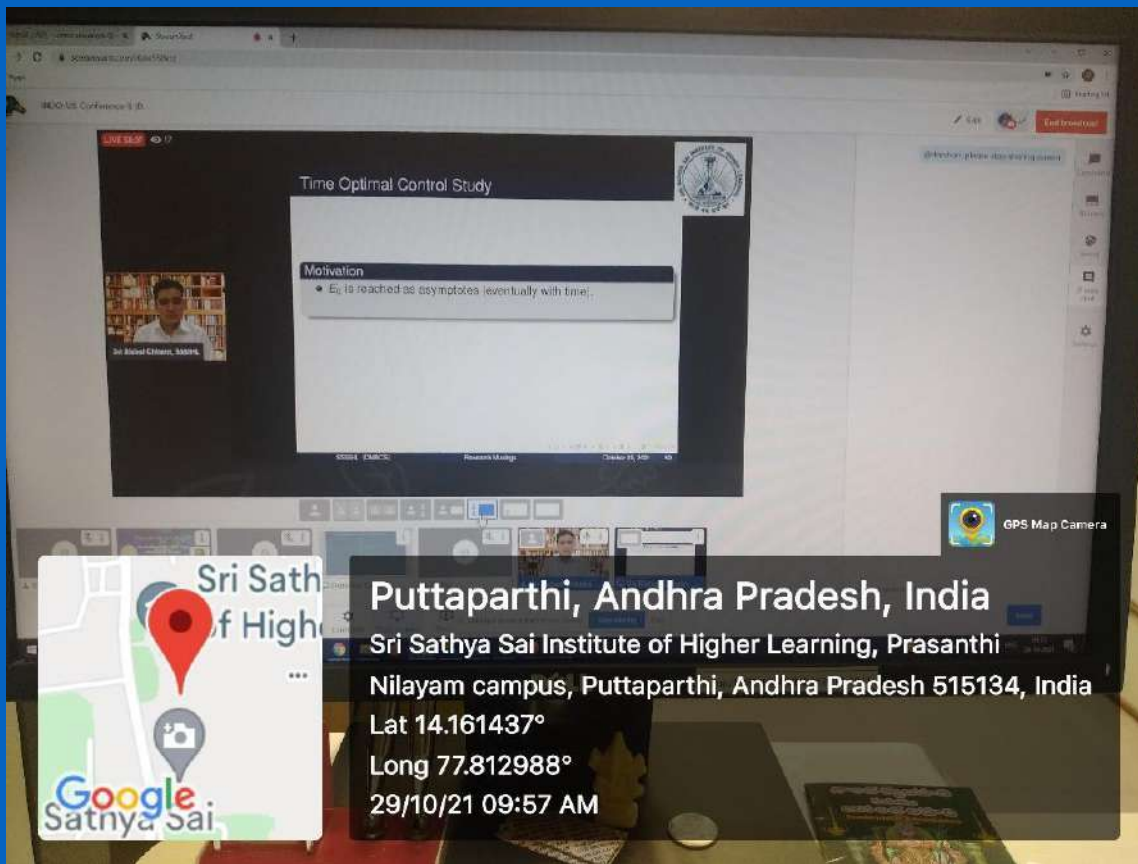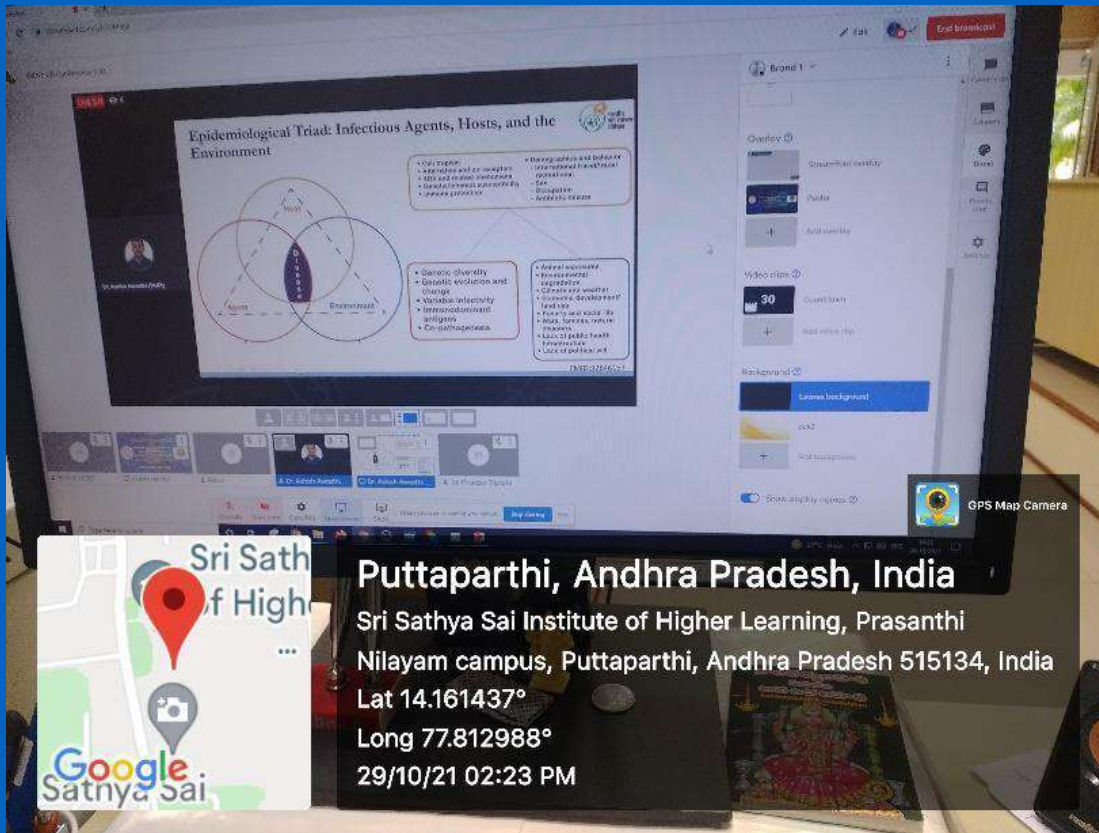
Puttaparthi, Andhra Pradesh, India
Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam campus, Puttaparthi, Andhra Pradesh 515134, India
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