The e-talk titled, "**CONTACT MECHANICS-BASED MATHEMATICAL MODELS IN ROBOTIC SYSTEMS**" was delivered by **Dr.Debanik Roy,** Scientist, Bhabha Atomic Research Centre, DAE, Mumbai on **Day-1** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 17-07-2020 from 11.00 am to 1.00 pm.

The participants of the session were welcomed by Dr. Govindarajan, Professor and Head Department of Mathematics and the speaker for the day was introduced by Dr. S. Athithan, Assistant Professor, Department of Mathematics. Dr. Roy has attained many professional benchmarks, including best technical paper prize, honorary membership of technical committee on robotics of IASTED, Canada, overseas visiting professorship, guest speakers at various international conferences etc. He has been distinguished as a biographee in "Marquis Who's Who in the World" in three successive editions, namely, 2007, 2008 & 2010 and also honored by the International Biographical Centre, U.K. He is actively associated as editorial board member of several peer-reviewed international journals in robotics & automation and computational mathematics.

The talk emphasized about the concept of Based Mathematical Models in Robotic Systems for contact Mechanics as a fundamental body of knowledge and plays a pivotal role in the development of Robotic System. Dr. Roy was discussed Grasp Synthesis, Basics of CRG, use of URG and MG and some applications of Robotic systems. The domain of Grasp Synthesis one of the niche ensembles of present day robotics research that caters for Rheology, sensor fusion and non linear coupled dynamics for control.

The lecture had 98 participants who were research scholars from mathematics and other departments and faculty members from our department and of other SRM campuses were also present.

The session concluded with a question and answer session were participants actively involved themselves in putting forth their queries which was well addressed by the speaker.

The e-talk titled, "**CALCULUS: ORIGIN, CONCEPTS AND APPLICATIONS**" was delivered by **Prof. Satyajit Roy**, Professor, Indian Institute of Technology Madras on **Day-2, session 1** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 18-07-2020 from 11.30 am to 1.00 pm.

This session was welcomed by Dr. A. Govindarajan, Professor and Head Department of Mathematics. The speaker was introduced by Mrs. Meena Parvathy Sankar, Assistant Professor, Department of Mathematics.

The talk was focused on Differentiation its basic concepts, the origin, formulating a differential problem supported by examples. Then the session continued by taking up topics of definition of limits and derivatives, how limits are approached in two dimension and extending it to three dimensions well explained with examples. Relation between continuous and derivatives were also illustrated. Topics where differentiation is used in real time problems such as forensic mechanics, microwave heating pattern and industries were also discussed.

The lecture had 93 participants who were research scholars from mathematics and other departments and faculty members from our department and of other SRM campuses were also present. The session ended with question and answer session in which research scholars actively involved themselves in rising queries in basic concepts as well as their research related problems.

The e-talk titled, "**GRAPH ALGORITHMS AND ITS COMPLEXITY**" was delivered by **Dr M .A. Shalu,** Associate Professor, IIIT DM, Kancheepuram on **Day-2, Session 2** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 18-07-2020 from 2.00 pm to 4.00 pm.

Professor and Head of the Department, Dr A. Govindarajan welcomed the participants of the session. The speaker was introduced by Mrs. Remigius Perpetua Mary, Assistant Professor, Department of Mathematics.

The main features of the talk were on algorithms and NP complete which plays a key role in the development of algorithms on graph theory. In this e-session, designing of an algorithm for two-coloring problem or bipartite graph problem with some examples were explained to the fullest. The concept of finding an independent set using a polynomial time non-deterministic algorithm and the basic difference between P and NP complete problems were also discussed.

The session had 80 participants including the research scholars of other departments like civil, computer science and architecture departments. The lecture was concluded with a question and answer session. The participants asked many questions which were well explained by the speaker.

The e-talk titled, "**LABELLING ON GRAPHS**" was delivered by **Dr. P. Vijaykumar,** Controller of Examination, GIET University Gunupur, Odisha on **Day-3,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 19-07-2020 from 11.00 am to 12.30 pm.

The participants of the session were welcomed by Dr. Govindarajan, Professor and Head Department of Mathematics and the speaker for the day was introduced by Dr. B. Vijaykumar, Assistant Professor, Department of Mathematics.

The talk emphasized about the concept of Graph labelling and it has a wide range of applications in various fields of science, Engineering and technology. Graph theory finds its application in various fields such as coding theory, radar, astronomy, security designs, missile guidance, communication networks, X-ray crystallography and database management and recently in dentistry. Certain keynotes of the topic were elaborated, as Graph labelling is widely used in the medical field and dentistry. Graceful labelling techniques are used in the structural aspects of the dental arch and its teeth.

The session had 87 participants including the research scholars and faculty members of other departments like civil, computer science and architecture departments. The session concluded with a question and answer session were participants from Mathematics research scholars actively involved themselves in putting forth their queries which was well addressed by the speaker.

The e-talk titled, "**FRACTAL GEOMETRY**" was delivered by **Dr. Minirani**, Associate Professor, NMIMS University, Mumbai on **Day-4,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 20-07-2020 from 2.30 pm- 4.30 pm.

This session was initiated by Dr. A. Govindarajan, Professor and Head Department of Mathematics. The speaker was introduced by Mr. A.D. Chandrasekar, Assistant Professor, Department of Mathematics.

The session began with the introduction to fractal geometry which originated from classical geometry. A complete idea was given about classical geometry and explained in detail how and what is fractal geometry and the need to study it. A short note about Father of Fractals was given and the history behind coining the theory. The talk proceeded by given a deep insight of definition of fractals.

The talk emphasized the facts about Mandelbrot set, shape of fractal and the method it was derived from a recursive equation. Concepts such as Fraction dimension of the set, self-similarity properties, relation between Euclidean and Fractal geometry, integrated function system was given a clear idea supported by appropriate examples. Applications and areas where research can be progressed were also given a look such as graphics, image compression, fractal antennas, climate studies, chaos theory especially in economy and statistics. Few images which are viewed through the fractal geometry were also previewed.

There were 87 participants for the session. Participants posted queries which were asked about how fractals can be incorporated in their fields of research such as topology, fuzzy, graph theory and the speaker has given her knowledge to it.

The e-talk titled, "**DYNAMICAL SYSTEMS USING MATHEMATICA**" was delivered by **Dr Govind Prasad Sahu,** Assistant Professor, Pt Ravishankar Shukla University, Raipur on **Day-5,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 21-07-2020 from 11.00 am- 1.00 pm.

The participants were welcomed by the Head of the Department, Dr A Govindarajan. The speaker of the session was introduced by Mrs. C. Abirami, Assistant Professor, Department of Mathematics.

The speaker started the session with the definitions of dynamical system, Linear, Non-linear system and discrete system. The basic matrix operations in Mathematics with examples were neatly explained. Classification of Dynamical systems were clearly explored. The importance of Jacobian matrix for Dynamical system and its classification were thoroughly explained.

Autonomous system of ODE Phase portraits, stability and fixed points of differential equations are well explored with nice examples like a phase portrait of a simple harmonic oscillator. The speaker also explained phase portraits with the three types of fixed points through examples. Types of two-dimensional linear systems, classification of dynamical systems using trace and determinants of the jacobian matrix, stability of non-linear system with examples are well explored.

The session had 81 participants including research scholars and faculty members from other departments like architecture and computer science and the talk concluded with the queries which was well addressed by the speaker.

The e-talk titled, "**HOW TO WRITE A GOOD SCIENTIFIC RESEARCH PAPER AND PUBLISH IN SCI JOURNALS"** was delivered by **Dr Jagdev Singh,** Professor and Head, Department of Mathematics, JECRC University, Jaipur on **Day-6,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 22-07-2020 from 11.00 am to 12.00 noon.

The participants of the session were welcomed by Dr. Govindarajan, Professor and Head Department of Mathematics and the speaker for the day was introduced by Dr. RM Kannan, Assistant Professor, Department of Mathematics.

The talk emphasized about the concept of writing a scientific paper and submitting it to a journal for publication is a time consuming and often daunting task. Barriers to effective writing include lack of experience, poor writing habits, writing anxiety, unfamiliarity with the requirements of scholarly writing, lack of confidence in writing ability, fear of failure, and resistance to feedback.

Reviewers consider the following five criteria to be the most important in decisions about whether to accept manuscripts for publication: 1) the importance, timeliness, relevance, and prevalence of the problem addressed; 2) the quality of the writing style (i.e., that it is well written, clear, straightforward, easy to follow, and logical); 3) the study design applied (i.e., that the design was appropriate, rigorous, and comprehensive); 4) the degree to which the literature review was thoughtful, focused, and up to date; and 5) the use of a sufficiently large sample. For these statements to be true there are also reasons that reviewers reject manuscripts. The following are the top five reasons for rejecting papers: 1) inappropriate, incomplete, or insufficiently described statistics; 2) over interpretation of results; 3) use of inappropriate, suboptimal, or insufficiently described populations or instruments; 4) small or biased samples; and 5) text that is poorly written or difficult to follow. With these reasons for acceptance or

rejection in mind, it is time to review basics and general writing tips to be used when performing manuscript preparation.

The session had 90 participants from various other departments. The participants from Mathematics and Computer Science departments actively involved themselves in putting forth their queries which was well addressed by the speaker.

The e-talk titled, "**LINEAR ALGEBRA AND APPLICATIONS"** was delivered by **Dr. B. R. Shankar,** Professor, NIT Suratkal on **Day-7 –Session 1,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 23-07-2020 from 11.00 am to 1.00 pm.

The session was welcomed by Dr. A. Govindarajan, Professor and Head Department of Mathematics. The speaker was introduced by Dr. L. Shobana, Assistant Professor, Department of Mathematics.

The talk started by the discussion of solving system of linear equations by the use of matrices. Various methods of finding inverses of a matrix was put forth like Cramer's rule, Cayley Hamilton Theorem. Concepts like fundamental theorem of algebra and Fredholm's alternative were also discussed. The notion of projections was discussed in detail.

The talk was carried on to the concepts of vector spaces and linear transformation. Different types of matrices and eigen values, vectors, Jordan canonical forms, generalized eigen vector decomposition, nilpotent operators, cyclic vectors was deliberated. Fitting decomposition was also explained. A little note was given about Jordon. Further a detailed note on Singular value decomposition supported by algorithms was given. The speaker also gave a note on online conduct of classes.

The session had a total of 85 participants who were research scholars and faculty members. Participants raised valuable questions and the speaker explained every query in detail and with great interest.

The e-talk titled, "**SIMILARITY TECHNIQUES IN FLUID FLOWS**" was delivered by **Dr. Govind Rajput,** Assistant Professor, Department of Applied Sciences and Humanities, SVKM's NMIMS MPTP Campus, Shirpur on **Day-7-Session 2,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 23-07-2020 from 4.00 pm to 5.00 pm.

Dr. L. Shobana, Coordinator of the program welcomed the participants of the session. The speaker was introduced by Dr. S. Perumal, Assistant Professor, Department of Mathematics.

The speaker emphasized the conversion of Ordinary Differential Equations or Non-Linear ODE equations in fluid flow which are PDE using similarity techniques, transformation and analysis. He also gave detailed information about two parameter group of transformations, one parameter group of transformations with examples.

In this session, obtaining the numerical solutions of transformed ODE using Runga – Kutta method of IV order, comparison between analytical and numerical method shooting method for BVP were clearly explained. Applications of similarity techniques and construction of graphs using mat lab simulation method was deliberated to the fullest.

The session has 85 participants from various departments including civil and architecture departments. The session concluded with question and answer session through slido, in which the queries were addressed well by the speaker.

The e-talk titled, "**MATHEMATICAL MODELING**" was delivered by **Dr.Prashant Srivastava,** Associate Professor, Indian Institute of Technology, Patna on **Day-8,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 24-07-2020 from 3.00 pm to 5.00 pm.

The participants of the session were welcomed by Dr. Govindarajan, Professor and Head Department of Mathematics and the speaker for the day was introduced by Dr. K. Jeyalakshmi, Assistant Professor, Department of Mathematics.

In this webinar there is a large element of compromise in mathematical modelling. The majority of interacting systems in the real world are far too complicated to model in their entirety. Hence the first level of compromise is to identify the most important parts of the system. These will be included in the model, the rest will be excluded. The second level of compromise concerns the amount of mathematical manipulation which is worthwhile. Although mathematics has the potential to prove general results, these results depend critically on the form of equations used. Small changes in the structure of equations may require enormous changes in the mathematical methods. Using computers to handle the model equations may never lead to elegant results, but it is much more robust against alterations.

The motivation of e-talk is Mathematical Modelling in real world problems is undisputed. Alternative Mechanisms can be explored through modelling in order to understand the system. The Mathematical Models can be used to generate quantitative predictions and qualitative insights into the systems. Theoretical models have their importance over empirical

modes as in science we not only need to understand patterns but also to answers why those patterns arise. We are more into causation than correlation.

The lecture had 85 participants from various other departments. The session concluded with a question and answer session were participants from Mathematics and Computer Science departments actively involved themselves in putting forth their queries which was well addressed by the speaker.

The e-talk titled, "**LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS**" was delivered by **Dr. M. Lakshmanan,** Professor of Eminence, Bharathidasan University, Trichy, on **Day-9- Session-1,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES,25-07-2020 from 11.00 am - 1.00 pm.

This talk provided an overview of linear and nonlinear differential equations and to distinguish their properties – integrability and motion of chaos. A detailed introduction about differential equations and dynamical systems, equation of motion supported by examples. The examples were derivations of well-known systems equation such as linear harmonic oscillator, damped linear harmonic oscillator, pendulum/forced pendulum, Mathews – Lakshmanan Oscillator, etc., An insight was given about Generalization to N- particle system. Knowledge about how dynamical system is closely associated with differential equation of different types was also discussed.

The talk proceeded with giving introduction to linear ordinary differential equation, linear differential operators and its properties, solutions to linear homogeneous equation. Fine points about deriving solutions to linear ordinary differential equations and nonlinear equations were presented and doubts were clarified with clear explanations then and there.

The talk continued with the topic of differential equations and singularities such as fixed singularities, movable singularities and the various authors' interpretation to the concepts.

Several problems taking up the basis of differentiation was put forth and explained as applications to the field of study.

The talk had 93 participants of research scholars and faculty members. Doubts clarification session was at the end of the talk were questions about modelling a differential problem for COVID 19 was also discussed. Few other participants raised various questions about quantum mechanics, methods of solving differential equations choosing the best which the speaker clarified in an explicit manner.

The e-talk titled, **"NUMERIC SOLUTION OF NAVIER- STOKES EQUATIONS-TWO DIMENSIONAL FLOW IN SQUARE CAVITY**" was delivered by **Dr P. Muthu**, Associate Professor and Head, Department of Mathematics, NIT, Warangal on **Day-9 – Session 2,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 25-07-2020 from 4.00 pm to 6.00 pm.

Dr. N. Parvathi, Professor, Department of Mathematics, welcomed the participants of this session and Dr. S. Sangeetha, Assistant Professor, Department of Mathematics, introduced the speaker to the webinar.

The speaker thoroughly explained the flow in enclosures, flow in open cavity and the dimensions of the cavity with neat examples. The concepts of finite difference approximation method, derivative valve boundary method and numerical method with fine examples were neatly explained by the speaker of the session.

The e-session concluded with the further applications and scope in the relevant area. The session had 89 participants from various departments like civil, computer science and architecture departments. The participants clarified their queries through slido which was clearly addressed by the speaker of the session.

The e-talk titled, "**HOW TO MEMORIZE NUMBERS**" was delivered by **Mr. Sahul Hameed,** M.E (Structural), Freelance Consultant, Memory Trainer on **Day-10,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 26-07-2020 from 11.00 am to 12.30 pm.

The participants of the session were welcomed by Dr. Govindarajan, Professor and Head Department of Mathematics and the speaker for the day was introduced by Dr. L. Shobana, Assistant Professor, Department of Mathematics.

The talk emphasized about the concept of how to memorize numbers? In today's world, we have to remember an amazing array of numbers – phone numbers, addresses, social security numbers, account numbers, credit card numbers, and pin numbers. The list of numbers increases all the time and it quickly gets confusing. You probably also try to remember important dates (your mother-in-law's birthday) and numbers like your employee ID and your health plan number, in case you don't have your card with you! Unfortunately, memorizing numbers is one of the most difficult things to do, because you can't "visualize" numbers the way you can visualize words, like the items on a grocery list. Fortunately, there are ways to make learning numbers easier by using some tested memory tricks.

In this webinar he discussed chunking is simply breaking down a long number into smaller units, so it is easier to remember. A perfect example of this is U.S. telephone numbers, which are broken down by area code, exchange, and local number, so that instead of a string of 10 digits, you have three digits, three digits and four digits. He gave more ideas for memorize the numbers and its uses in real life.

The lecture had 87 participants from various other departments. The session concluded with a question and answer session were participants actively involved themselves in putting forth their queries which was well addressed by the speaker.

The e-talk titled, "**FINITE STATE AUTOMATA AND CORDIAL NUMBERS**" was delivered by **Dr. J. Baskar Babujee**, Associate Professor, MIT Campus, Anna University, Chennai on **Day-11,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 27-07-2020 from 3.00 pm-4.30 pm.

This session was welcomed by Dr. N. Parvathi, Professor, Department of Mathematics. The speaker was introduced by Dr. Balamuralitharan, Assistant Professor, Department of Mathematics.

The talk started by introducing the concepts of automata by explaining in detail what is a compilers and translator, machine, string, language, finite state automata by apt physical life situations. How to design a Lexical Analyzer was given an idea. The talk again focused in detail theory of finite state machines, deterministic finite automata and non-deterministic finite automata supported by examples which brought out clearly the differences between the two machines. An idea of different types of grammars was also interpreted with suitable examples.

Furthermore, cordial labeling, introduction to cordial words and cordial numbers and relating to the concepts of number theory was highlighted. Many results in the study of finding general expressions for distinctive deterministic finite state automata involving cordial words and numbers were analyzed. Few open problems were also discussed as a future scope for researchers.

The session had 85 attendees who enthusiastically involved themselves in listening to the lecture and raising reasonable doubts which was well made addressed by the speaker.

The e-talk titled, "**FUZZY LOGIC AND ITS APPLICATIONS**" was delivered by **Dr. R. Sujatha,** Associate Professor, SSN College of Engineering, Kalavakkam on **Day-12,** of RESEARCH DEVELOPMENT PROGRAMME ON MATHEMATICAL METHODS IN APPLIED SCIENCES, 28-07-2020 from 11.00 am to 12.30 pm.

The participants were welcomed by Dr. N. Parvathi, Professor, Department of Mathematics. The speaker of the session was introduced by Dr. L. Shobana, Assistant Professor, Department of Mathematics.

The speaker started the session with the introduction of Fuzzy logic and the difference between Fuzzy and Crisp set. Membership functions with examples, operators of Fuzzy sets like union was clearly explained. The concepts like Fuzzy logic operation, Fuzzy predicate, Fuzzy rule as a Fuzzy relation were discussed in the session. The speaker also explained the famous Mamdani method, Sugeno method, Center of gravity method, Center of Sum method with examples.

In this webinar, to determine the wash-time of a domestic washing machine using Mamdani Fuzzy model in step by step by defining a membership function input and output was clearly explored. The speaker also initiated the research scholars to do research in Software reliability and Fuzzy graphs. There were 81 participants in the session from various departments. Many questions were raised by the active participants and it was addressed well using Slido app by the speaker.