



B.M.S. COLLEGE OF ENGINEERING, BENGALURU

Autonomous Institute, Affiliated to VTU

Department of Chemical Engineering

REPORT ON VALUE ADDED COURSE

- 1. Name of the Department:** Chemical Engineering
- 2. Name of the Activity:** Value-added course on introduction to dynamic systems theory and machine learning in chemical engineering
- 3. Objectives:**
 - To provide a perfect toolkit for modeling diverse systems in Chemical engineering.
 - To tackle the applications to real-world scenarios that are at the forefront in today's world.
- 4. Date, Time Venue of the Activity**

Date: 21/11/2022 to 28/11/2022

Time: 9:00 am to 4:30 pm

Venue: FDC Hall, PG Block, BMSCE
- 5. Name of collaborating agency:**

Mr.Shreyas Joshi and Ms.Isha Misra, Prime Minister Research Foundation (PMRF) - PhD scholars from Indian Institute of Science (IISc) were the resource persons for the Value-Added Course
- 6. Brief summary of the Value Added Course**

The Value-Added Course on Dynamical Systems and Machine Learning had an inaugural function where all the faculty members of the Chemical Engineering Department attended and graced the occasion. The workshop convener, Dr. Samita Maitra welcomed all the participants and explained the importance and the outcomes of the course and also suggested that everyone should utilize the facility for their future endeavors.

DAY 1: November 21, 2022 – Mr. Shreyas Joshi:

The day started off with an introductory session which provided an insight into the fundamental concepts in chemical engineering required for mathematical modelling. After the tea break, the theory of a reactive system, using the earlier concepts of CRE was explained using both the numerical and analytical approaches. The afternoon session continued with building on the idea of a reactive system in a real-world scenario by developing a COVID-19 model using SIR-framework and the effects of intervention. It was followed



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by elaborating the concepts learnt by solving problems on MATLAB.

DAY 2: November 22, 2022 – Mr. Shreyas Joshi and Ms. Isha Misra

The session began with the recapitulation of the previous day and then topics on probabilistic models were introduced. We were made to design models based on Reaction Kinetics, Random Walk, Genetic Drift and Game Theory. Problem solving was done on MATLAB after the theory sessions after which students were able to form codes on real-life situations. During the second half of the session, Ms. Isha Misra established the base of what a Dynamic model was and explained the details of fixed points, stability and then the application of these concepts into the population growth and auto-catalytic reactions were done. Logistic equations were formed.

DAY 3: November 23, 2022 – Ms. Isha Misra

The day's discussion started with the continuation of Dynamic systems in the 2-D planes and the prey-predator model was designed analytically and visualized with MATLAB. The dynamics based on simple and damped oscillators were modelled using analytical methods. The various analytical methods like Regular Perturbation Analysis were done by comparing the numerical and analytical estimates. The concepts of order of error were introduced.

DAY 4: November 24, 2022 – Ms. Shreyas Joshi and Mr. Isha Misra

The basics of statistics and the elementary concepts of Machine Learning was touched upon during the first half of the session. The knowledge about the estimation of parameters using regression analysis was taught. After the break, the Poincare Lindstedt method was used to estimate the analytical solutions and modelling was done using MATLAB.

DAY 5: November 27, 2022 – Ms. Isha Misra

The online session began with the Method of multiple timings used for developing analytical solutions for the various models. The basics of Fourier transforms, and coefficients was dealt with, and various codes were generated using MATLAB for the same.

DAY 6: November 28, 2022 – Mr. Shreyas Joshi

The idea about Classification in Machine Learning and Statistics, a supervised learning approach in which the computer program learns from the data given to it and make new observations was disseminated. The classification predictive modelling provided the task of approximating the mapping function from input variables to discrete output variables.



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Valedictory Programm At 4.00 pm on November 28, 2022

The Value-Added Course ended with a Valedictory programme. Our beloved Principal Dr. S Muralidhara, Vice-principal and HoD graced the occasion. They encouraged the students to put the theory into practice. The course was well appreciated through the feedback given by the course participants. Digniteries distributed certificate of appreciation to the resourse persons **Mr. Shreyas Joshi and Ms. Isha Misra**. HoD distributed Certificates to all the participants which was followed by a photo session. High tea was provided to all the participants.

7. Outcomes

- The participants have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
- The strengths and weaknesses of many popular machine learning approaches are understood.
- The participant gained exposure to the latest technological developments, to provide an opportunity to develop inter-disciplinary skills

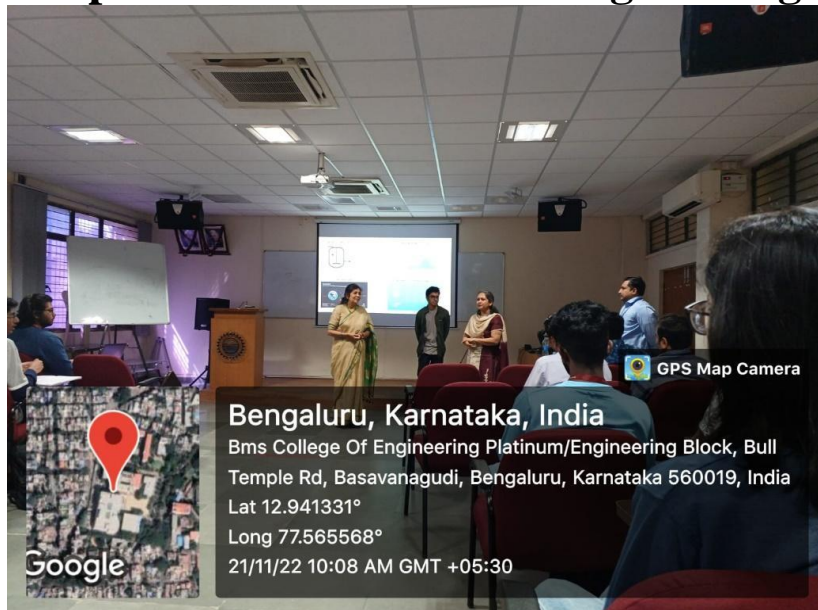
8. Number of participants

Particulars	Number of Students		Non-Teaching Staff		External Participants	
	Male	Female	Male	Female	Male	Female
Number of Participants	19	16	-	-	-	-

9. Two or three relevant Photographs of the activity



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Photograph1: Inauguration of the Value added program on 21st Nov 2022



Photograph 2: Group Photograph of Value added program on 21st Nov 2022



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Photograph3: Validatory function of the Value added program on 28st Nov 2022