



Report of One Week FDP on
“Teaching Learning using MATLAB”

Nov 24th-28th, 2020

Sponsored by

**AICTE-TRAINING AND LEARNING ACADEMY
(ATAL)**

The one week Faculty Development Programme (FDP) was organized and conducted by the Department of Mechanical Engineering, School of Studies of Engineering and Technology, Guru Ghasidas Vishwavidyalaya, Bilaspur.

The FDP was sponsored by AICTE-Training And Learning (ATAL) Academy of AICTE, Ministry of Higher Education, Govt. of India, and was for the duration of Five days from 24-11-2020 to 28-11-2020. A total of 225 participants registered for the FDP from all across the country. The number of participants who successfully completed the FDP was 108.

The objective of the FDP was to help participants acquaint, orient and embrace the usage of modern computing resources in the Teaching-Learning pedagogy in problem solving in Mechanical Engineering curriculum. The highly popular computing resources in MATLAB were the chosen platform for disseminating and knowledge sharing during the FDP. The entire FDP was conducted online with MS Teams platform. The resource persons Dr. R. N. Patel and Dr. Lalit Kumar Sahu from NIT Raipur delivered expert lectures on MATLAB and SIMULINK and other related features of MATLAB, while Dr. Pankaj Kumar Gupta delivered expert lectures on the Teaching-Learning pedagogy in problem solving using MATLAB. In total there were 15 sessions of knowledge sharing, including the one by Mr. S K Rajeev Nair, Yoga Trainer, who delivered session on “Inner Engineering using Yoga & Meditation”.

EXPERTS/RESOURCE PERSONS

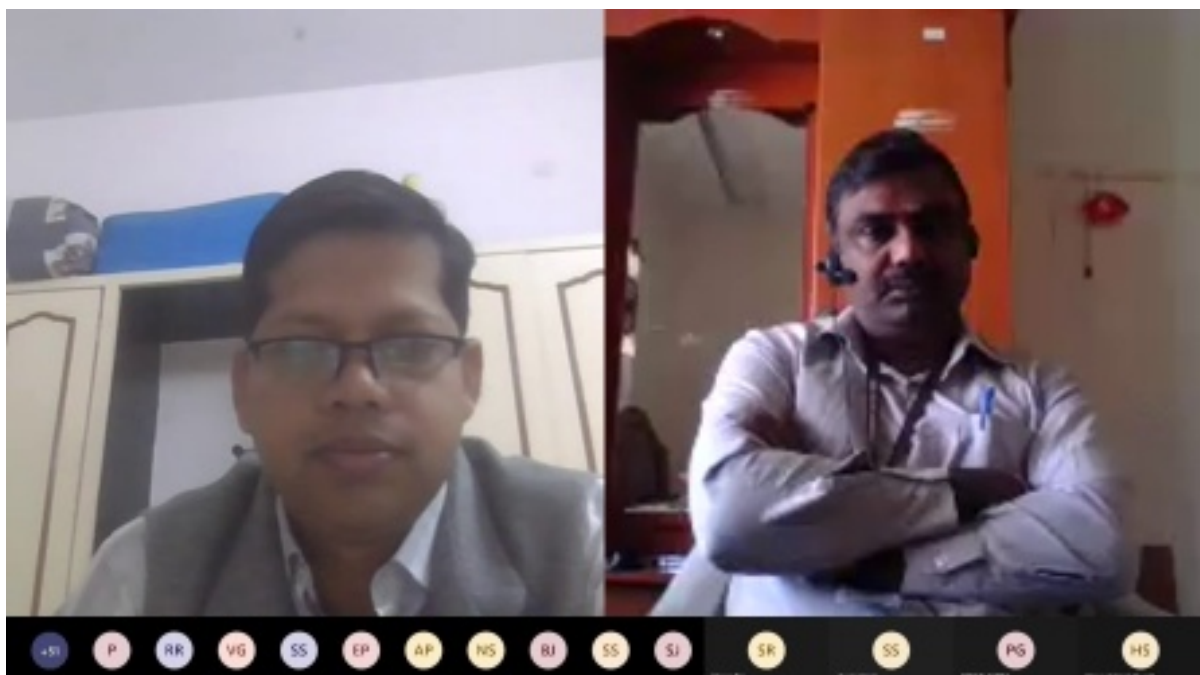
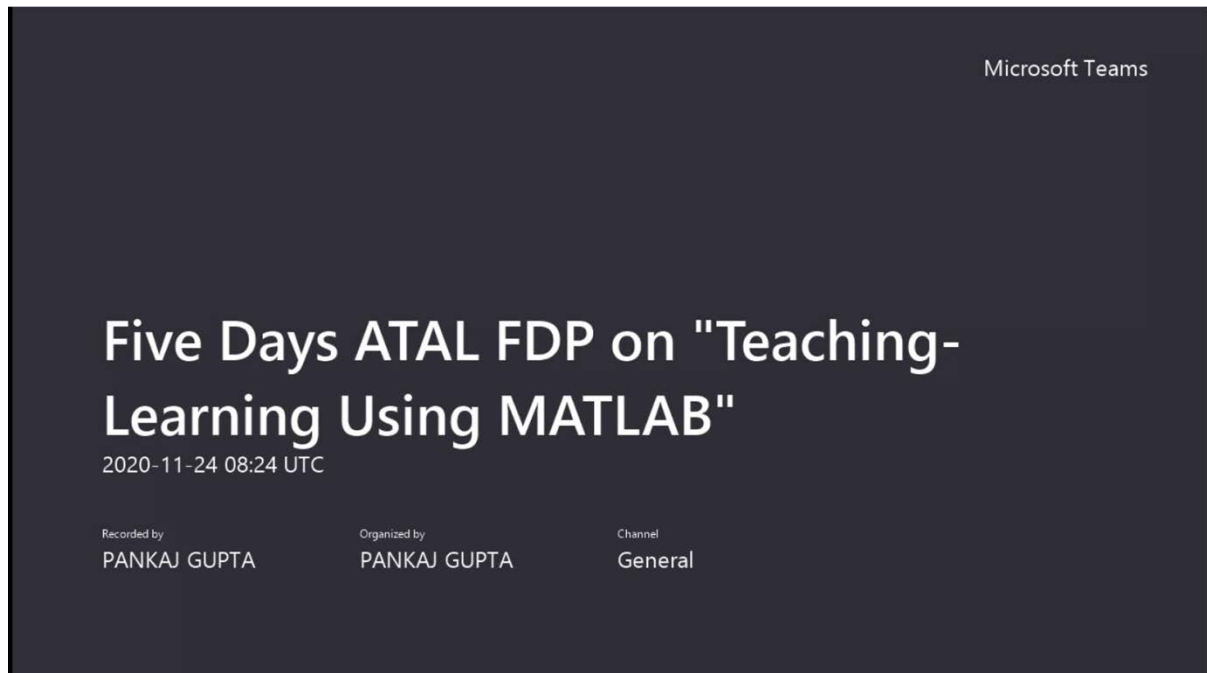
Resource Persons	Qualification	Research Interests
	B.Tech. (Electrical Engg.) M.Tech. & Ph.D. (IIT Delhi)	Power and Energy Systems, Renewable Energy
	B.E. (Electrical Engg.) M.Tech. & Ph.D. (MANIT Bhopal)	Power Electronics & Drives, Vehicular Electrification, Power Electronics Converters Multilevel Inverters
	B.E. (Mechanical Engg.) M.S.(Research) & Ph.D. (IIT Delhi)	Computational Fluid Dynamic Finite Element Method Two-Phase Flow Solar Thermal Applications

SESSION-WISE TIME SCHEDULE (FINAL):

DAY/SESSION	CONTENTS	SPEAKER
Inauguration		
9:30 – 10:00 AM		
Day 1: 24-11-2020	Introduction to MATLAB – Basic features and MATLAB Desktop Environment	Dr. R.N. Patel
Session 1 Time: 10:30 – 12:30	Syntax and Variables	
Session 2 Time: 1:30 – 3:30 PM	Matrix Operations and Applications MATLAB Graphics and Plotting	Dr. R.N. Patel
Session 3 Time: 4:00 – 6:00 PM	MATLAB in Mechanical Engineering : Introduction to Problem Solving	Dr. Pankaj K. Gupta
DAY 2: 25-11-2020	Programming in MATLAB: Control Flow, Operators and MATLAB functions	Dr. R.N. Patel
Session 1 Time: 10:00 – 12:00		
Session 2 Time: 1:30 – 3:30 PM	Introduction to SIMULINK	Dr. Lalit K. Sahu
Session 3 Time: 4:00 – 6:00 PM	MATLAB in Mechanical Engineering : Examples from Solid Mechanics	Dr. Pankaj K. Gupta
DAY 3: 26-11-2020	Debugging a MATLAB Program and Report Generation	Dr. R. N. Patel
Session 1: 9:30-11:00 AM		
Session 2 Time: 11:30 – 1:00	Basics of MATLAB Graphical User Interface (GUI)	Dr. R.N. Patel
Session 3 Time: 2:00 – 4:00 PM	MATLAB in Mechanical Engineering : Examples from Solid Mechanics	Dr. Pankaj K. Gupta
Time: 4:30 – 6:30 PM	YOGA & MEDITATION	Mr. Rajeev Nair
DAY 4: 27-11-2020	Mathematical Modeling of Systems using SIMULINK	Dr. Lalit K. Sahu
Session 1 Time: 10:00 – 12:00		
Session 2 Time: 1:00 – 3:00 PM	Physical Modeling using MATLAB-Simulink and Simulation Case Studies	Dr. Lalit K. Sahu
Session 3 Time: 3:30 – 5:30 PM	MATLAB in Mechanical Engineering : Examples Fluid & Thermal Sciences	Dr. Pankaj K. Gupta
DAY 5: 28-11-2020	MATLAB in Mechanical Engineering : Examples Using Graphical User Interface	Dr. Pankaj K. Gupta
Session 1 Time: 10:00 – 12:00		
Session 2 Time: 1:00 – 3:00 PM	MATLAB in Mechanical Engineering : Examples using Graphical User Interface	Dr. Pankaj K. Gupta
ONLINE MCQ TEST Time: 3:30 – 4:10 PM	MCQ type Test	
VALEDICTORY 4:15 – 4:45 PM	VALEDICTORY AND FORMAL CLOSING	

Inaugural and First Day Session 1

The FDP was inaugurated by Prof. T.V. Arjunan, Dean, School of Studies of Engineering and Technology, GGV Bilaspur. He shared his vast knowledge and experience and the need to enhance technology-enabled teaching-learning pedagogy. The valedictory session was chaired by him and he expressed his gratitude and congratulated one and all who contributed to the successful completion of the FDP. After the last session of the last day, a short test was held for the participants, as per the norms of AICTE ATAL Academy.



On Day 1 of the FDP, three sessions were held. The first two sessions were delivered by Dr. R. N. Patel who started with the MATLAB interface and desktop environment and gradually took the participants to MATLAB variables definition, syntax and basic features. The third Session was taken by Dr. Pankaj Kumar Gupta, who introduced the participants to the Teaching-Learning pedagogy using MATLAB with many examples from Mathematics, Mechanical, Civil, and Chemical Engineering disciplines.

DAY 1 SESSION 2

The screenshot shows a PDF document titled "Programming in MATLAB" by Ram N. Patel & Ankush Mittal, published by Pearson. The document content is as follows:

Example: Solving the system of equations

$$2x_1 + 8x_2 + 2x_3 = 26$$
$$3x_1 + 4x_2 + 6x_3 = 12$$
$$6x_1 + 2x_2 + 4x_3 = 14$$

Solution: The given system of equation can be written in matrix form as: $A \cdot X = B$

Where, $X = [x_1 \ x_2 \ x_3]^T$, A and B are given below

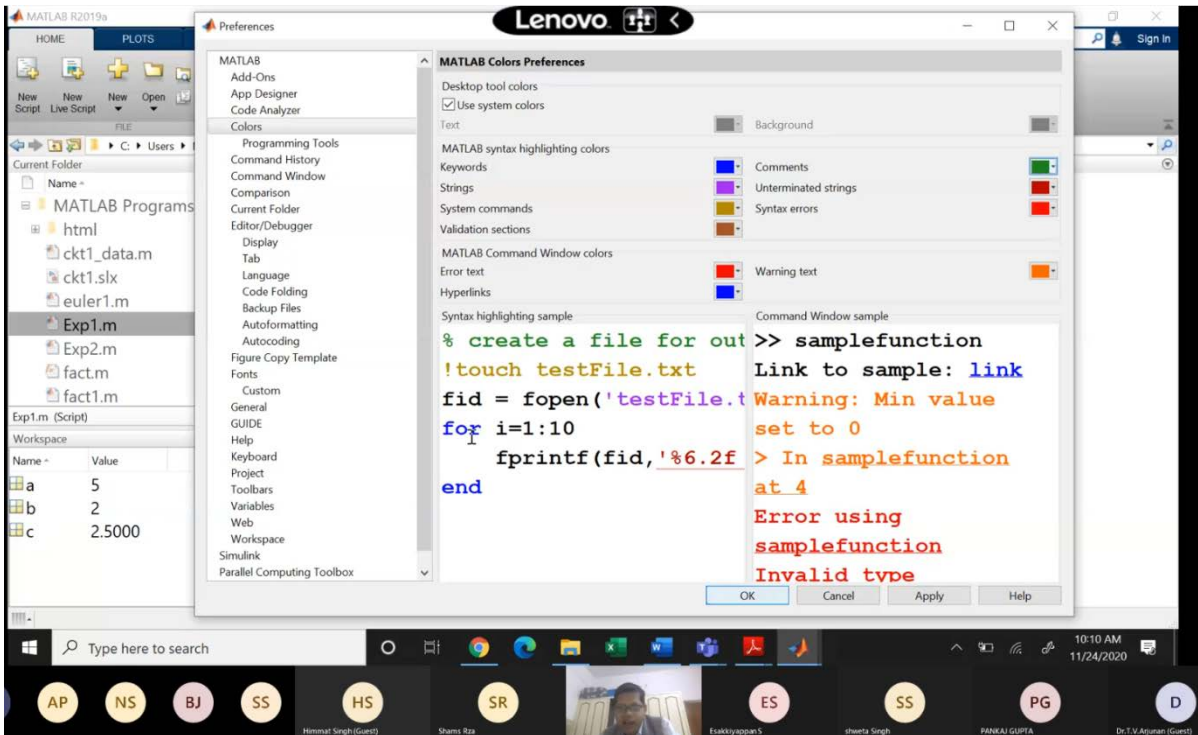
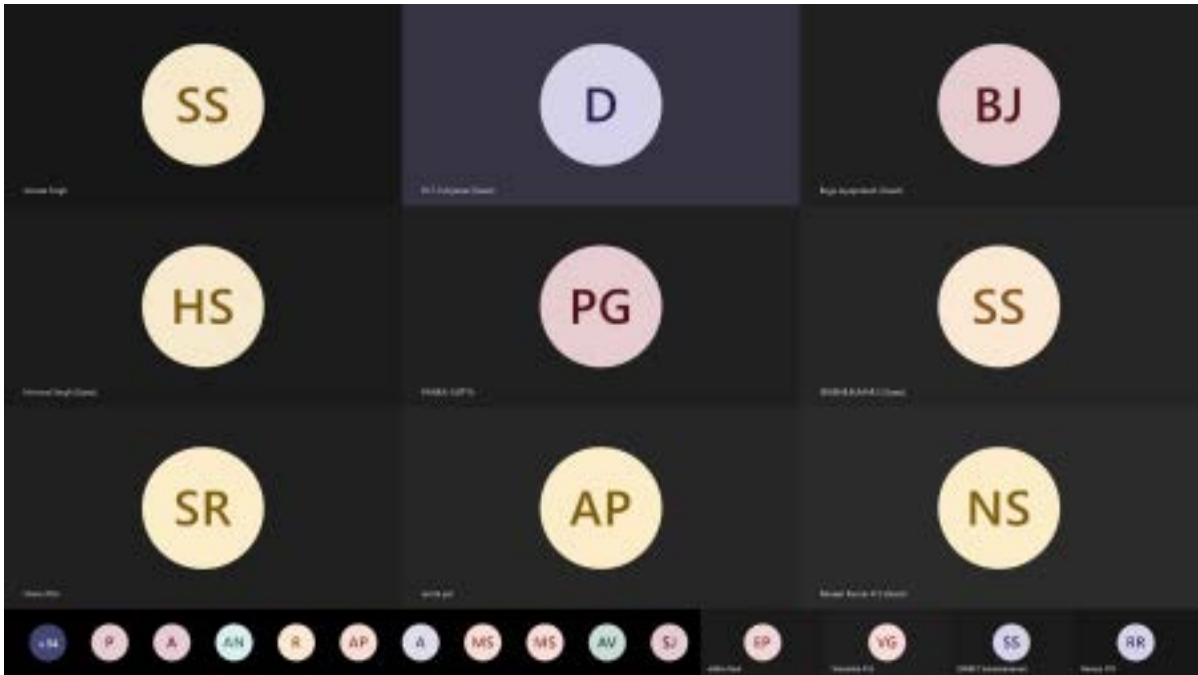
```
>> A = [2 8 2; 3 4 6; 6 2 4], B = [26 12 14]'
```

A =

2	8	2
3	4	6
6	2	4

B =

The screenshot also shows a Windows taskbar at the bottom with several application icons and a system tray displaying the time as 2:44 PM on 11/24/2020.





DAY 1 SESSION 3

A presentation slide with a white background and a yellow header. The header contains the ANTE logo on the left and the ATAL logo on the right. The main title is 'TEACHING LEARNING USING MATLAB' in large, bold, yellow and blue letters. Below the title, it lists the Coordinator: Dr. Pankaj Kumar Gupta, Associate Professor, Department of Mechanical Engineering, Guru Ghasidas Vishwavidyalaya (A Central University). The slide also features the university's circular logo and the text 'TEACHING LEARNING USING MATLAB' at the bottom. A date '11/24/2020' is visible in the bottom left corner. At the bottom of the slide, there is a black bar with circular icons for participants: 'P', 'BJ', 'SS', 'DN', 'NS', 'LP', 'SS', 'BP', 'MH', and 'C'. A small video thumbnail of a participant is visible on the right side of this bar.

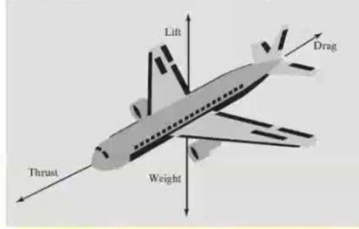


Example – Element by Element Operations.....



EXAMPLES

Example: Calculate the drag coefficient. Finally, use this experimentally determined drag coefficient to predict how much drag will be exerted on the aircraft at velocities from 0 mph to 200 mph.



(Ref: Holly Moore: MATLAB for Engineers, PEARSON, Third Edition)

Input

Drag	20,000 N
Air density ρ	$1 \times 10^{-6} \text{ kg/m}^3$
Velocity V	100 mph
Surface area A	1 m^2

Output

Drag coefficient	
Drag at velocities from 0 to 200 mph	

```
drag = 20000;
density = 0.000001;
velocity = 100*0.4470;
area = 1;
cd = drag*2/(density*velocity^2*area)
cd =
    2.0019e+007
velocity = 0:20:200;
velocity = velocity*0.4470;
```

Define the variables, and change V to SI units.

Calculate the coefficient of drag.

Redefine V as a matrix. Change it to SI units and calculate the drag.

```
drag = cd*density*velocity.^2*area/2;
table = [velocity', drag']
table =
    1.0e+004 *
         0
    0.0009    0.0800
    0.0018    0.3200
    0.0027    0.7200
    0.0036    1.2800
    0.0045    2.0000
    0.0054    2.8800
    0.0063    3.9200
    0.0072    5.1200
    0.0080    6.4800
    0.0089    8.0000
```

11/24/2020

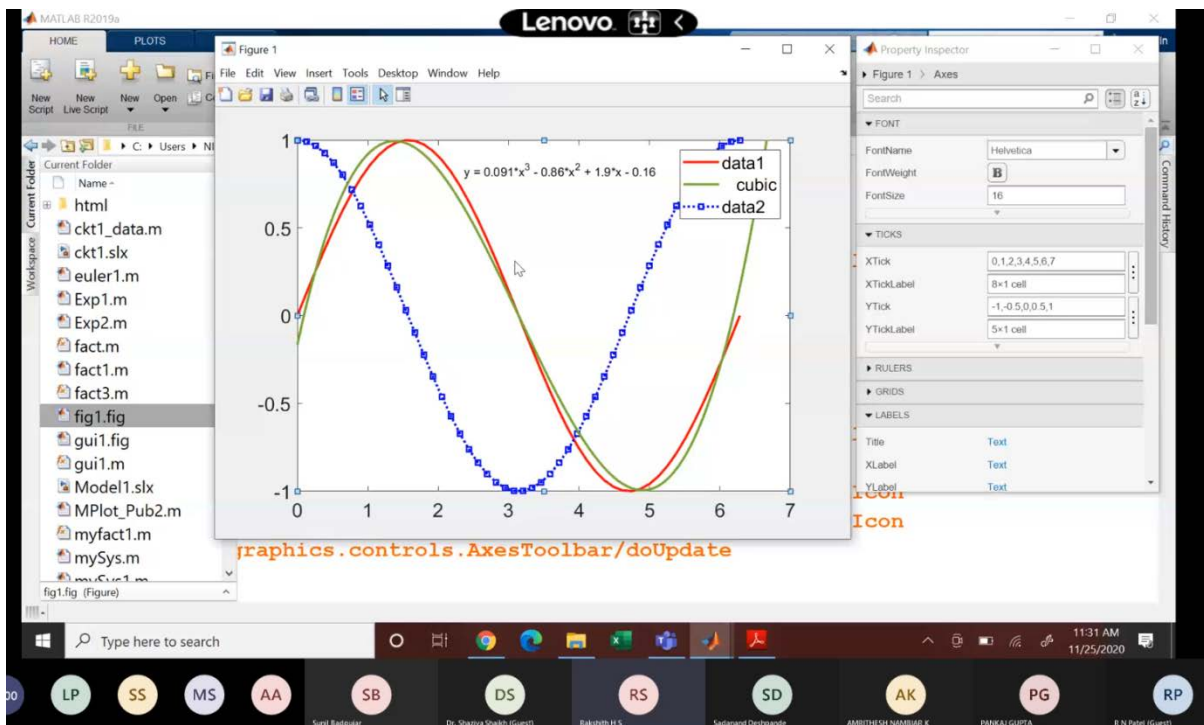
TEACHING LEARNING USING MATLAB

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DAY 2 SESSION 1

The second day of the FDP saw three sessions taken by Dr. RN Patel, Dr. Lalit Kumar Sahu and Dr. Pankaj Kumar Gupta. Dr. Patel shared his expertise in MATLAB with many basic examples and hands on exercises. Dr. Sahu introduced the participants to the wonderful feature in MATLAB – SIMULINK. The last session was taken by Dr. Gupta who demonstrated the use of MATLAB with examples from Solid Mechanics topic on Mohr's Circle.



DAY 2 SESSION 2

GETTING STARTED WITH SIMULINK

MATLAB SIMULINK®

DAY 2 SESSION 3

A biaxial stress element as shown in Figure has $\sigma_x = 40 \text{ N}$, $\sigma_y = -20 \text{ N}$, and $\tau_{xy} = 30 \text{ N}$ ccw. Use Mohr's circles to determine the principal stresses. Check the result with a numerical method.

MATLAB Coding: Adding Annotations.....

```
%% Creating and Adding Annotations on the Graph
% For adding textual matter, use TEXT
text(xc+R1/12,-txy,sprintf('A (%6.2f, %6.2f)',xc,-txy),...
     'HorizontalAlignment','left','FontSize',12); % Mark A(Sx,-txy)
text(xc-R1/12,txy,sprintf('B (%6.2f, %6.2f)',xc,txy),...
     'HorizontalAlignment','right','FontSize',12) % Mark B(Sy,txy)
text(Center1,1.1*R1,'\tau_{max}',...
     'HorizontalAlignment','center','FontSize',12) % Mark tau_max
text(Center1,-1.1*R1,'\tau_{max}',...
     'HorizontalAlignment','center','FontSize',12)
text(Center1+1.1*R1,R1/12,'\sigma_1',...
     'HorizontalAlignment','center','FontSize',12) % Mark Sigma1
text(Center1-1.1*R1,R1/12,'\sigma_3',...
     'HorizontalAlignment','center','FontSize',12) % Mark Sigma3
```

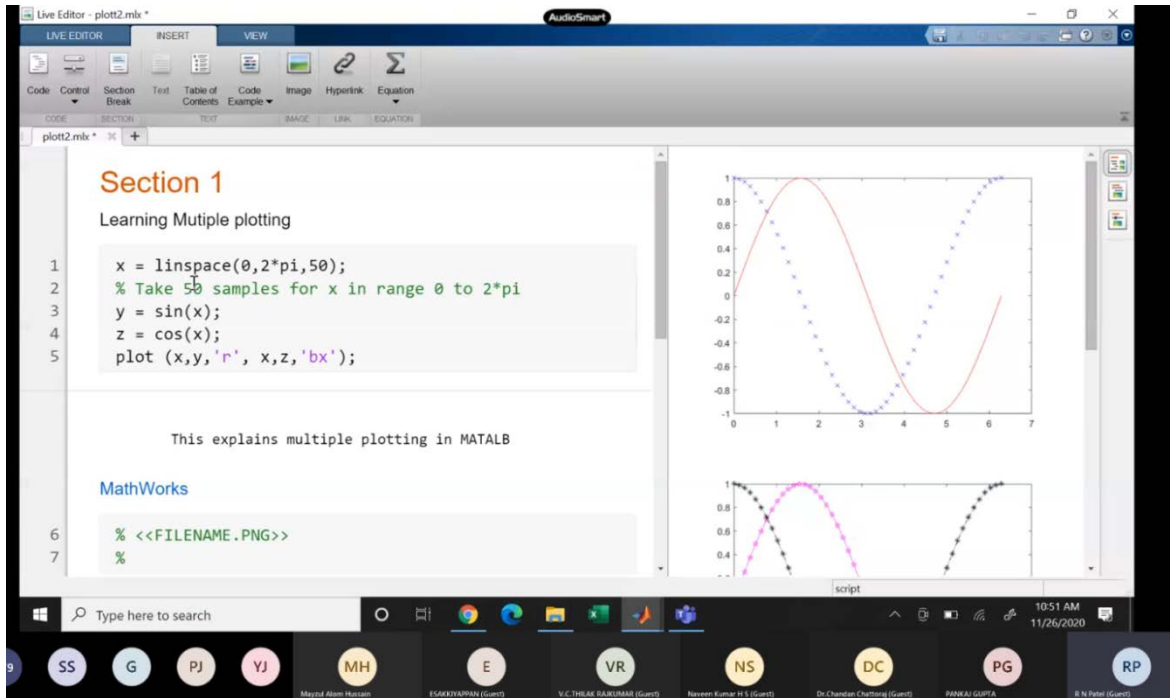
MOHR'S CIRCLE

11/25/2020 TEACHING LEARNING USING MATLAB 12

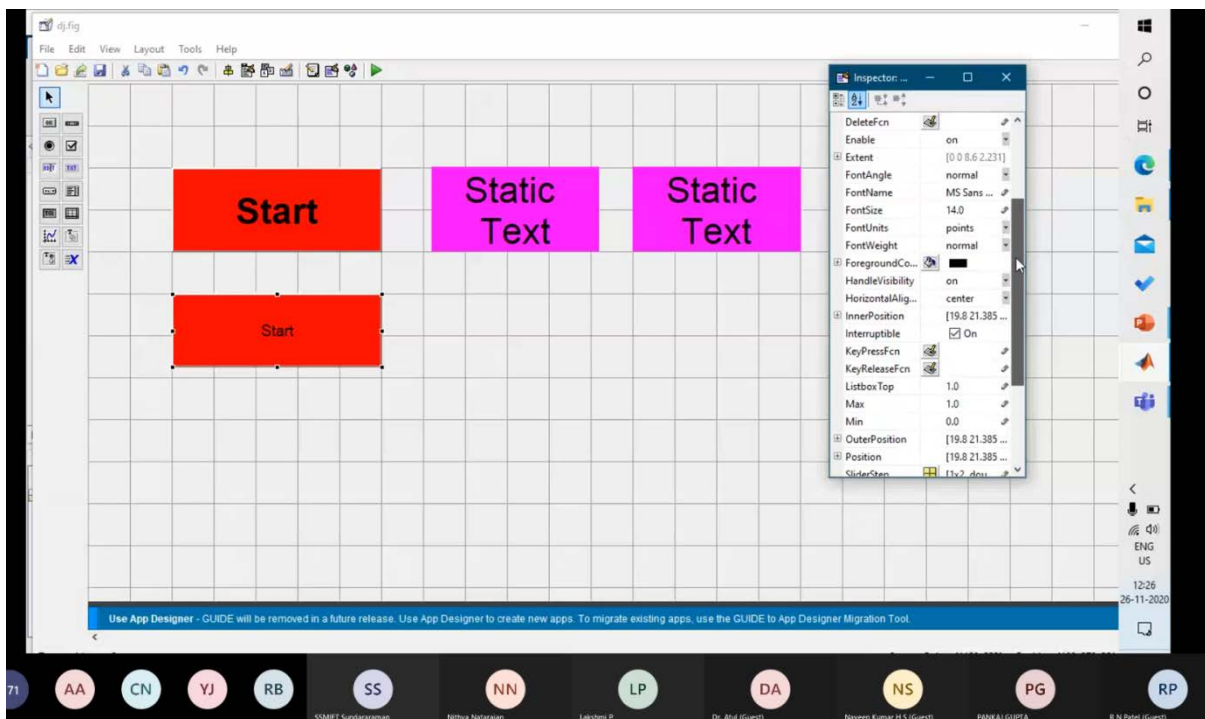
DAY 3 SESSION 1

On the third day, Dr. R.N. Patel delivered two sessions, taking the participants further into the simple constructs, loops, logic statements, arrays and plotting features available in MATLAB with examples and hands on. The third Session was

delivered by Dr. Gupta with another demonstration of teaching-learning and problem solving pedagogy using Shear Force and Bending Moment diagrams for various beams. A fourth session on this day was on “Inner Engineering using Yoga and Meditation” taken by Yoga and Meditation trainer Mr. S.K. Rajeev Nair.



DAY 3 SESSION 2



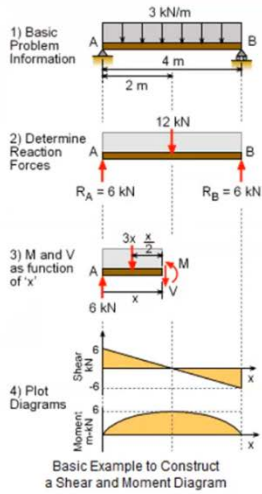
DAY 3 SESSION 3



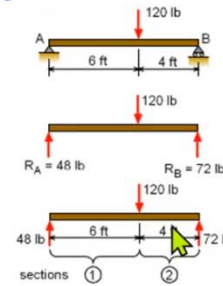
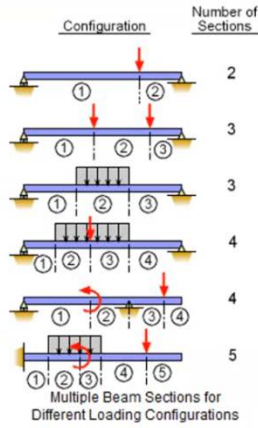
SF & BM – Conventional Method.....



SHEAR FORCE & BENDING MOMENT



General Method to Develop Shear and Moment Diagrams



11/26/2020

TEACHING LEARNING USING MATLAB

<https://www.ecourses.ou.edu/>

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HS SS CN VR SB SS LP NS KS RK PG

Sunil Badgiger SSMET Sundararaman Lakshmi P Naveen Kumar H S (Guest) Kalpesh N Shah Rashmi Kemwat (Guest) PANKAJ GUPTA

DAY 3 SESSION 4

Chhatrapati Shivaji Group of Institutions
 ANNUAL-FDP
 "Beauty of Inner [unclear] with Yoga and Meditation"
 By: S. K. Rajeev Nair - C

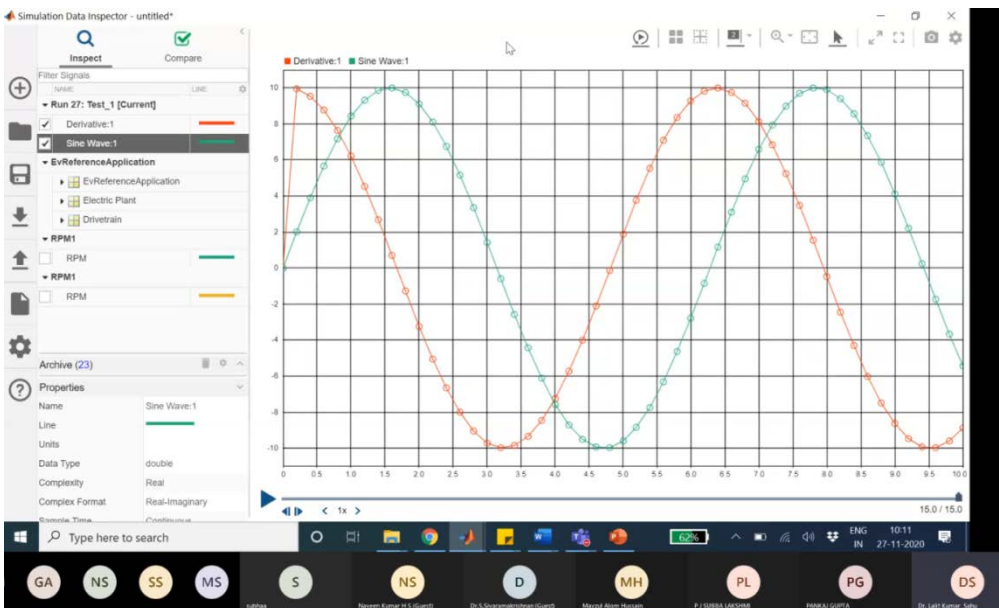
+39 SS HS P KA LP CN D HS MS AP NS KS S SS

Naveen Kumar H S (Guest) Kalpesh N Shah [unclear] (Guest) SSMET Sundararaman



DAY 4 SESSION 1

The fourth day of the FDP had three sessions taken by Dr. Lalit K. Sahu and Dr. Pankaj K. Gupta. Dr. Lalit started with simple examples on SIMULINK and how a model can be developed and tested. In his second session, he demonstrated with hands on examples and more features of SIMULINK. The third session was by Dr. Gupta, wherein different examples were shown on Fluid and Thermal Sciences with the use of MATLAB.



DAY 4 SESSION 2

Spring Mass Damper System

$F = ma$
 $F = m \frac{d^2x}{dt^2}$
 $F = kx$
 $F = c \frac{dx}{dt}$
 $F = m \frac{d^2x}{dt^2} + c \frac{dx}{dt} + kx$

$\xi > 1$ overdamped
 $\xi = 0$ critical
 $\xi < 1$ underdamped

Spring & damper

Meeting now 13:32

NS D PL DM MM PA AD AT PG DS

DAY 4 SESSION 3

Example from Fluid Mechanics – Potential Flow....

Streamlines for a cylinder with circulation in cross flow

Figure 1

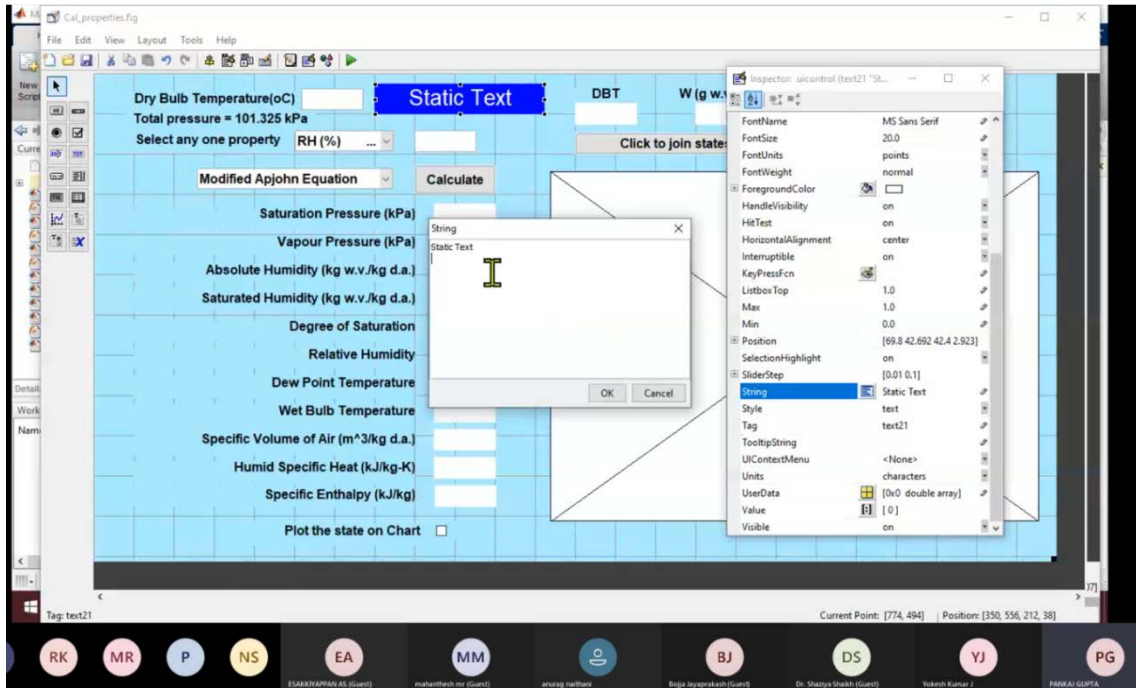
TEACHING LEARNING USING MATLAB

11/27/2020

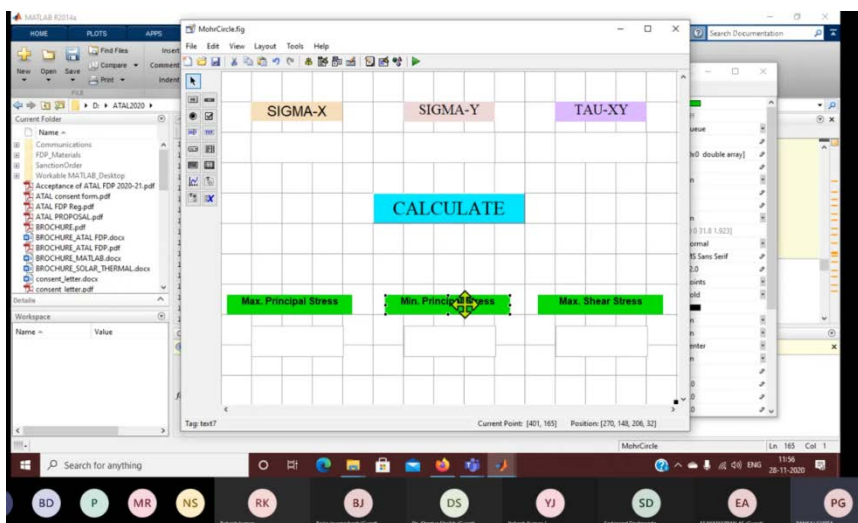
NS BD NS AM D SB VR KS PL PG

DAY 5 SESSION 1

The final day of the FDP had two sessions taken by Dr. Gupta. He gave more examples from Fluid Mechanics, Heat Transfer and Solid Mechanics courses and the relevant problem solving pedagogy using MATLAB. Few examples were also shared with the participants on the many advanced features in MATLAB and their utility in teaching-learning in problem solving pedagogy. After the sessions, an Online Test was conducted for the participants to evaluate their learning.



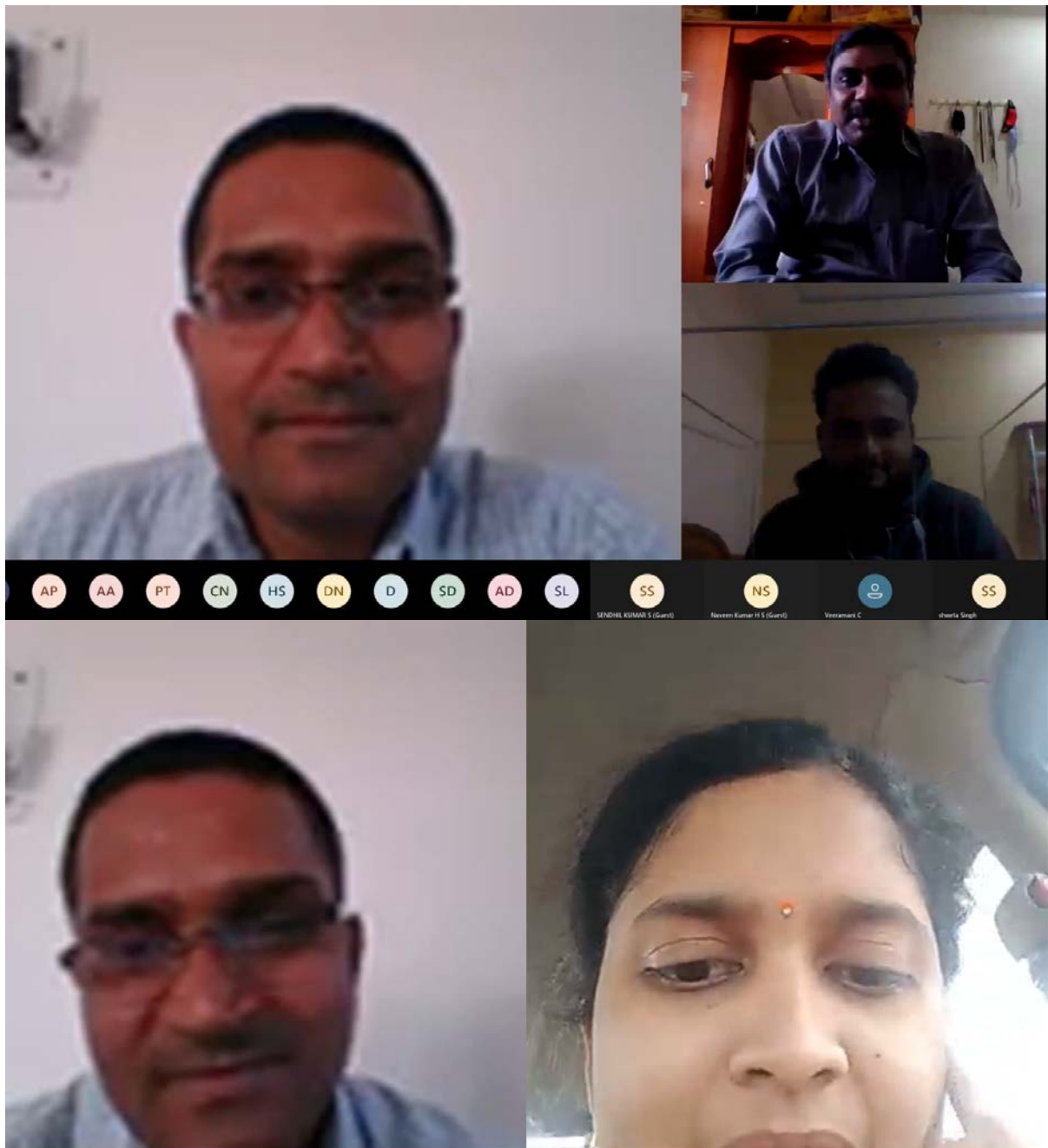
DAY 5 SESSION 2

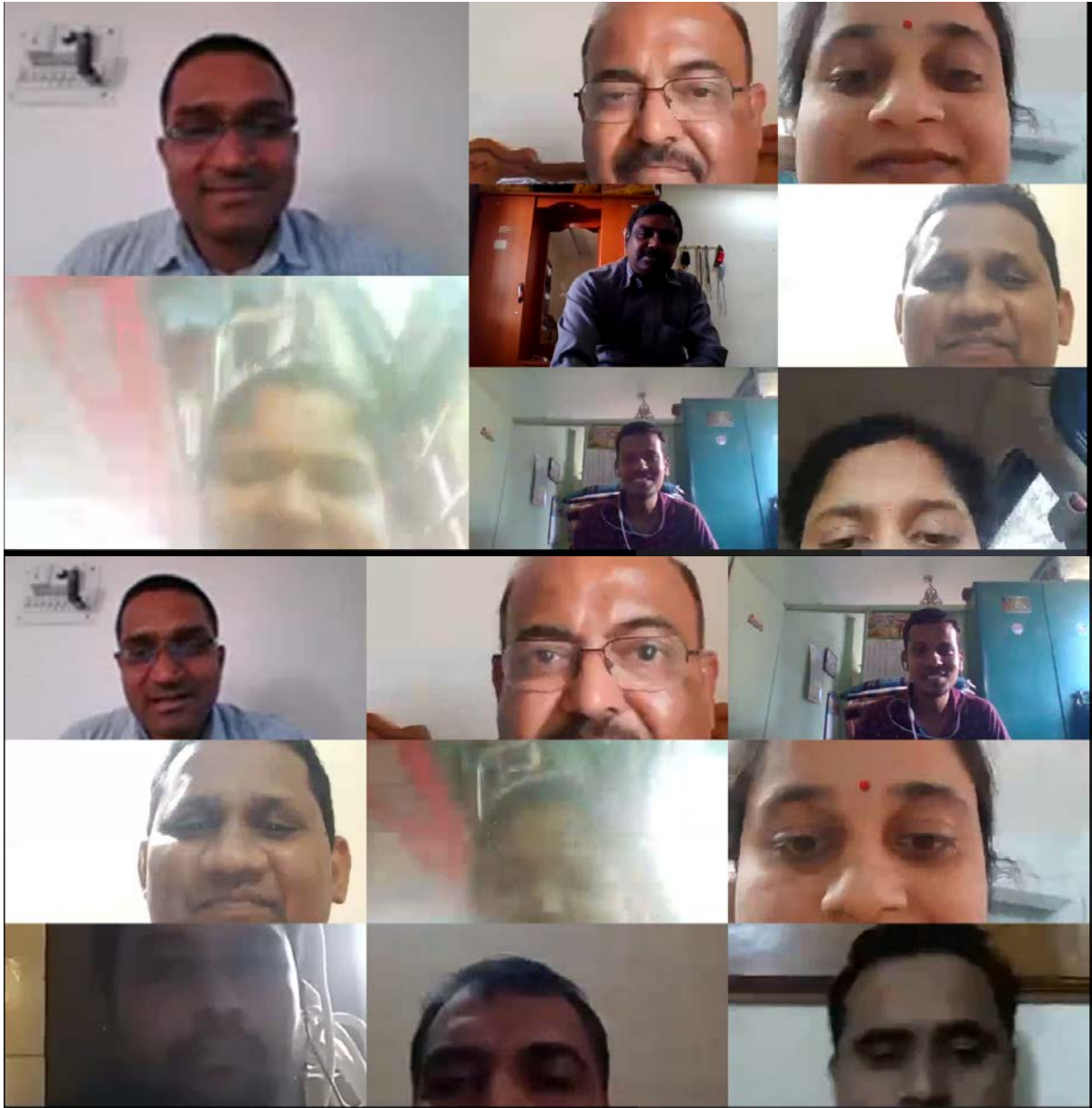


DAY 5 VALEDICTORY

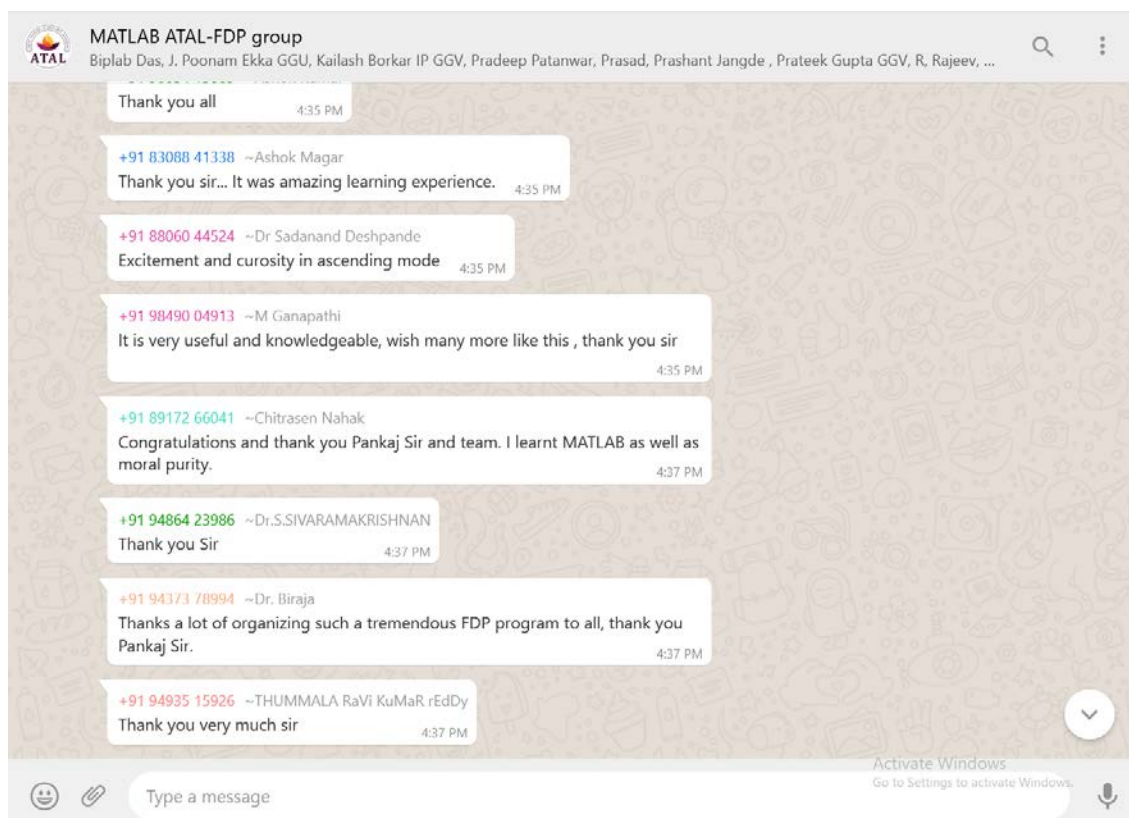
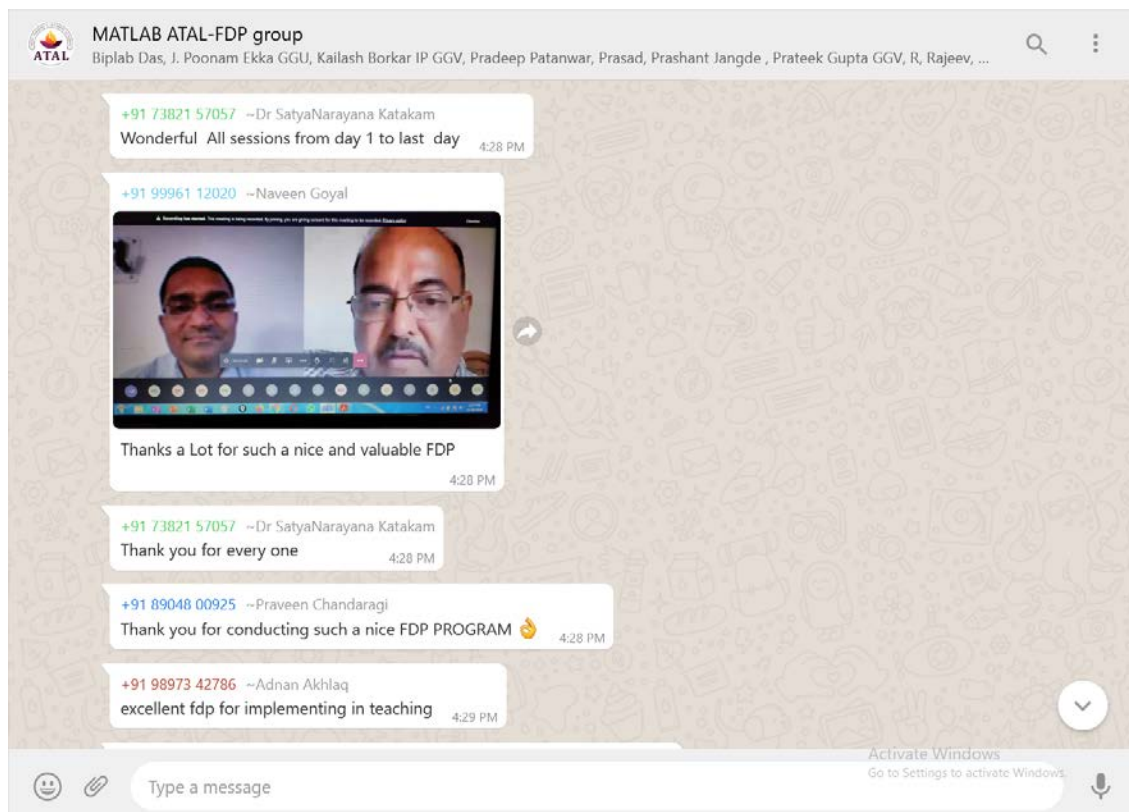
The day concluded with the Valedictory functions, chaired by Prof. T.V. Arjunan who congratulated the FDP organizing team as well as the participants, ATAL Academy and finally the Honorable Vice-Chancellor and Registrar for their support. At the end, the coordinator expressed his sincere thanks to all involved directly and indirectly in making the FDP a grand success.

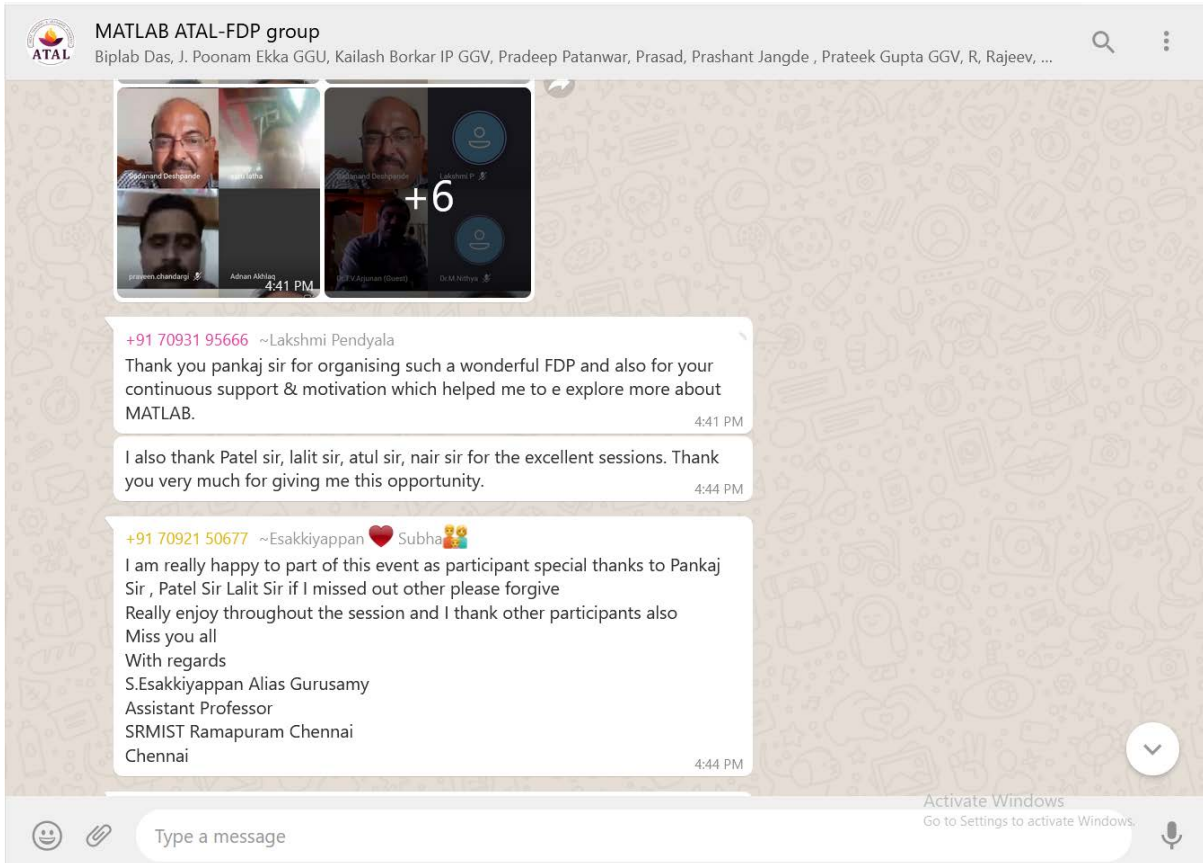
Glimpses of Valedictory on the closing day





The FDP received excellent feedback on its content and delivery, and many participants unequivocally praised that it was a unique FDP wherein everyone felt very involved and it was a focused FDP in its theme of teaching-learning.





I express my sincere thanks to ATAL Academy for sponsoring and providing the wonderful platform and opportunity for knowledge-sharing to mutually benefit everyone involved in it.