SKITM (Acropolis Technical Campus), Indore

NOTICE

January 31, 2020

Event: A three weeks (54 hours) hands-on training program on "MATLAB and Simulink with Signal Processing, Communications, Antenna and Image Processing Toolboxes".

Commencement Date: February 03-22, 2020, 01:30pm-04:00pm (daily).

Speaker: Dr. Amit Udawat (Head, ECE).

Venue: Software Lab, ECE Department.

Audience/Participants: 2nd year, 3rd year and final year students.

Program Coordinator: Prof. Anagha Chougaonkar (ECE)

Associate Coordinators: Prof. Sneha Nagar (ECE) and Prof. Abhishek Rawat (ECE).

All the faculty members not having engagements are requested to attend the programme.

31/1/2020

Dr. Amit Udawat
Head, ECE

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Department of Electronics And Communication
Shivajirao Kadam Inst. of Tech. & MGMT- Technical Campus
Tillore Khurd, Ralamandal, INDORE (M.P.)

Director
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Content and Proposal of MATLAB Training Course

A. MATLAB Fundamentals (10 hours)

This module delivers a comprehensive introduction to the MATLAB technical computing environment. Themes of data analysis, visualization, modeling, and programming are explored throughout the course. Topic includes the following:

1. **Course Overview**: Familiarization with the course.
2. **Commands**: How to enter commands to perform calculations and create variables, *store data in variables, use of built in functions and constants.*
3. **Vectors and Matrices**: How to create MATLAB variables that contain multiple elements, *how to enter and make use of arrays, create evenly spaced vectors, functions to create array.*
4. **Importing Data**: How to bring data from external files into MATLAB, *saving and loading variables, how to import tool*
5. **Indexing into and Modifying Arrays:** Use indexing to extract and modify rows, columns, and elements of arrays, *extract multiple elements, change values in arrays*
6. **Array Calculations**: Perform calculations on arrays, vectors
7. **Calling Functions**: Use and Call functions to obtain multiple outputs.
8. **Obtaining Help**: Use the MATLAB documentation to discover information about MATLAB features.
9. **Plotting Data**: Use plotting functions, plotting vectors, annotating plots
10. **MATLAB Scripts**: Write and save MATLAB programs in MATLAB Editor
11. **Logical Arrays**: Use logical expressions to extract elements of interest from MATLAB arrays, *Logical Operations and Variables, Combining Logical Conditions, Logical Indexing*
12. **Programming**: Write programs that execute code based upon some condition, *Decision branching, Looping -operations.*

B. Signal Processing Toolbox (10 hours)

This module delivers aspects of analyzing signals and designing signal processing systems using MATLAB and Signal Processing Toolbox. Parts of the module also use DSP System Toolbox. Topic includes the following:

1. **Creating and analyzing signals**: Using Signal Analyzer App
    a. Visualize, measure, analyze, and compare signals in the time, frequency, and time-frequency domains.
    b. Extract voices from a song by duplicating and filtering signals.
2. **Preprocess Signals:** Synchronize data collected by different sensors at different instants.
    a. Determine if a signal matches a segment of a noisy longer stream of data.
    b. Locate the local maxima in a set of data and determine if those peaks occur periodically.
    c. Determine how often and how sharply a bi-level signal turns on and off.

3. **Perform Spectral and Time-Frequency Analysis:** Power spectrum, coherence, windows
    a. Find Periodicity Using Frequency Analysis: Spectral analysis helps characterize oscillatory behavior in data and measure the different cycles.
    b. Find and Track Ridges Using Reassigned Spectrogram: Use the reassigned spectrogram in Signal Analyzer to sharpen the time and frequency localization of spectrograms.
4. **Designing and analyzing filters**: How to design, observe and analyze filter characteristics (adaptive and multi-rate filters).
5. **Signal Generation and Preprocessing:** Create, resample, smooth, denoise, and detrend signals
6. **Measurements and Feature Extraction:** Locate Peaks, signal statistics, pulse and transition metrics, power, bandwidth, distortion
7. **Correlation and Convolution:** Performs Cross-correlation, autocorrelation, cross-covariance, auto-covariance, linear and circular convolution
8. **Digital and Analog Filters:** FIR and IIR, single-rate and multirate filter design, analysis, and implementation
9. **Transforms:** Fourier, chirp Z, DCT, Hilbert, cepstrum, Walsh-Hadamard
10. **Signal Modeling:** Linear prediction, autoregressive (AR) models, Yule-Walker, Levinson-Durbin

C. Communications Toolbox (10 hours)

This module provides algorithms and apps for the analysis, design, end-to-end simulation, and verification of communications systems. Algorithms include channel coding, modulation, MIMO, and OFDM to compose and simulate a physical layer model of wireless communications system. Topic includes the following.

1. **Simulating a Communications Link:** Simulating a communications system using toolbox functions and blocks
2. **Waveform Generation:** Using Wireless Waveform Generator App-Create, impair, visualize, and export modulated waveforms.
3. **Visualization and Measurements:** Using Scatter Plot and Eye Diagram with MATLAB Functions
4. **PHY Subcomponents:** Physical layer subcomponents including waveform generation, modulation, error control coding, filtering, synchronization, equalization, MIMO.
5. **RF Modeling:** Model RF impairments and RF front end designs.
6. **Propagation Channel Models:** Model and visualize noisy SISO and MIMO channels having Rayleigh, Rician, fading profiles, and atmospheric impairments. Multiple Doppler spectrum shapes are analyzed.
7. **Measurements, Visualization, and Analysis:** Use graphical utilities such as constellation and eye diagrams to visualize the effects of various impairments and corrections for measuring system performance.
8. **End-to-End Simulation:** Simulate link-level models of communications systems using bit error rate simulations. Analyze system response to the noise and interference inherent

in communication channels, and evaluate the tradeoffs between competing system architectures and parameters.

D. Antenna Toolbox (8 hours)

This module provides fundamentals on Design, analyze, and visualize antenna elements and antenna arrays. It provides functions and apps for the design, analysis, and visualization of antenna elements and arrays. One can design standalone antennas and build arrays of antennas using either predefined elements with parameterized geometry or arbitrary planar elements.

It uses the method of moments (MoM) to compute port properties such as impedance, surface properties such as current and charge distribution, and field properties such as the near-field and far-field radiation pattern. One can visualize antenna geometry and analysis results in 2D and 3D.

One can integrate antennas and arrays into wireless systems and use impedance analysis to design matching networks. It provides radiation patterns for simulating beam forming and beam steering algorithms. Gerber files can be generated from your design for manufacturing printed circuit board (PCB) antennas. One can install the antennas on large platforms such as cars or airplanes and analyze the effects of the structure on antenna performance. A site viewer enables one to visualize antenna coverage on a 3D terrain map using a variety of propagation models. Topic includes the following.

1. **Introduction to Antenna Toolbox**
2. **Antenna Catalog:** Antenna elements, backing structures, parameterized geometry visualization, antenna design, dielectrics
3. **Array Catalog:** Finite and infinite arrays, layout visualization
4. **PCB Fabrication and Custom Geometry:** Shapes and Boolean operations, custom mesh and geometry, PCB stack, Gerber file generation
5. **Analysis, Benchmarking, and Verification:** Antenna and array analysis, meshing, solvers, comparison of Antenna Toolbox simulations with measured results
6. **Import, Export, and Visualization:** Read, visualize, and write STL files and MSI planet antenna files, measure pattern data in 2D and 3D, create interactive polar plots
7. **Installed Antenna and Large Structures:** Antennas on platforms, infinite arrays, and infinite ground planes
8. **RF Propagation:** Site and terrain visualization, propagation model specification, communication links, signal strength, signal coverage maps.

E. Image Processing Toolbox (8 hours)

This module provides fundamentals on image processing, visualization, and analysis. It provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization, and algorithm development. One can perform image segmentation, image enhancement, noise reduction, geometric transformations, and image registration using deep

learning and traditional image processing techniques. It supports processing of 2D, 3D, and arbitrarily large images.

It let you automate common image processing workflows. One can interactively segment image data, compare image registration techniques, and batch-process large datasets. Visualization functions and apps let you explore images, 3D volumes, and videos; adjust contrast; create histograms; and manipulate regions of interest (ROIs).

One can accelerate your algorithms by running them on multicore processors and GPUs. Many toolbox functions support C/C++ code generation for desktop prototyping and embedded vision system deployment. Topic includes the following.

1. **Introduction:** Learn the basics of Image Processing Toolbox
2. **Import, Export, and Conversion:** Image data import and export, conversion of image types and classes
3. **Display and Exploration:** Interactive tools for image display and exploration
4. **Geometric Transformation and Image Registration:** Scale, rotate, perform other N-D transformations, and align images using intensity correlation, feature matching, or control point mapping
5. **Image Filtering and Enhancement:** Contrast adjustment, morphological filtering, deblurring, ROI-based processing
6. **Image Segmentation and Analysis:** Region analysis, texture analysis, pixel and image statistics
7. **Deep Learning for Image Processing:** Perform image processing tasks, such as removing image noise and creating high-resolution images from low-resolutions images, using convolutional neural networks (requires Deep Learning Toolbox™)
8. **3-D Volumetric Image Processing:** Filter, segment, and perform other image processing operations on 3-D volumetric data
9. **Code Generation:** Generate C code and MEX functions for toolbox functions
10. **GPU Computing:** Run image processing code on a graphics processing unit (GPU)

F. Simulink (8 hours)

This module covers multi-domain simulation and Model-Based Design with support of system-level design, simulation, automatic code generation, and continuous test and verification of embedded systems. It provides a graphical editor, customizable block libraries, and solvers for modeling and simulating dynamic systems. Integrated with MATLAB with incorporation of MATLAB algorithms into models and export simulation results to MATLAB for further analysis.

1. **Model based design with Simulink:** Defining the system and Layout with modeling and validation
2. **Simulink Environment Fundamentals:** Building block diagrams interactively or programmatically by choosing blocks from block libraries. Connecting blocks using signal links to establish mathematical relationships between system components.
3. **Modeling:** Model-Based Design of dynamic systems, model algorithms and physical systems using block diagrams. Model linear and nonlinear systems, factoring in real-

world phenomena such as friction, gear slippage, and hard stops. Build discrete components that reflect real-life system and simulate the interaction of those components.

4. **Simulation:** Interactively simulate system model, run models, review results, validate system behavior. Range of fixed-step and variable-step solvers are chosen for continuous, discrete, and mixed-signal systems. Solvers are integration algorithms that compute system dynamics over time.
5. **Project Management:** Create projects, manage shared model components, interact with source control

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SKITM, Indore

Department of Electronics & Communication

Add on Course on " MATLAB"

Session Plan

S.No.	Topics	Session Duration(Hours)
1	Course Overview: Familiarization with the course.	
2	Commands: How to enter commands to perform calculations and create variables, store data in variables, use of built in functions and constants.	3 Hours
3	Vectors and Matrices: How to create MATLAB variables that contain multiple elements, how to enter and make use of arrays, create evenly spaced vectors, functions to create array.	
4	Importing Data: How to bring data from external files into MATLAB, saving and loading variables, how to import tool	
5	Indexing into and Modifying Arrays: Use indexing to extract and modify rows, columns, and elements of arrays, extract multiple elements, change values in arrays	3 Hours
6	Array Calculations: Perform calculations on arrays, vectors	
7	Calling Functions: Use and Call functions to obtain multiple outputs.	
8	Obtaining Help: Use the MATLAB documentation to discover information about MATLAB features.	3 Hours
9	Plotting Data: Use plotting functions, plotting vectors, annotating plots	
10	MATLAB Scripts: Write and save MATLAB programs in MATLAB Editor	
11	Logical Arrays: Use logical expressions to extract elements of interest from MATLAB arrays, Logical Operations and Variables, Combining Logical Conditions, Logical Indexing	3 Hours
12	Programming: Write programs that execute code based upon some condition, Decision branching, Looping -operations.	
13	Creating and analyzing signals	
14	Preprocess Signals	3 Hours
15	Perform Spectral and Time-Frequency Analysis	
16	Designing and analyzing filters:	
17	Signal Generation and Preprocessing	3 Hours
18	Measurements and Feature Extraction	
19	Correlation and Convolution	
20	Digital and Analog Filters	3 Hours
21	Transforms	
22	Signal Modeling	
23	Simulating a Communications Link: Simulating a communications system using toolbox functions and blocks	3 Hours
24	Waveform Generation	

25	Visualization and Measurements	3 Hours
26	PHY Subcomponents	
27	RF Modeling	
28	Propagation Channel Models	3 Hours
29	Measurements, Visualization, and Analysis	
30	End-to-End Simulation	
31	Introduction to Antenna Toolbox	3 Hours
32	Antenna Catalog	
33	Array Catalog	
34	PCB Fabrication and Custom Geometry	3 Hours
35	Analysis, Benchmarking, and Verification	
36	Import, Export, and Visualization	
37	Installed Antenna and Large Structures	3 Hours
38	RF Propagation	
39	Introduction: Learn the basics of Image Processing Toolbox	
40	Import, Export, and Conversion	3 Hours
41	Display and Exploration	
42	Geometric Transformation and Image Registration	
43	Image Filtering and Enhancement	3 Hours
44	Image Segmentation and Analysis	
45	Deep Learning for Image Processing	
46	3-D Volumetric Image Processing	3 Hours
47	Code Generation	
48	Model based design with Simulink	
49	Simulink Environment Fundamentals	1 hour
50	Modeling	
51	Simulation	1 hour
52	Project Management	
	TOTAL	**50 HOURS**

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Course Coordinator

Director
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Approved By:
Dr. Amit Udawat
H.O.D. ECE

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A hands-on training program on "MATLAB and Simulink with Signal Processing, Communications, Antenna and Image Processing Toolboxes".

Name	3/2/2020	4/2/2020	5/2/2020	6/2/2020	7/2/2020	8/2/2020	10/2/2020	11/2/2020	12/2/2020	13/2/2020	14/2/2020	15/2/2020	17/2/2020	18/2/2020	19/2/2020	20/2/2020	21/2/2020	22/2/2020
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H SAINI																		
UMAR																		

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Shivajirao Kadam Institute of Technology & Management, Indore

Department of Electronics & Communication Engineering

Certificate

This is to certify that Mr./Ms. **RIMJHIM** has attended Training Session on **"MATLAB and Simulink with Signal Processing, Communications, Antenna and Image Processing Toolboxes""** Organized by Department of Electronics & Communication Engineering SKITM, Indore

Dr. Sanjay T. Purkar
Director SKITM

Dr. Amit Udawat
Head of Department

Mrs. Anagha
Coordinator

Shivajirao Kadam Institute of Technology & Management, Indore

Department of Electronics & Communication Engineering

Certificate

This is to certify that Mr./Ms. **SAKSHAM TRIVEDI** has attended Training Session on **"MATLAB and Simulink with Signal Processing, Communications, Antenna and Image Processing Toolboxes""** Organized by Department of Electronics & Communication Engineering SKITM, Indore

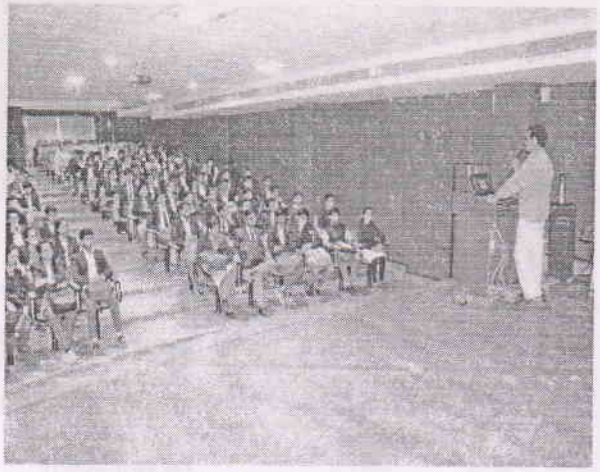
Dr. Sanjay T. Purkar	**Dr. Amit Udawat**	**Mrs. Anagha**
Director SKITM	**Head of Department**	**Coordinator**

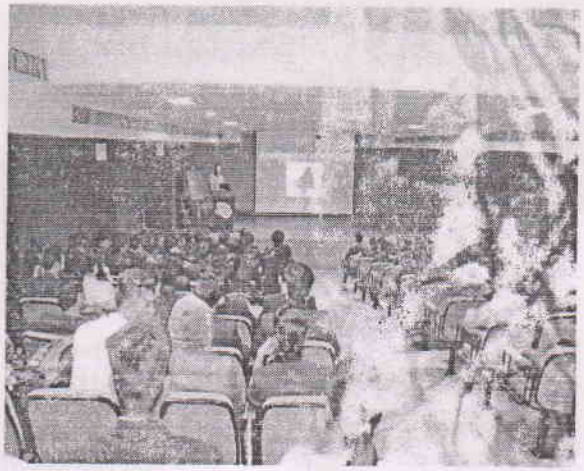
SKITM Technical Campus, Indore

Department of Electronics and Communication Engineering

Report on Training/Workshop on MATLAB Applications (Day 1)

A three week training/workshop program on MATLAB Applications is organized in Electronics and Communication Engineering (ECE) department from February 03, 2020. Dr. Amit Udawat was the instructor. He started with the comprehensive introduction to the MATLAB technical computing environment. He elaborated on Introduction to MATLAB and its applications in academics and industry, need of MATLAB in research in the present domains of Electronics and Communication Engineering, Mechanical Engineering and Computer Science Engineering. Learning MATLAB can open the door for many jobs in robotics, automation, automobile industries, aerospace, data science, data analysis, Python, Java, and more. Students from 1st year, 2nd year and 3rd year participated in the training. Prof. Anagha Chougaonkar coordinated the event.





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