Pool of Generic Electives (GE) offered by Department of Electronic Sciences in Instrumentation

Category-IV

GENERIC ELECTIVES (GE-2A): **MATLAB and its Applications**

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
MATLAB and its Applications	4	2	0	2	None	None	Electronic Science

Learning Objectives

- To learn to interact and perform the computations on MATLAB
- To plot the functions using various types of plot command
- To understand the difference between the functions & Scripts in MATLAB
- To familiarize with the fundamentals of digital image and signal processing

Learning outcomes

After completion of the course, students will be able to-

Interact with MATLAB for various computations
Generate plots and its use in reports
Familiar with inbuilt MATLAB functions and will be able to create user defined Functions and write scripts for various applications
Understands fundamental of digital image and signal processing

SYLLABUS

Unit-1 **(06 Hours)**

Introduction to MATLAB: MATLAB features, MATLAB Windows, defining variables, formatting output, types of operators, different operations on variables, checking existence, clear
Operations, data type, precedence.

Unit-2 **(08 Hours)**

Introduction to Arrays: Defining scalars, vectors, matrix, multi-dimensional arrays, different Operations (mathematical, logical, and relational) on array, reshaping matrices, importing & exporting of data.

Character and Strings: Defining character and string, accessing character or substring from string, string concatenation and comparing, conversion between strings and number. Defining and working with cell arrays.

Data Plotting: Graph, plot, types of plot, multiple plots, labeling graph, line colors, style and Marker.

Unit-3 **(08 Hours)**

Script and Function M File: M-file, writing script files, writing functions, error correction, saving files. Flow control statement: Conditional or selection, error handling, loop control, program termination.

Unit-4 **(08 Hours)**

Signal Processing: Generation of continuous time & discrete time signal, time shift, time scaling, amplitude scaling of signal. Generation of amplitude modulated signal, frequency modulated signal Image processing: Study of basic tools of Image Processing, Image segmentation, restoration, histogram processing, changing color of image.

Practical component (if any) - MATLAB and its Applications Lab- 60 Hours

1. Define variables, create a matrix of any size with all possible methods and perform various mathematical operations.
2. Create a multidimensional array and delete any Row/Column from it and create a new array.
3. Plot and label all the trigonometric functions using the subplot command.
4. Generate various kinds of continuous and discrete time signals. Plot them with different color, line style and markers and label the graph.
5. Generate various kinds of continuous and discrete time signals. Perform time scaling, time shifting and amplitude scaling on them.
6. Generate the (i) square wave and (ii) triangular wave of a specific amplitude and time period and plot it on a single graph.
7. Define a string and count the number of vowels, spaces and consonants in it. Also mention the size and length of the string.
8. Write a script to remove (i) all the alphabets from the alphanumeric string, (ii) all the spaces from a string.

9. Create a function which compares any two strings of equal length and return 'M' for matched character and 'U' for unmatched Character. Also display the number of characters matched.
10. Generate the (i) AP, (ii) GP and (iii) Fibonacci series.
11. Write a script to test whether a user defined no. is Prime or not.
12. Write a script which can evaluate the percentage (%) and grade of the student when subject marks are entered by the user.
13. Write a script to generate the amplitude and frequency modulated signal.
14. Create a function to change the colors of user defined images.

Essential/recommended readings

1. Khanna, M., Bhatt, G. and Kumar, P., MATLAB Essentials for Problem Solving, PHI Learning, New Delhi.
2. Mathews, J.H. and K.D. Fink, Numerical Methods Using MATLAB - Third Edition, Prentice Hall, Upper Saddle River, New Jersey.
3. Linfield, G. & Penny, J., Numerical methods using MATLAB, Ellis- Horwood.
4. Van Loan, C.F., Introduction to Scientific Computing - A Matrix-Vector Approach Using MATLAB, Prentice Hall, Upper Saddle River, New Jersey.
5. Nakamura, S., Numerical Analysis and Graphic Visualization with MATLAB - Second Edition, Prentice Hall PTR, Upper Saddle River, New Jersey

GENERIC ELECTIVES (GE-2B): **Sensors and its Applications**

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/ Practice		
Sensors and its Applications	**4**	**3**	**0**	**1**	**Class XII pass with Science**	**Nil**

Learning Objectives

- To understand the operation of commonly used sensors and actuators.
- To be able to analyze and select most appropriate sensors or actuators for an application.
- To analyze characteristics of sensors and actuators by knowing their basic laws and processes.

Learning outcomes

After completion of the course, students will be able to-

Identify and comprehend various sensors used in the real-life applications and paraphrase their importance.

Classify and explain with examples the utilization of sensors for measurement of temperature, strain, motion, position and light in the industry.

Understand the role of sensors and actuators to make sensitive measurements of physical parameters like pressure, flow, acceleration, velocity etc.

SYLLABUS

Unit 1 **(12 Hours)**

Mechanical and Electromechanical sensor: Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, Applications of electromechanical sensor: Human motion monitoring, Human health monitoring, Speech recognition, Human-machine interface

Unit 2 **(12 Hours)**

Transducers: Classification, Active and Passive. Principle, working and applications of following types: Resistive (Strain Gauge): Theory, type, materials, design consideration, sensitivity, gauge factor, Capacitive, Inductive (LVDT), Piezoelectric, Light (LDR), Temperature (RTD, Thermocouple, Thermistor). Magneto strictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type.

Unit 3 **(12 Hours)**

Flow meters, mechanical type: theory of variable head type flow meters-orifice plate, venturi tube, flow nozzle, Positive displacement flow meters. Rota meter: thermal mass flow meter, Principle and constructional details of electromagnetic flow meter, different types of ultrasonic flow meters.

Unit 4 **(9 Hours)**

Tachometers: Mechanical, Electric, Contact less, Frequency, Stroboscopic tachometers, Manometers: different types – elastic type pressure gauges, Bourdon type bellows, diaphragms.

Practical component (if any) - Sensors and its Applications Lab- 30 Hours

1. Measurement of pressure, strain and torque using strain gauge.
2. Measurement of displacement using LVDT.
3. Measurement using load cells.
4. Measurement using capacitive transducer.
5. Measurement using inductive transducer.
6. Measurement of temperature using Temperature Sensors.
7. Characteristics of Hall effect sensor.

8. Measuring change in resistance using LDR
9. Discharge coefficient of orifice plate.
10. Measurement of flow using E.M. flow meter.
11. Measurement of flow using Ultrasonic flow meter.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than seven.

Essential/recommended readings

1. A.K Sawhney, A course in mechanical measurements and instrumentation, Dhanpat Rai& Co, 12th edition, 2001.
2. R.K. Jain, Mechanical and Industrial Measurements, Tata McGraw Hill, New Delhi, 1996, 11th edition.
3. A.K. Sawhney, Electrical & Electronic Measurements & Instrumentation, 19th revised edition, 2012
4. Nakra& Choudhary, Instrumentation measurements and analysis, Tata McGraw Hill, 2nd edition, Revised 2016-2017

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.