Malaviya National Institute of Technology Jaipur
Department of Electrical Engineering

Sheet No. 1A

1. Use MATLAB to make the following calculations with values x=5 and y=2. Verify the results with a calculator.
   (a) U=3x/2y
   (b) 3/2(xy)
   (c) $w=xy^3/(x-y)$
   (d) $p=x^3/(x^2+y^2+1)$
   (e) q=x.sin(y)*y.sin(x/5)

2. Evaluate $(e^x + e^{-x})/2$ for x=2 using MATLAB. Enter the value of x before you write expression

3. Do the following operation using MATLAB.
   (a) Create a vector y having a regular spacing of 0.25 between 3 and 11, using the *colon notation(:)* and the using *linspace* command.
   (b) Create a vector z having 20 regularly spaced values starting at -5 and ending at -5, using the *colon notaton (:)* and *linspace* command.
   (c) Create a vector u having 50 logarithmically equally spaced values starting at 10 and ending at 1000.

4. Write a MATLAB code to take the names of two students, truncate them to the length of one with lesser number of characters, and then compare them to decide which one comes first in the alphabetic list.

5. What will be the output of the following commands-
   (a) A=[1, 2 ; 3, 4]
   B=[A 2*A]
   (b) A(1 , :)
   (c) B(: , 2)
   (d) E=[A , B]
   (e) F=[A ; B]
   (f) A([1 , 2] , :) = A([2 , 1] , :)

6. Consider A=[8 1 6; 3 5 7; 4 9 2and B=inv(A), what will be the output of following commands?
   (a) C=A*B
   (b) D=C/B
   (c) E=B\C

7. What will be the MATLAB output for the following expressions
   (a) [1 0 7] >= [1+2i 5i 7+7i]
   (b) (1+10i) < (2+i)
   (c) abs(1+10i) > abs(2+i)

(d) 'raman'<='raghu'

(e) 'Gopal'=='Gopal'

8. Assume matrices E=[1 2; 3 4]; F=[2 3; 4 5] ,
   What is the output of the following commands
   (a) X=E*F
   (b) G=E.*F
   (c) H=E^3
   (d) J=E.^3
   (e) K=E./F
   (f) L=E.^F

9. What is the output generated by following MATLAB commands?
   (a) X=[1, 2, 3;4, 5, 6] ; Y=exp(X)
   (b) X=[-pi : pi/2 : pi]; Y=sin(X).^2+cos(X).^2

10. Given the matrices
    A=[-3, 11; 5, -7]; B=[2, 15; 18, -5]; and C=[1, 10; 9, 12]
    Show that
    $(A^{-1})' = (A')^{-1}$
    $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

11. Prove that $A^3 - 4A^2 - 3A + 11I=0$ where A=[1 3 2; 2 0 -1; 1 3 2] and I is unity matrix and 0 is null matrix.

12.Given a matrix A=[1 3 5 7; 2 4 6 8; 5 1 7 9; 9 1 5 7]

Create the following sub matrices from the elements of A

(a) Matrix made of only odd columns of A
(b) Matrix made of only even rows of A
(c) Matrix made of all those elements of A, which belong neither to the even columns and nor to the even rows of the original matrix
(d) Write a MATLAB command to eliminate the last row and last column of a given matrix regardless of its size.
(e) Write MATLAB commands to access the second last row and second last column of any given matrix A, irrespective of its size.

13. Matrix A is given as A=[11 12 13 14; 21 22 23 24; 31 32 33 34; 41 42 43 44].Perform the following operations on matrix A

(a) Interchange the first and fourth rows.
(b) Interchange the second and third columns.
(c) Interchange the second row with second column
(d) Reset all elements with odd row and column numbers to zero; rest of the elements must remain unchanged.
(e) Rearrange all the columns of the matrix A with their order changed to the sequence:3,1,4,2
(f) What will be the result of following operation ? Explain
    P=A([1 3 4 2], [3 1 4 2])

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Sheet No.1B

Q.1 Let x = -6+8j

Find

i. Real component of x
ii. Real component of x
iii. Magnitude of x (use three different methods)
iv. Phase angle of x (two different methods)
v. Phase angle in degrees using direct command

Q.2 If x= 1+1j
Convert Cartesian co-ordinates of the complex no. x into polar coordinates.

Q.3 If θ=1 , and r=5, then convert Polar to Cartesian coordinate.

Q. 4 Given two sides a=3.2 and b=4.6 of a triangle and angle $\theta=60^0$ between these two sides, find the length of the third side and area of triangle.

Q.5 Write the MATLAB statements to calculate the sum of the series

$$s = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} \qquad \text{for } x = 1.5$$ ‘

Q.6 The values of *a, b, c* and *d* are $-190.5*10^{-2}$, $14.6*10^{3}$, 0.00056 and 456.28 respectively. Write a program to evaluate the following statements

$f1 = \frac{ab}{cd} + a * b$ and $f2 = \frac{a}{bc} - \frac{d}{a}$

Q.7 Given the radius of a circle r-5cm, find circumference and its area.

Q.8 Given the base of the right angle triangle =5cm and the acute angle, $\theta=42^0$ Find the length of its perpendicular

Q.9 For an electrical circuit with an inductance L=0.01mH and resistance R=100ohms, the damped natural frequency of oscillation is $f = \sqrt{\frac{1}{LC} - \frac{R^2}{4c^2}}$. Write a program to calculate the frequency for different values of c varying from0.1 to 1in steps of 0.1

Q.10 Evaluate the following trigonometric functions for $\theta = 30^0, 120^0, 210^0 \text{ and} 300^0$

i. sin (θ),
ii. cos (θ)
iii. tan (θ)
iv. cot (θ)

Q.11 Evaluate the following trigonometric functions for $\theta = 3, 5 \text{ and } 8$.

i. sinh (θ),
ii. cosh (θ),
iii. tanh (θ),

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Sheet 2

Q.1 Let the matrix $A=\begin{pmatrix}1 & 10 & 20\\ 2 & 5 & 6\\ 7 & 8 & 9\end{pmatrix}$. Reshape the matrix into column vector. Use a single command

Q.2 Reshape the matrix $A=\begin{bmatrix}1 & 2 & 3 & 4\\ 5 & 6 & 7 & 8\\ 9 & 10 & 11 & 12\end{bmatrix}$.into the matrix B of size (6x2).

Q.3 Let $A=\begin{bmatrix}6 & 7\\ 8 & 9\end{bmatrix}$ $x=\begin{bmatrix}1\\ 2\end{bmatrix}$ $y=\begin{bmatrix}3 & 4\end{bmatrix}$

i. Append the vector x as new column of A and store in matrix B
ii. Append the vector y as new row of A and store in matrix C

Q.4 Given the matrices $F=\begin{bmatrix}6 & 7\\ 8 & 9\end{bmatrix}$ *and* $G=\begin{bmatrix}6 & 7 & 1\\ 8 & 9 & 2\end{bmatrix}$. Delete the first row of matrix F and first two columns from matrix G.

Q. 5 Let $A=\begin{bmatrix}6 & 7\\ 8 & 9\end{bmatrix}$. Delete the element with indices (1, 2) from matrix A.

Q.6 Let matrix A be given by $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$. Compute matrix B, where $B=\begin{bmatrix}A_1 & A_2\\ A_3 & A_4\end{bmatrix}$, where A_1=A, A_2=A+12, A_3=A+24 and A_4=A+10

Q.7 Let a column vector z be given as z= [2; 3; 4; 5]

i. Form a diagonal matrix A, using the elements of z as the main diagonal elements of A
ii. Form a matrix B, using the elements of vector z as elements of first upper diagonal of B
iii. Form a matrix C, using elements of vector z as elements of first lower diagonal of C

Q.8 Let matrices x and y be given as
x = [2 3; 4 5] and y = [1 2 3; 4 5 6; 7 8 9]
Write command to obtain

i. A column vector composed of diagonal elements of x

ii. A column vector composed of diagonal elements of y
iii. A column matrix having first upper diagonal elements from y

Q.9 The vector x and y are given as
x = [2 3 4]; y = [1 0 5]. Illustrate the use of different relational operators.

Q.10 Evaluate the value of the polynomial $y = 2s^2+3s+4$ at s = 1 and s = -3.

Q.11 Find the roots of the polynomial $s^4+3s^3-15s^2-2s+9$

Q. 12 Write the program to add two polynomials, $a = (s^2 + 2s + 1)$ and $b = (s^3 + s + 5)$ and write the answer.

Q. 13 Evaluate the product of the polynomials (s+3), (s+6) and (s+2).

Q. 14 Determine the polynomial whose roots are
i. r1 = -1 and r2 = -2
ii. r1 = -0.5 + 0.866i and r2 = -0.5 - 0.866i

Q.15 Determine the characteristic equation of the matrix $A = \begin{bmatrix} 1 & 3 & 2 \\ 0 & 1 & 5 \\ 2 & 8 & 6 \end{bmatrix}$.

Q. 16 Evaluate the value of matrix polynomial $2s^2 + 3s + 4$ where the square matrix s is $s = \begin{bmatrix} 1 & -3 & 2 \\ 5 & 1 & 8 \\ 6 & 4 & 3 \end{bmatrix}$ using a single command.

Q. 17 Determine the partial fraction for $F(s) = \dfrac{2s^3 + 9s + 1}{s^3 + s^2 + 4s + 4}$

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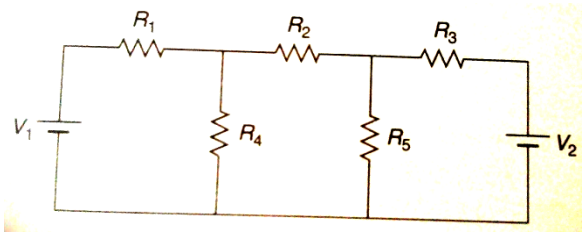
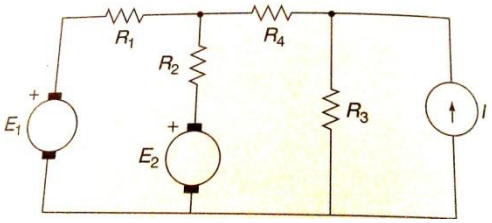
Sheet No 3
Use MATALB

Q.1 Determine the current flowing through each branch in the resistive circuit shown in figure below. the circuit parameter are as follows
R_1= 5 ohms, R_2= 100 ohms, R_3= 200 ohms, R_4= 150 ohms, R_5= 250 ohms, V_1= 100 V, V_2= 50 V.



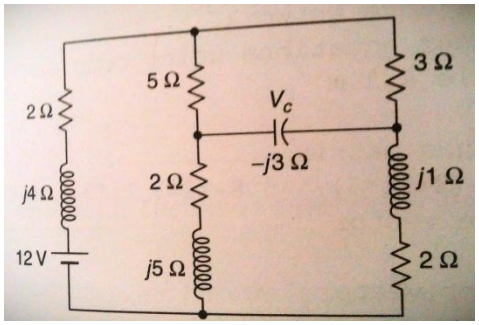
Ans i1=0.95A, i2=0.32A, i3=0.07A, i4=0.63A, i5=0.25A.

Q.2 Find the node voltages and current flowing through resistance R_4 in the circuit shown below. The circuit parameters are as follows E_1 = 100V, E_2 = 50V, R_1 = 1.5kohms, R_2 = 1.2kohms, R_3 = 2.2kohms, R_4= 1.4 kohms, I= 100mA.



Ans V1= 94.7837V, V2=145.5471V, I=-0.0338A

Q.3 Find the voltage across the capacitor in the network shown below



Ans V_C=-0.135V

Q.4 A voltage of 100V, 50 Hz is applied across a 10 ohm resistance. Write the time equation for voltage and resulting current. Draw the voltage and current waveform and show that the current in a purely resistive circuit is in phase with voltage.

Q.5 Use subplot plot command to plot the current and voltage waveform for two cycles in purely inductive and purely capacitive circuit with circuit parameter V=100 V, f=50 Hz, L=20mH and C= 1000μF.Take time increment as 10^{-3}.Plot the capacitor voltage and current on same axis and inductor voltage and current on same axis with different colours. Properly label the graph. Use legends.

Q.6 A voltage $v = 100\sin wt$ is connected across a circuit having $Z = 5\angle -60^0$. Plot the voltage, current, and power in the circuit. Predict the nature of the circuit.

Q.7 Calculate the resonant frequency in a series RLC circuit .the circuit. The circuit parameters are as follows: R==100ohm, L = 85μH, C =298μF, V=10V.

a. Plot X_L, X_C, and R as a function of frequency and obtain resonant frequency graphically.
b. Plot impedance and current as a function of frequency and obtain resonant frequency graphically
c. Show graphically how power factor varies with frequency. Show that at resonant frequency Power factor angle is $\theta = 0$.

Ans Resonant frequency = 1MHz

Q.8 Use plot command, line command and hold on command to generate multiple plots of

$y1 = e^{-0.1x}.*\sin x \qquad increment\ \ step = 0.01; \quad 0 \le x \le 20$

$y2 = \sin x \qquad increment\ \ step = 0.1; \quad 0 \le x \le 20$

$y3 = \cos x \qquad increment\ \ step = 0.1; \quad 0 \le x \le 20$

Q.9 Plot the curve given by the equation a = $10e^{-t}$ for t = 0 to 5. Show the grid line on the plot.

Q.10 Divide the figure window into four subwindows and plot the following functions

a. Plot v v/s I, where v = 4*I and I = 1, 2, 3, 4, on the upper left subwindow
b. Plot y v/s x, where y = x^2 and x = 1, 2, 3, 4, on the upper right subwindow
c. For t = 0 : 2*pi in step t= pi/60, plot sin(t) v/s t, on the lower left subwindow
d. For t = 0 : pi/30 : 2*pi, plot cos(t) v/s t, on the lower right subwindow

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Sheet No. 4

Q.1 Write a MATLAB program to obtain the sum of all integers from 0 to 20, using for loop statement, when the increment value is only 1

Q.2 Write a program to illustrate the use of for loop statement for discrete arbitrary integer values of the index, given as a vector.

Q.3 Write a program to find the average of any 10 numbers using for statement. Check the program with the following values
3 5 24 5 6 4 10 23 45 2

Q.4 Write a program using while loop to find the squared of integers less than 5.

Q.5 Write the program to add first 10 digits using while loop.

Q.6 Write a program to evaluate y=2x + 1, otherwise y=2x. Use if-else statement. Check the program with value of x as (i) 7and (ii)2

Q.7 The marks obtained by the student of a class in a particular subject are as follows
50 65 72 70 82 85 86 88 70 71 75 72 82 80 81 90 92 56 64 65 70 71 95. Usea suitable operator to determine the following

a. The number of students who scored 75 and above
b. The number of students who scored between 65 and 85
c. The order of students who scored between 50 and 60

Q.8 Write a script file to plot the function

$$y=\begin{cases}15\sqrt{4x}+10 & x\geq 9\\ 10x+10 & 0\leq x\langle 9\\ 10 & x\langle 0\end{cases}$$

$$for\ -5\leq x\leq 30$$

Choose a spacing of dx = 35/300 to obtain 300 points

Q.9 Write a script file to determine how many terms are required for the sum of the series $5k^2$-2k, k=1,2,3….to exceed 10,000. What is the sum for this many terms?

Q.10 Wrote the script file using conditional statements to evaluate the following function

$$y=\begin{cases}\sqrt{x^2}+1 & for\ x\langle 0\\ 3x+1 & for\ 0\leq x\langle 10\\ 9\sin(5x-50)+31 & for\ x\geq 10\end{cases}$$

Check the program for x= -5, x=5, and x=15

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Sheet No. 5

Q.1 Write a function to calculate roots of quadratic equation $ax^2+bx+c=0$, where a, b, c are constants. Calculate the roots for a=1, b=4, c=4, by calling the function in the command window.

Ans. r1 = -2; r2 = -2

Q.2 Write a function subprogram to calculate the sum of following series

$$S = 1 + r + r^2 + ... + r^n$$

Q.3 Write a program to solve the function

$$x = \frac{y^3\sqrt{2y+4}}{\left(y^3+1\right)^2}$$

(a) Find x for y=4 Ans (x=0.525)

(b) Find x for y = 2, 4, 6, 8, 10 Ans (x=0.2794, 0.0525, 0.0183, 0.0087, 0.0049)

Q.4 Write a program to find the sum of integers between two numbers using function approach.

Q.5 Write a function to find out the number of students securing first division among the given no. of total students. Execute the function from command window, by passing the input variables form the command window.

Q.6 What are the similarities and difference between a function file and a script file.

Q.7 Study "inline" functions. Calculate the value of following mathematical expression at $x = 4$ using inline function

$$F(x) = x^3 + 4x^2 + 5x + 6$$

Ans 154

Q.8 Study the use of function handle and do question no. 2 using it for values of r=2&n=4. Verify the answer obtained in question 2

Ans 31

Q.9 Create a function $f(t)=4e^{-2t}$, for t in the range 0 to 5. Also demonstrate the use of function handle.

Q.10 Study "str2func". Use it to create function handle and display results for question 8