Nirma University
Institute of Technology
Semester End Examination (IR), December - 2021
B. Tech. in Computer Science and Engineering / IC Engineering, Semester-V
2ECOE76 MATLAB for Engineers

Roll /
Exam No. ___19BCE1_9___

Supervisor's initial
With date ___09/12/21___

Time: 2 Hours

Max. Marks: 50

Instructions:
1. Attempt all questions.
2. Figure to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Assume suitable data wherever necessary.

Q.1 Answer the following: **[20]**

(A)   The recursion relations can, in addition to defining orthogonal (06)
polynomials, also define some special functions of mathematical
physics. For example, the spherical Bessel functions that play an
important role in defining the modes of spherical cavities in
electrodynamics and scattering amplitudes in both classical and
quantum physics are defined through the following recursion
relation:

$$j_{m+2}(x) = \left(\frac{3+2m}{x}\right)j_{m+1}(x) - j_m(x)$$

With

$$j_1(x) = \frac{\sin(x)}{x^2} - \frac{\cos(x)}{x} \text{ and } j_2(x) = \left[\frac{3}{x^3} - \frac{1}{x}\right]\sin(x) - \frac{3\cos(x)}{x^2}$$

Using MATLAB functions, plot $j_5(x)$ over the interval 0<x<15.

OR

(A)   Write a MATLAB code which generates the following function.   (06)

$$y(2j) = \frac{x(j+1) + x(j-1)}{2} \text{ and } y(2j-1) = \frac{x(j) - x(j-1)}{2}$$

Where the given array x=[2,3,-4,6,1,-2,7,10,3,1].

(B)   Write a MATLAB code for the following figure 1 as per the given (08)
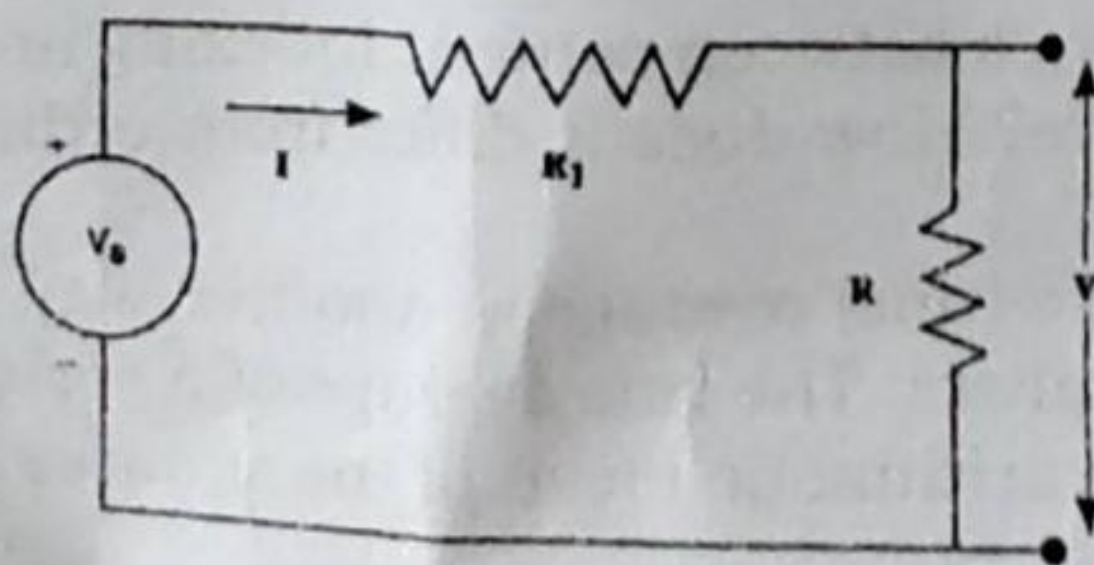instructions below.:

Figure 1

a) Write two equations named L_1 and L_2 for currents through R_1 and R and verify that the two lines L_1 and L_2 intersect at the point I=0.025V and V=2.5Amp by plotting them as I vs. V. Given that $R_1=100\ \Omega$, R=100 Ω and V_s=5V.

b) Rewrite this script file such that you make use of the fplot command.

c) Holding the graph for the case R = 100Ω, sketch L_1 and L_2 again for R = 50Ω and R = 500Ω. How do the values of the voltage and the current change as R increases; and decreases?

d) Determine the largest values of the current and voltage that can exist in the circuit when R varies over non-negative values.

(C) The meaning of amplitude, angular frequency, and phase can be better understood using MATLAB to obtain graphs of the cosine function for a family of a values, ω values, and φ values.   (06)

a) With ω= 1 and Φ= π/3, plot the cosine curves corresponding to a = 1:0.1:2.

b) With a= 1 and ω= 1, plot the cosine curves corresponding to Φ = 0: π/10: π.

a) With a= 1 and Φ= π/4, plot the cosine curves corresponding to ω = 1:0.1:2.

Q.2 Answer the following: [10]

(A) Create a 3-D plot in MATLAB from a 2-D, 10 × 10 matrix (in the xy (06) plane) having ones along the main diagonals, zeros everywhere else, with the center element having a magnitude of 2. It is desired that the zx planes indicate the magnitudes of the elements position on the xy plane all having triangular shapes.

OR

(A) Describe the following MATLAB commands: (06)
ferror, feof, ftell, frewind, fseek, fwrite

(B) The spiral of Archimedes is a curve described in polar coordinates by (04) the equation r=kθ, where r is the distance of a point from the origin and θ is the angle of that point in radians with respect to the origin. Plot the spiral of Archimedes for 0<θ<6π when k=0.5 using MATLAB commands. Be sure to label your plot properly.

Q.3 Answer the following in terms of MATLAB: [20]

(A) 1. How can you convert from a sparse array to a full array, and vice (08) versa?

2. What is a cell array? How does it differ from an ordinary array?

3. What is the difference between content indexing and cell indexing?

4. What is a structure? How does it differ from ordinary arrays and cell arrays?

(B) The root-mean-square (rms) average is another way of calculating a (07) mean for a set of numbers. The rms average of a series of numbers is the square root of the arithmetic mean of the squares of the numbers:

$$rms\ average = \sqrt{\frac{1}{N}\sum_{i=1}^{N} x_i^2}$$

Write a MATLAB program that will accept an arbitrary number of positive input values and calculate the rms average of the numbers. Prompt the user for the number of values to be entered, and use a for loop to read in the numbers.

(c) Suppose that a game contained a set of six-sided dice with two (05) opposite faces colored red, two opposite faces colored green, and two opposite faces colored yellow. If one of these dice is tossed 20 times, what is the probability that there will be 5 or less green results? What is the probability that there will be 10 or less green results? Write a MATLAB code for the same.

n = 20

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