

Total No. of Questions : 8]

SEAT No. :

P2321

[Total No. of Pages : 4

[4934] - 101

M.Sc. (Semester - I)

ELECTRONIC SCIENCE

EL1UT - 01 : Mathematical Methods in Electronics and Network Analysis  
(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

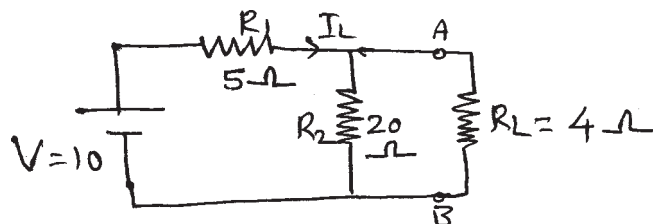
- 1) Attempt any five questions.
- 2) All questions carry equal marks.
- 3) Use of non-programmable calculator is allowed.

Q1) Answer the following:

- a) "An electrical system can be modelled using differential equations", justify the statement using appropriate example. [4]
- b) What are the different types of differential equations? Classify and give examples of each. [3]
- c) Explain the terms Mesh, node and links of Network. [3]

Q2) Answer the following:

- a) Draw a circuit diagram of op-amp first order butterworth high pass filter. Determine its transfer function in S-domain. [4]
- b) What is linear differential equation of order two? What is meant by homogeneous and non homogeneous differential equation? Give examples of each. [3]
- c) Draw Norton's equivalent and find the current and voltage across the load in the following circuit. [3]



P.T.O.

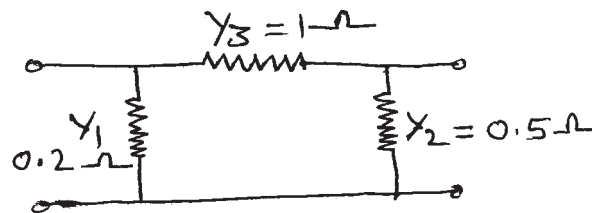
**Q3)** Answer the following:

- a) Determine the stability of following equation [4]

$$Q(S) = S^3 + 6S^2 + 11S + 6$$

- b) Determine the unit step response to the series R-C circuit using differential equation. [3]

- c) Find the equivalent T-network for the given  $\pi$ -network. [3]



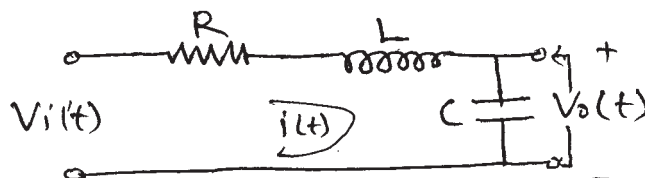
**Q4)** Answer the following:

- a) Explain the concept of transfer function. Draw pole zero plot in s-plane and determine poles and zeros of the following system. [4]

- b) Find the inverse Laplace transform of [3]

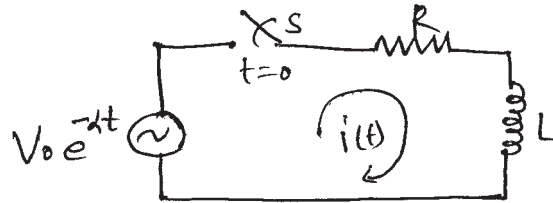
$$F(s) = \frac{2s+5}{s^2+5s+6}$$

- c) Obtain the state equation for the following electrical system. [3]



**Q5)** Answer the following:

- a) Find the current  $i(t)$  in the following series RL circuit. [4]



- b) Represent the Cartesian co-ordinate (9,6, 2) in Spherical Co-ordinate system. [3]
- c) What are the advantages of state variable approach over transfer function approach? [3]

**Q6)** Answer the following:

- a) What is z-transform? Determine the z-transform of unit impulse  $\delta(n)$ . [4]
- b) State initial value theorem. Using this theorem find the value of  $I(s)$  for the Laplace transform  $I(s) = \frac{2s+3}{(s+1)(s+3)}$ . [3]
- c) Draw the poles and zeros for the current  $I(s)$  in a network given by the following equation  $I(s) = \frac{2s}{(s+1)(s+2)}$ , obtain ILT of this equation. [3]

**Q7)** Answer the following:

- a) Using method of separation of variables separate the variables of Laplace equation in Spherical co-ordinate system. **[5]**
- b) State and prove maximum power transfer theorem for AC circuit. **[5]**

**Q8)** Answer the following:

- a) State convolution theorem. Determine the Laplace transform of  $\frac{1}{s^2(s+1)}$  using convolution theorem. **[5]**
- b) How physical system can be analysed by converting them into an equivalent electrical circuit? Explain it with suitable example. **[5]**

