Total No. of Questions : 8]

SEAT No. :

P2683

[Total No. of Pages : 3

[5034]-101
M.Sc. - I
ELECTRONIC SCIENCE
EL1UT01 : Mathematical Methods in Electronics and Network Analysis
(2013 Pattern) (Semester - I) (Credit System)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer any five questions.*
2) *All questions carry equal marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Figures to the right side indicate full marks.*
5) *Use of non-programmable calculator is allowed.*

Q1) Answer the following:

a) State and explain different types of modelling. Explain any one with suitable example. **[4]**

b) Explain the terms graph, tree and node of network. **[3]**

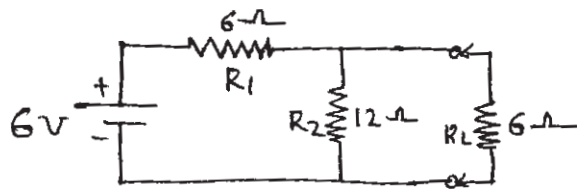
c) Explain the terms ordinary and partial differential equation. Give an example of each. **[3]**

Q2) Answer the following:

a) Draw a circuit diagram of op-amp first order butterworth low-pass filter. Determine its transfer function in S-domain. **[4]**

b) What are the order and degree of differential equations? Give examples of each. What is meant by linear differential equation? **[3]**

c) Draw Thevenin's equivalent and find the voltage across R_L in the following circuit. **[3]**



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Q3) Answer the following:

a) Examine the stability of given equation using Routh's method.

$s^3 + 4s^2 + s + 16 = 0$ **[4]**

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

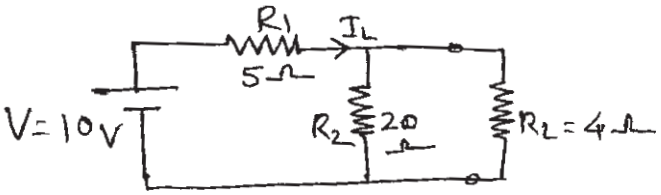
c) T-equation of a resistive network is characterised by $Z_a = 2\Omega$, $Z_b = 2.5\Omega$ and $Z_c = 5\Omega$. Obtain its Π equation. **[3]**

Q4) Answer the following:

a) Show that Laplace transform of $f'(t) = SF(s) - f(0)$. Find the Laplace transform of $f(t) = Ae^{-at}$ and $f(t) = \sinh at$. **[4]**

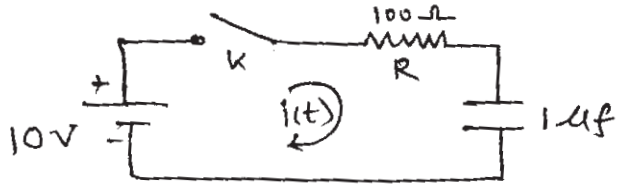
b) The co-ordinates of a point in Cartesian co-ordinates system are (3,4,12). Determine co-ordinates in cylindrical co-ordinate system. **[3]**

c) Draw Norton's equivalent and find the current I_L in the following circuit. **[3]**



Q5) Answer the following:

a) In given circuit switch K is closed at t = 0. Find the values of i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **[4]**



b) Solve $\frac{d^2x}{dt^2} = -\frac{k}{m}x$, where k & m both are constants. **[3]**

c) Find the inverse Laplace transform of $F(s)=\dfrac{2s+5}{s^2+5s+6}$. **[3]**

Q6) Answer the following:

a) The z-transform of a sequence $x(z)$ is given by $x(z)=\dfrac{z-1}{1-3z^{-1}}$, $|z|<3$

Determine the first three terms of the sequence. **[4]**

b) State final value theorem. Using this theorem determine the final value of

$$\mathrm{I}(s)=\frac{s+6}{s(s+3)}.$$ **[3]**

c) Draw the poles and zeros for the current I(s) in a network given by

$$\mathrm{I}(s)=\frac{3s}{(s+2)(s+4)}.$$ **[3]**

Q7) Answer the following:

a) Find inverse z-transform.

$$x(z)=\frac{z}{z-1},\ |z|>1$$ **[5]**

b) Find $\mathrm{L}^{-1}\left\{\dfrac{1}{s(s^2+9)}\right\}$ using convolution theorem. **[5]**

Q8) Answer the following :

a) Separate the variables of 2-dim. Laplace equation in cartesian co-ordinate systems and hence obtain the solution for it. **[5]**

b) What is the need of modelling? State different types of mathematical modelling. Explain any one with suitable example. **[5]**