PG/IS/ELC-103/15

M.Sc. 1st Semester Examination, 2015

ELECTRONICS

(*Network Analysis and Synthesis*)

[Theory]

PAPER – ELC-103

Full Marks : 50

Time : 2 hours

Answer **Q. No. 1** and any **three** from the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

1. (*a*) State Tellegen's theorem and mention the validity of this theorem indicating the type of networks.

(*b*) What do you mean by hybrid parameters ? Where this parameters can extensively be used and why ?

(*c*) Expand the following function as partial fraction :

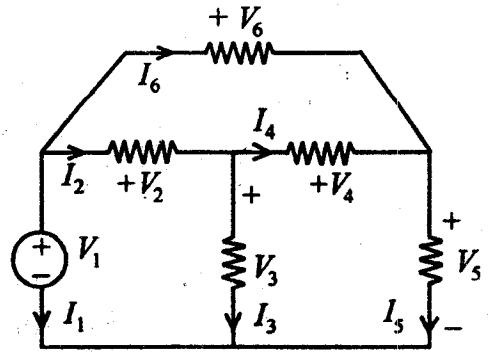
$$F(s) = \frac{2s+3}{s^2+3s+2}.$$

(*d*) Classify pass band and stop band in the case of a filter.

(*e*) State the Dirichlet's conditions in connection with Fourier analysis. 2×5

2. (*a*) In the following network, check the validity of Tellegen's theorem. Given 5

$V_1 = 8\text{ V},\ V_2 = 4\text{ V},\ V_4 = 2\text{ V}$
$I_1 = 4\text{ A},\ I_2 = 2\text{ A},\ I_3 = 1\text{ A}$



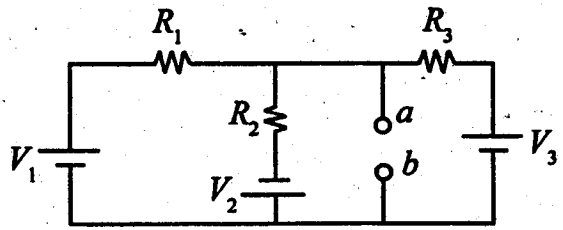
(*Continued*)

(*b*) Define the following terms : 5

(*i*) node
(*ii*) tree
(*iii*) loop
(*iv*) cut-set
(*v*) tie-set.

3. (*a*) State and prove Thevenin's theorem. Find the Norton's equivalent ckt. of a Thevenin's ckt.

(*b*) Find the Thevenin's equivalent ckt. across the terminal *a* and *b* of the following ckt.



$R_1 = 2\ \Omega, R_2 = 5\ \Omega, R_3 = 1\ \Omega$

$V_1 = 10\ \text{V}, V_2 = 12\ \text{V}, V_3 = 20\ \text{V}$

Also find the load current for the load of $4\ \Omega$. 6+4

4. (*a*) Obtain the Laplace transformation of $f(t) = 1 - e^{-at}$, a is constant.

   (*b*) Obtain the Laplace transformation of unit step function and Ramp function.

   (*c*) State and prove convolution theorem. 3+2+5

5. (*a*) A series circuit with $R = 10\ \Omega$, $L = 0{\cdot}1\ H$ and $C = 50\ \mu F$ has an applied voltage $V = 50\angle 0°$ with a variable frequency. Find the resonant frequency, the value of the frequency at which maximum voltage occurs across the inductor and the value of the frequency at which maximum voltage occurs across the capacitor.

   (*b*) Define the quality factor Q and mention its effect on bandwidth. 6 + 4

6. (*a*) A network function is given by

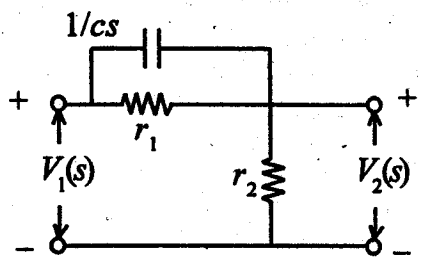
$$P(s) = \frac{2s}{(s+2)(s^2+2s+2)}$$

   obtain the pole-zero diagram.

(*b*) Explain with reasons why the following expression for the driving point impedance $z(s)$ is not suitable for representing a passive network :

$$z(s) = \frac{s^4 - s^3 + 2s^2}{s + 5}$$

(*c*) For the given circuit find the voltage transfer function. 3+3+4



[*Internal Assessment* : 10 marks]