Printed Pages—8 **EEC304**

(Following Paper ID and Roll No. to be filled in your Answer Book)	
PAPER ID : 0325	**Roll No.**

B. Tech.

(SEM. III) ODD SEMESTER THEORY EXAMINATION 2010-11

FUNDAMENTALS OF NETWORK ANALYSIS AND SYNTHESIS

Time : 3 Hours *Total Marks : 100*

Note : Attempt **all** questions. All questions carry **equal** marks. Missing Data if any may be suitably assumed.

1. Attempt any **four** parts of the following : **(5×4=20)**

(a) The waveform f(t) in the Fig. 1 is defined as :

$$f(t) = \frac{3}{\varepsilon^2}(t-\varepsilon)^2, 0 \le t \le \varepsilon$$
$$= 0, \text{ elsewhere.}$$

Show that as $\varepsilon \to 0$, f(t) becomes a unit impulse function.

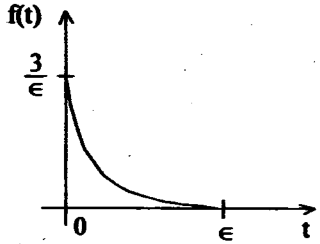

Fig. 1

(b) Find the response to the excitation shown in Fig. 2 when the network is (i) an ideal differentiator, (ii) an ideal integrator.

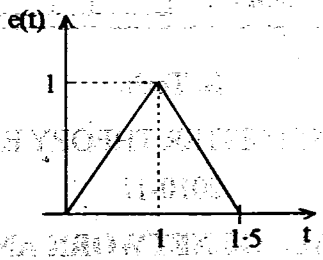

Fig. 2

(c) Using Shifting property of the step function, obtain an equation of the waveform shown in Fig. 3.

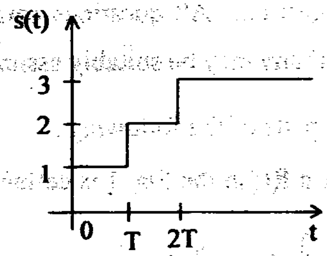

Fig. 3

(d) For the circuit shown in Fig. 4, at $t = 0$, the switch goes from position 1 to 2, find $i(t)$, given that $e(t) = e^{-t} \sin 2t$. Assume that the circuit had been steady state for $t > 0$.

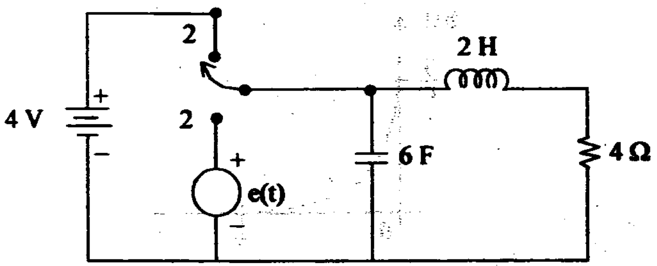

Fig. 4

(e) For the circuit shown in Fig. 5, $i(t) = 4e^{-2t} u(t)$, find $v(t)$; $0^- < t < \infty$.

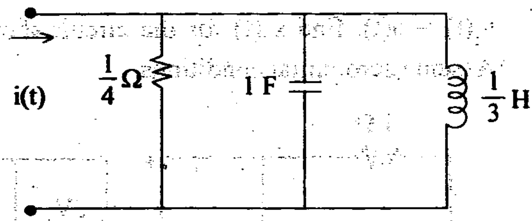

Fig. 5

(f) Find the requirement for the RC time constant in the RC differentiator circuit, such that output voltage is approximately the derivative of input voltage.

2. Attempt any **four** parts of the following : **(5×4=20)**

(a) Use the convolution integral, find the inverse transform of the following :

(i) $F(s) = \dfrac{K}{(s+a)(s+b)}$

(ii) $F(s) = \dfrac{s}{(s+1)^2}$

(b) Find $i_2(t)$ for the circuit shown in Fig. 6 using Thevenin's theorem. The excitation is $e(t) = 100 \cos 20u(t)$.

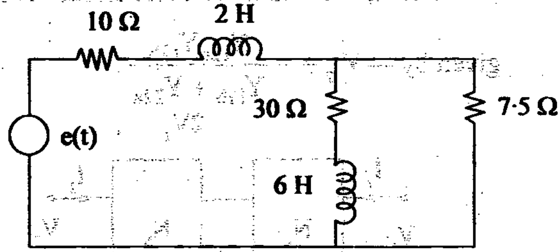

Fig. 6

(c) Determine the transfer function $H(s) = \dfrac{V_3(s)}{V_1(s)}$ when $v_1(t) = u(t)$, find $v_3(t)$ for the circuit shown in Fig. 7. Assume zero initial conditions.

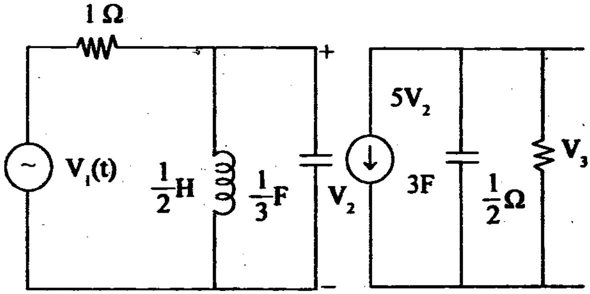

Fig. 7

(d) Prove that for a passive reciprocal network $AD - BC = 1$, where A, B, C and D are the transmission parameters.

(e) For the cascade connection of two ports network shown in Fig. 8, shown that the transfer impedance Z_{12} of the overall circuit is given in terms of the Z-parameters of the individual two ports by the equation

$$Z_{12} = \frac{Z_{12a} Z_{12b}}{Z_{11b} + Z_{22a}}.$$

In addition, show that the short-circuit admittance Y_{12} is given by $-Y_{12} = -\dfrac{Y_{12a} Y_{12b}}{Y_{11b} + Y_{22a}}$.

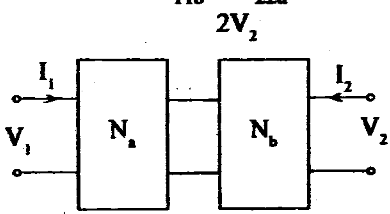

Fig. 8

(f) For the network shown in Fig. 9, determine the Y and Z parameter.

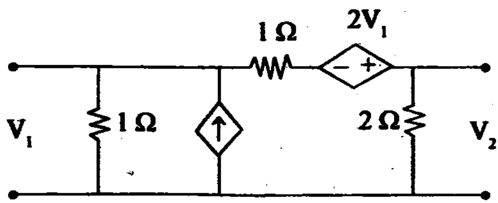

Fig. 9

3. Attempt any two parts of the following : (10×2=20)

(a) Find the network for the following function in Foster-I and Cauer-I form

$$Y(s)=\frac{(s+1)(s+3)}{(s+2)(s+4)}.$$

(b) For the pole-zero diagram shown in Fig. 10, pick the diagram an R-L impedance function and synthesize in the series Foster form.

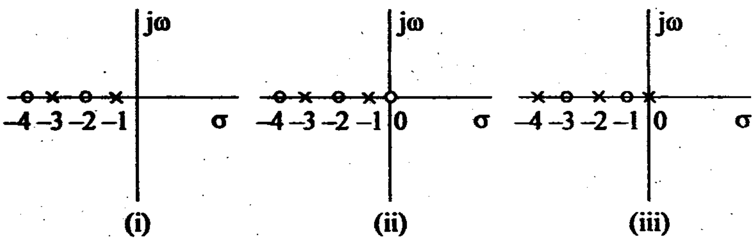

Fig. 10

(c) Given $Z(s)=\frac{s^2+Xs}{s^2+5s+4}$

(i) What are restrictions on X for Z(s) to be positive real function ?

(c) For the circuit shown in Fig. 15, derive an expression for V_{01} and V_{02}, assuming ideal op-amp.

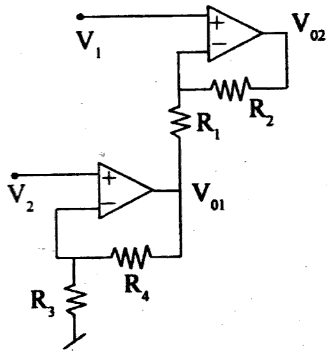

Fig. 15