ABU DHABI POLYTECHNIC

EMET

Power Transmission/ EMEE-304

Final Examination

Semester 2- 2016/2017

120 minutes

Instructor Shoaib Hussain

Students answer on the question paper
Calculators, drawing kits and dictionaries are allowed
No additional materials are required

STUDENT NAME	
STUDENT NUMBER	A
CRN	1269
DEPARTMENT	EMET

READ THESE INSTRUCTIONS CAREFULLY

Write your *name*, *number*, and department **clearly** in the boxes above.
Answer **all** questions.
Show **all** your working and use appropriate **units.** Otherwise, you may lose marks.

You may use a pencil for all your work.

Answers that are not **clearly readable**, if any, will not be marked.

Question	Score
Q1	/26
Q2	/12
Q3	/22
Total	

All mobile devices are not allowed during examination.

Abu Dhabi Polytechnic considers cheating or attempting to cheat a serious offense that will result in disciplinary action taken against involved individuals.

Formulae

$$i_c = c.v'_c$$

$$v_L = L.i'_L$$

$$w_c = \frac{1}{2}c.v_c^2$$

$$w_L = \frac{1}{2}L.i_L^2$$

Standard form of 1st order differential equation:

$$y'(t) + p(t).y(t) = q(t)$$

$$\mu(t) = e^{\int p(t)dt}$$

Solution for the 1st order differential equation:

$$y(t) = \frac{1}{\mu(t)}\int \mu(t).q(t)dt + \frac{c}{\mu(t)}$$

Solution for the 1st order total transient response:

$$F(t) = F_f + Ae^{st} = F_f + (F(0) - F_f)e^{st}$$

$$F_f \; is \; the \; forced \; response, F(0) \; is \; the \; initial \; response$$

Natural response for 2nd order systems:

If the roots are real and distinct: $F(t) = A_1e^{s_1t} + A_2e^{s_2t}$

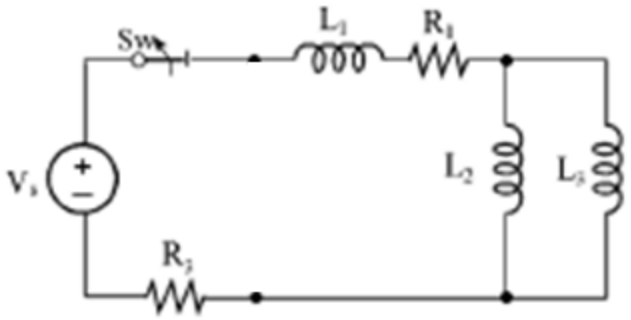
If the roots are complex: $F(t) = Be^{\alpha_1 t}.sin(w_n t + \beta)$

Energy transfer:

$$w_{transferred} = \int v(t).i(t)dt$$

w is the energy in all cases.

1. Find the solution for the input current in the circuit given below. [CLO: 1,2]



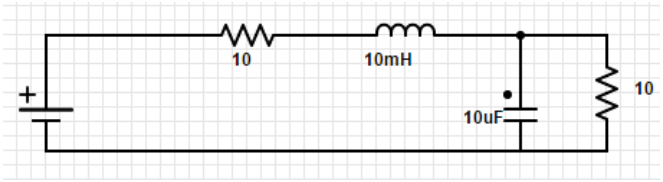
The switch stays closed. $L_1 = 20\ mH, L_2 = 40\ mH, L_3 = 60\ mH, R_1 = 22\ \Omega = R_2$. Let $V_s = 10\ V$.

a) Simplify the circuit and show the reduced equivalent circuit. Also calculate the time constant of the system. [6]

b) Using your answer to a), write the differential equation for the circuit and solve for the input current $i_s(t)$. [10]

c) Derive an expression for the total energy transferred from the source (hint: use your answer to b) and use the power-integral equation to obtain an expression for the energy transfer) [10]

2. Consider the 2nd order system shown below. [CLO 3,4]

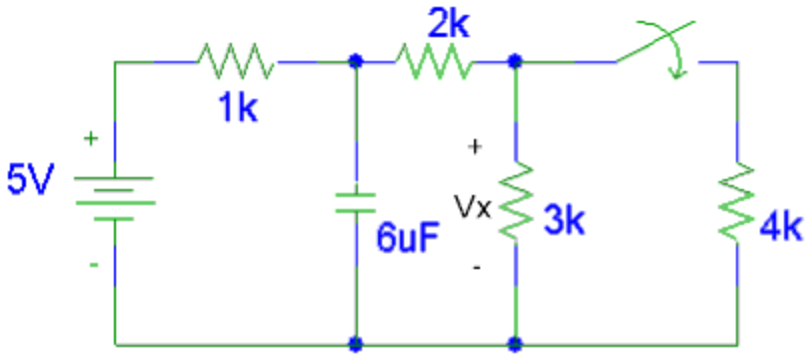


a) Find the roots of the system. [6]

b) Write down the equation for the natural response of the source current using your answer to a). [2]

c) What will be the steady-state voltage of the capacitor (t->∞) ? [4]

3. You need to calculate the total response of the voltage [V_x(t)] across the 3k ohm resistor. Consider the circuit given below. [CLO: 4,6]



The switch is initially open and closes at t = 0.

a) Find the roots of the system and the time constant for voltage V_x. [6]

b) Find the forced response of the voltage V_x. [4]

c) Find the independent conditions of the circuit. [4]

d) Find the dependent initial condition of V_x if needed. [4]

e) Find the total response of the voltage V_x using all your previous answers. [4]

BONUS

Find the expression for the energy transferred to the 3k resistor using your answer to previous question.