Ryerson University
Department of Electrical and Computer Engineering
ELE302: Electric Networks
Final Examination, December, 2005
Duration: 3 hours

Student's Name: ....

Student's Number: .... **Section: ....**

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NOTES:

1. Please **TICK** mark against the name of your professor.

2. This is a **Closed Book** examination. No aids other than the approved calculators are allowed.

3. Answer **all questions**.

4. **Laplace Table** is provided in the back of this question paper.

5. **No questions are to be asked** in the examination hall. If needed, make any valid assumptions to solve the question, but please state clearly the assumptions used.

Question No.	*Mark of each question*	*Mark obtained*
Q1	20	
Q2	20	
Q3	20	
Q4	20	
Q5	20	
Q6	20	
Total:		

Q1:Part-A

In the circuit shown in Figure-1, the switch is opened after a long time at t = 0.

(a) Calculate $v_c(0+), i_L(0+), \frac{dv_c}{dt}(0+)$ *and* $\frac{di_L}{dt}(0+)$ [6]

(b) Write the differential equation of $v_c(t)$. [4]

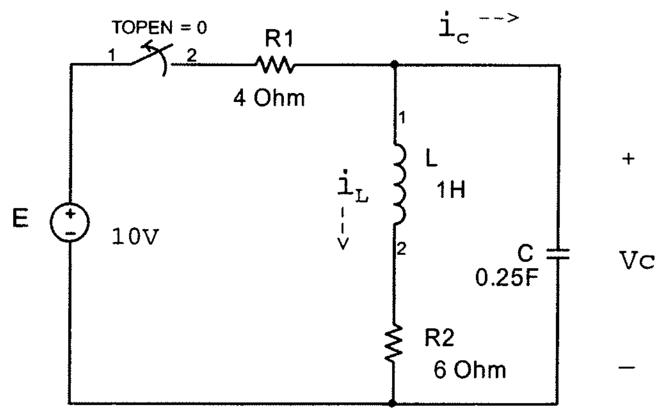


Figure-1

Q1: Part-B

The circuit response of a circuit due to impulse excitation is given as

$h(t) = 5\,e^{-2t}\sin 4t\,.u(t)$. Determine the step response of the circuit. [10]

Q2:

(a) Draw the Laplace Transformed equivalent circuit of Figure-2, when $v_c(0) = 1V$ and $i_L(0) = 1A$. [5]

(b) Solve for $v_L(t)$. [15]

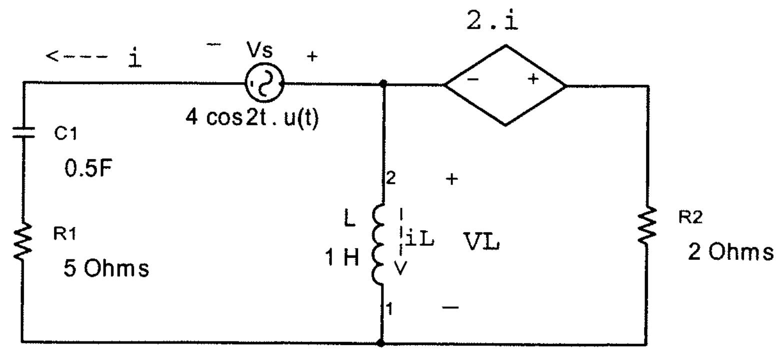


Figure-2

Q3: Part-A

Derive the transfer function $H(s) = \dfrac{V_0(s)}{V_i(s)}$ of the circuit shown in Figure-3A. [10]

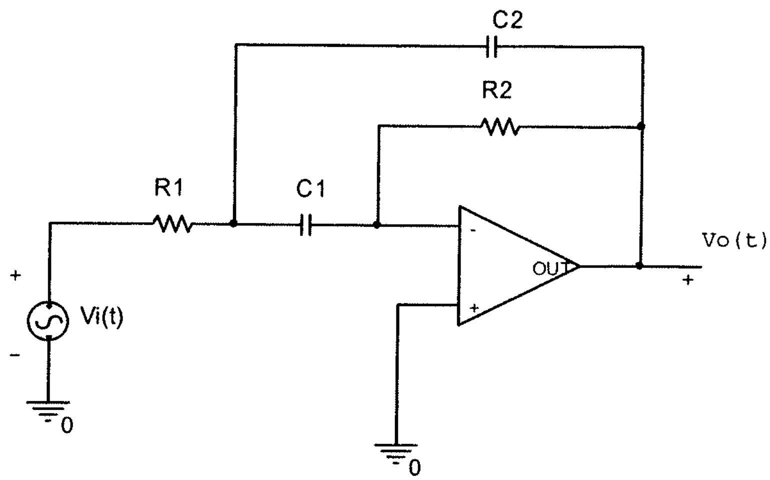


Figure-3A

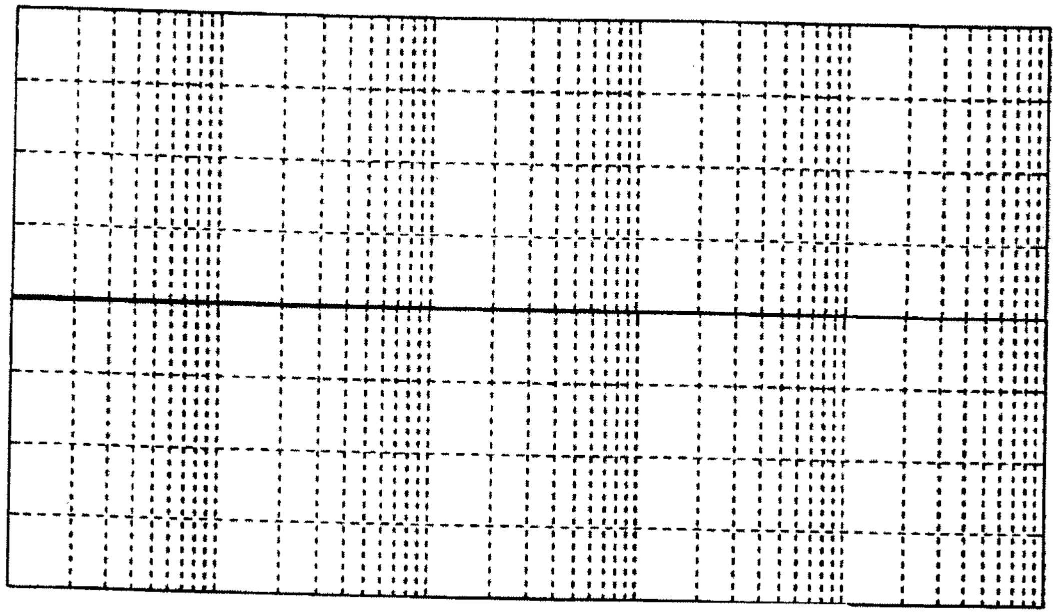
Q3: Part-B

Construct the Bode plots of amplitude in dB and phase in degrees of the following transfer function.

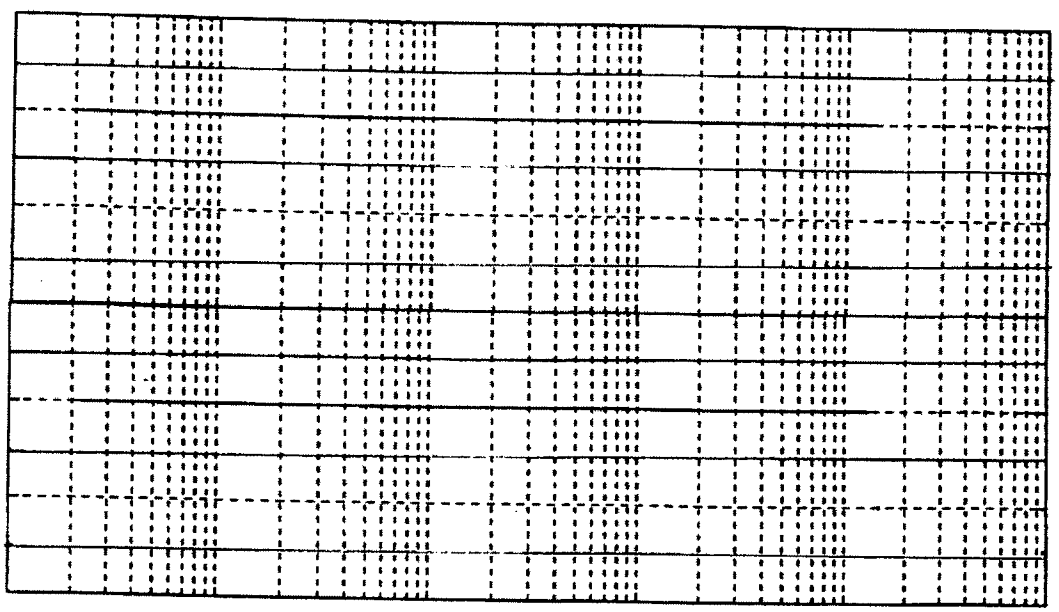
$$H(s) = \frac{100\,s^2}{(s+50)(s+200)}$$

Use the graph paper attached with this question paper. [10]

dB



θ



Q4: Part-A

(a) Figure-4A shows a mutually coupled circuit. Write the mesh equations. [5]

(b) If $R1 = 1\ \Omega$, $X1=X2=X3=Xc = 2\ \Omega$, and $X13 = X31 = 1.5\ \Omega$, solve the voltage V_0 across the capacitor.

[5]

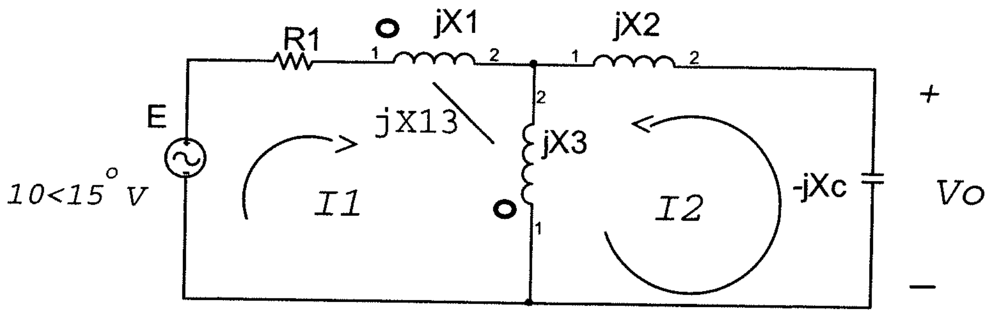


Figure-4A

Q4: Part-B

In Figure-4B , T1 and T2 are two ideal transformers. Calculate the power output in the 1.5 Ω resistance. [5]

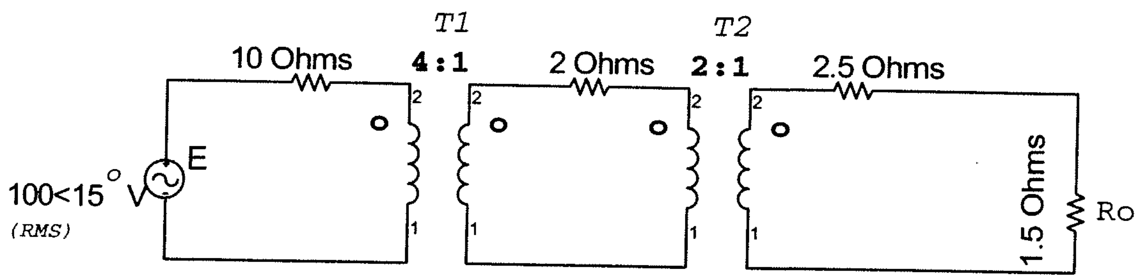


Figure-4B

Q5: Figure-5 is a balanced 3-phase circuit of 60 Hz frequency. The line voltages in RMS for abc phase sequence are given as:

$V_{AB} = 220\angle 0^0\ V,\ V_{BC} = 220\angle -120^0\ V, \text{ and } V_{CA} = 220\angle 120^0\ V.$

(a) When Z = 3+j6 Ω, calculate the line currents without the capacitors in the circuit. [5]

(b) Calculate the power factor, the total complex power, total real power and total reactive power without the capacitors in the circuit. [4]

(c) Calculate the capacitor C per phase needed to improve the total power factor to one. [6]

(d) Calculate the new line current after the capacitors are connected. [5]

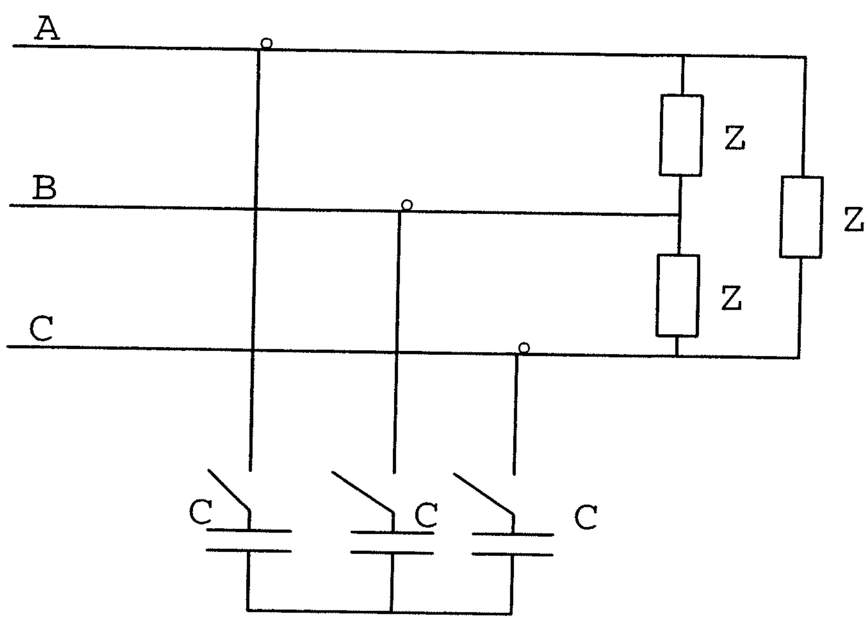


Figure-5

Q6: Part-A

Figure-5A shows a periodic voltage function.

(a) Calculate the Fourier coefficients in terms of n, where n is the number of harmonics present.

(b) Write the expression of v(t) as function of first four (non –zero) terms of the Fourier series.

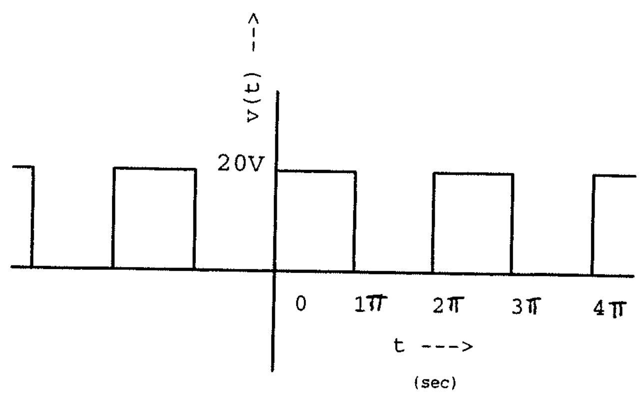


Figure-5A

Q6: Part-B

The Fourier series of the source $v_s(t)$ in Figure-6B is given as $v_s = 5 + \sum_{n=1}^{\infty}(\frac{10}{n^2}\sin n\omega_0 t)$,

where n is odd integer and $\omega_o = 50$ rad/sec.

Find the dc- and 2^{nd} harmonic components in $V_o(t)$. [10]

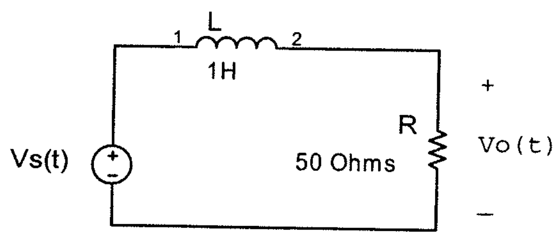


Figure-6B

Laplace Table

f(t) →	**F(s)**
$\delta(t)$	1
Ku(t)	K /s
t.u(t)	$1/s^2$
$f(t-a)u(t-a)$	$e^{-as}F(s)$
e^{-at} u(t)	1 / (s+a)
e^{-at} f(t)	F(s+a)
sin (wt) .u(t)	$w/(s^2+w^2)$
cos (wt) . u(t)	$s/(s^2+w^2)$
e^{-at} cos (wt). u(t)	$\dfrac{s+a}{(s+a)^2+w^2}$
e^{-at} sin (wt). u(t)	$\dfrac{w}{(s+a)^2+w^2}$
$\dfrac{d\,f(t)}{dt}$	$s\,F(s) - f(0^-)$
$\dfrac{d^2 f(t)}{dt^2}$	$s^2F(s) - s\,f(0^-) - f'(0^-)$
$\int_{\infty}^{t} f(q)\,dq$	$\dfrac{F(s)}{s} + \int_{\infty}^{0} f(q)\,dq$