National Exams May, 2010

07-Elec-A1 Circuits

3 hours duration

NOTES:

1. **No questions to be asked.** If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any logical assumptions made.

2. Candidates may use one of two calculators, a Casio or Sharp approved models. **No programmable modes** are allowed.

3. This is a **closed book** examination.

4. Any **five questions** constitute a complete paper. Please indicate in the front page of your answer book which questions you want to be marked. If not indicated, only the first five questions as they appear in your answer book will be marked.

5. All questions are of equal value.

6. **Laplace Table** and other useful equations are given in the last page of this question paper.

Marking scheme:

Q1:(i) 12, (ii) 8;

Q2:(i) 12, (ii) 8;

Q3:(i) 12, (ii) 8;

Q4: (i) 10, (ii) 2, (iii) 8;

Q5: (I) 12, (ii) 8;

Q6: (i) 8, (ii) 12

Q1: (i) Write the Mesh current equations of the circuit shown in Figure-1 [12]

(ii) Solve for the current **Ix** as shown in the circuit. [8]

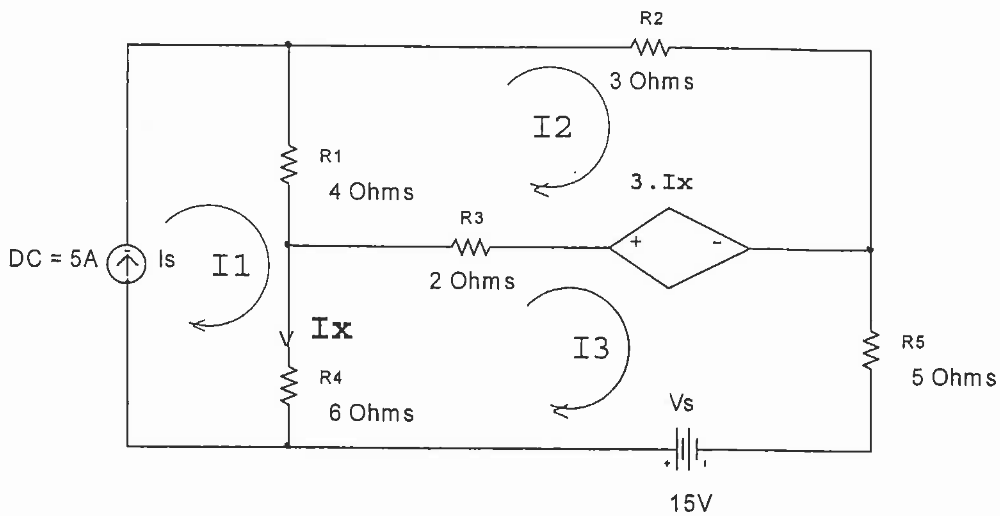

Figure-1

Q2: In Figure-2, the switch was in position-A for a long time. At t = 0, it is moved to Position-B.

Calculate (i) $v_c(0+)$, $\frac{dv_c}{dt}(0+)$, and $v_c(\infty)$ [4+6+2]

(ii) $v_c(t)$ when $t \geq 0$ [8]

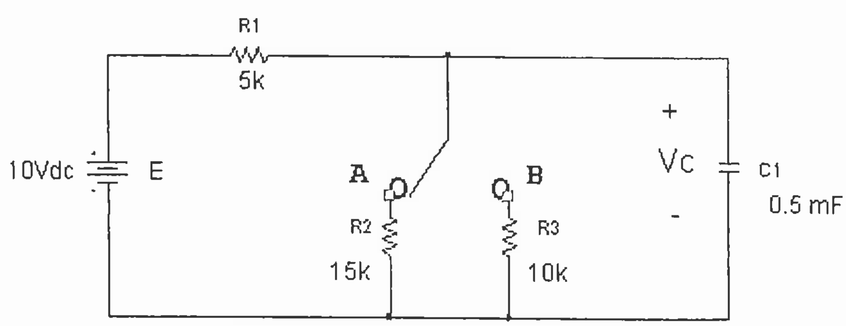

Figure-2

Q3: (i) Write the nodes equations of the circuit shown in Figure-3. [12}

(ii) Solve the node equations to find the voltage Vo ,as shown in the circuit. [8]

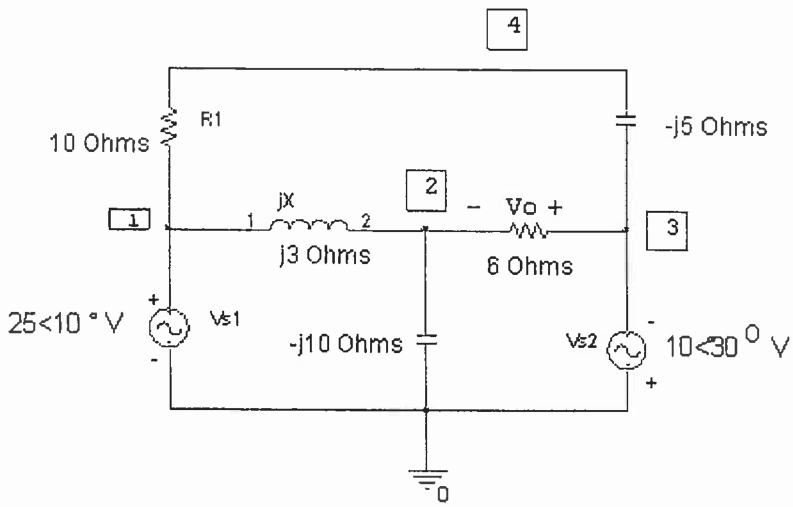

Figure-3

Q4: (i) Thevenize the circuit at terminals A-B as shown in Figure-4. [10]

(ii) What must be the value of the load ZL for the maximum power transfer ? [2]

(iii) What is the maximum power transfer possible to ZL ? [8]

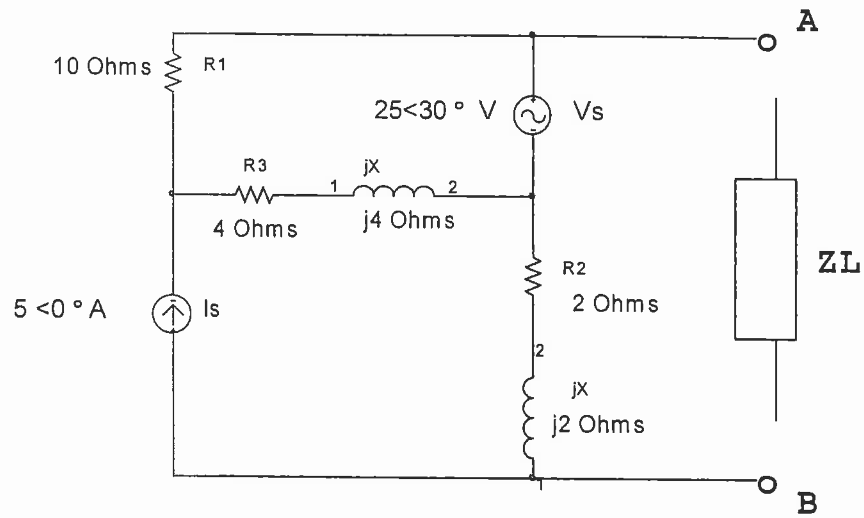

Figure-4

Q5: In the circuit shown in Figure-5, (i) calculate the resonance frequency, f_o of the circuit. (ii) At the calculated resonance frequency, calculate the voltage across the capacitor. [12+8]

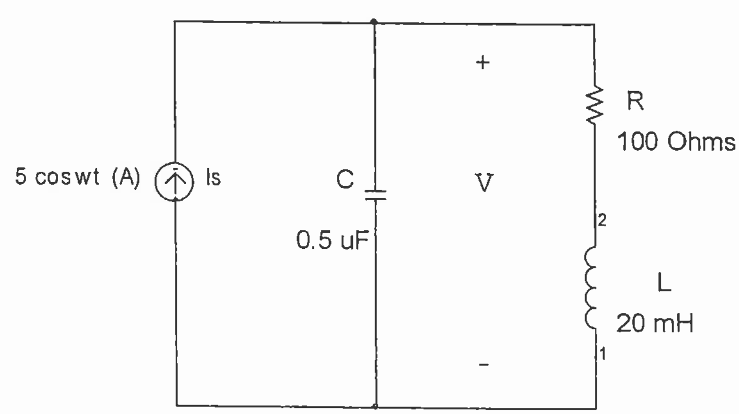

Figure-5

Q6: In the Figure-6, $v_c(o+)=0$ and $i_L(0+)=0$.

(i) Calculate the Transfer function, $H(s) = \frac{Vo(s)}{Vin(s)}$ [8]

(ii) If Vin is a step function of 10V as shown in Figure-6, calculate $v_o(t)$, for $t \geq 0$. [12]

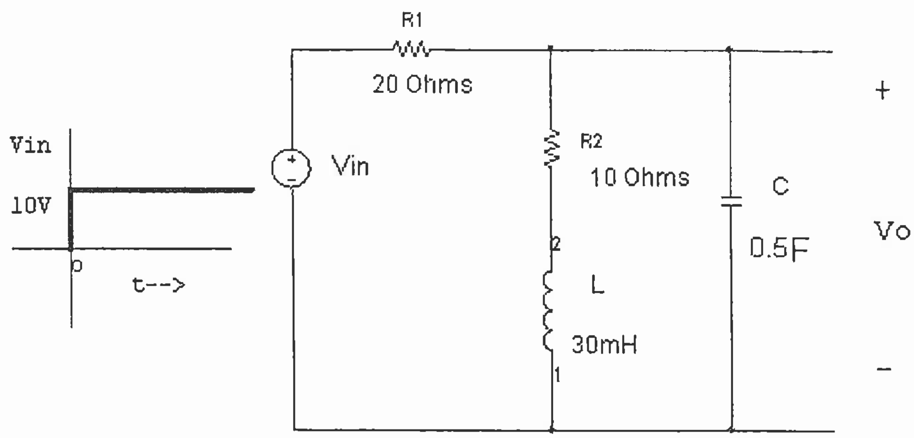

Figure-6

Appendix

Some useful **Laplace Transforms:**

f(t)	→	F(s)
Ku(t)		K /s
e^{-at} u(t)		1 / (s+a)
sin wt .u(t)		w / (s^2+w^2)
cos wt . u(t)		s / (s^2+w^2)
$\frac{d\,f(t)}{dt}$		s F(s) – f(0^-)
$\frac{d^2 f(t)}{dt^2}$		s^2F(s) – s f(0^-) –f^1(0^-)
$\int_{-\infty}^{t} f(q)\,dq$		$\frac{F(s)}{s} + \int_{-\infty}^{0} f(q)dq$
