National Exam December, 2014

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 models** 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 some useful equations are given in the last page of this exam paper.

Q1: For the circuit shown in Figure-1,

(a) Calculate the equivalent resistance of the circuit , R_{AB} at the terminals A and B. [10]

(b) Solve for the current I at the location shown. [5]

(c) Calculate the Power dissipation in the 12Ω resistance. [5]

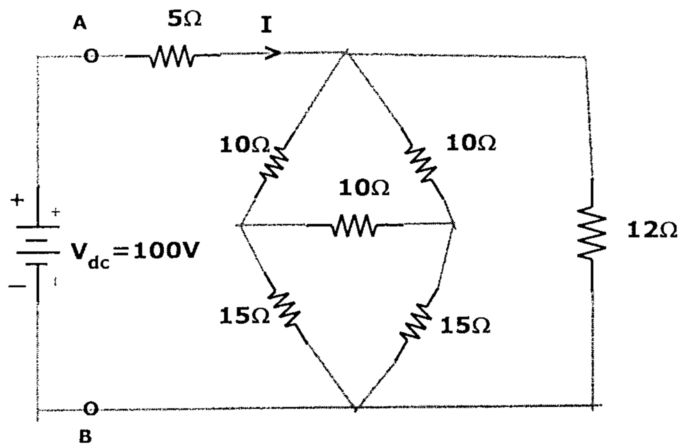

Figure-1

Q2: For the circuit shown in Figure-2 ,

(i) Write the mesh current equations for the mesh currents shown. [8]

(ii) Solve the mesh currents I1 and I2. [8]

(iii) Solve the power dissipation in the 5Ω. [4]

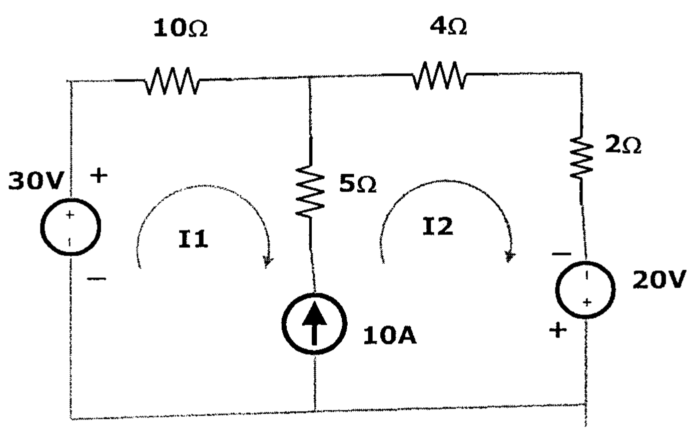

Figure-2

Q3: In the circuit shown, the switch was initially closed between A and B. The switch is opened at $t = 0$.

(i) Solve $i_{(o)}$. [4]

(ii) Solve $\frac{di}{dt}(0^{+})$ [6]

(iii) Solve $i_{(t)}$ for $t \geq 0$. [10]

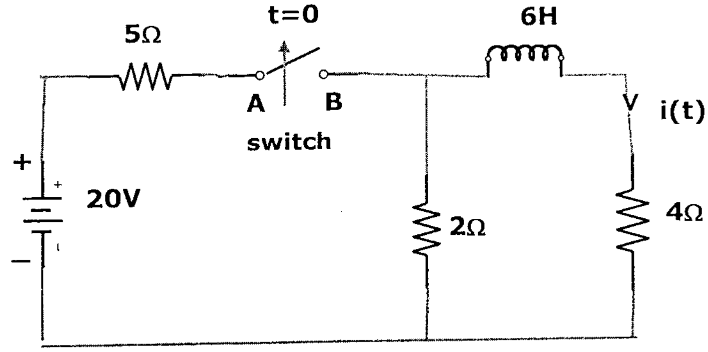

Figure-3

Q4: In circuit shown in Figure-4, solve $v_o(t)$ by Superposition theorem. [20]

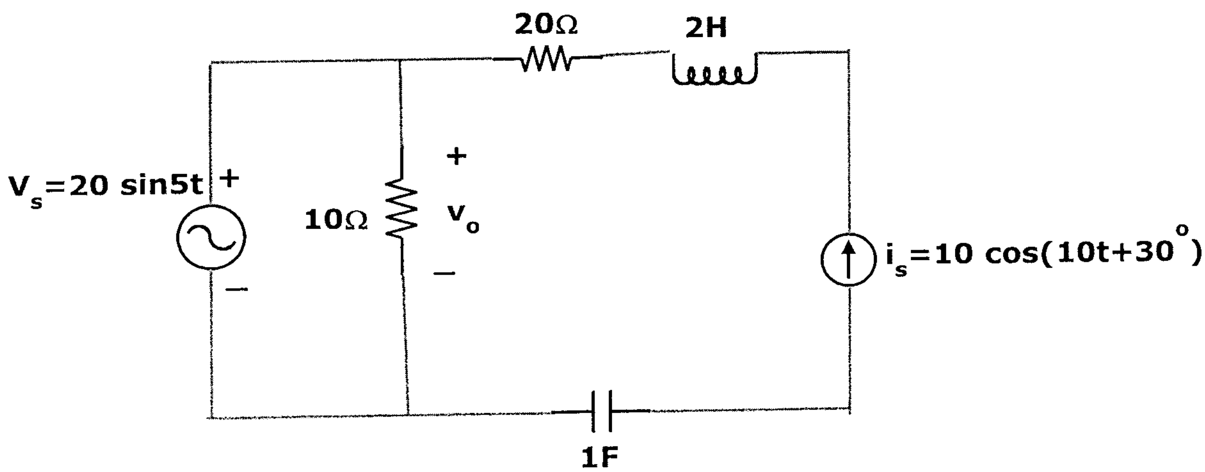

Figure-4

Q5: For the circuit shown in Figure-5,

(i) Thevenize the circuit at terminals A and B. [10]

(ii) What Z_{Load} to be connected at terminals A and B to get maximum power in Z_{Load} ? [4]

(iii) Calculate the maximum power in Z_{Load}. [6]

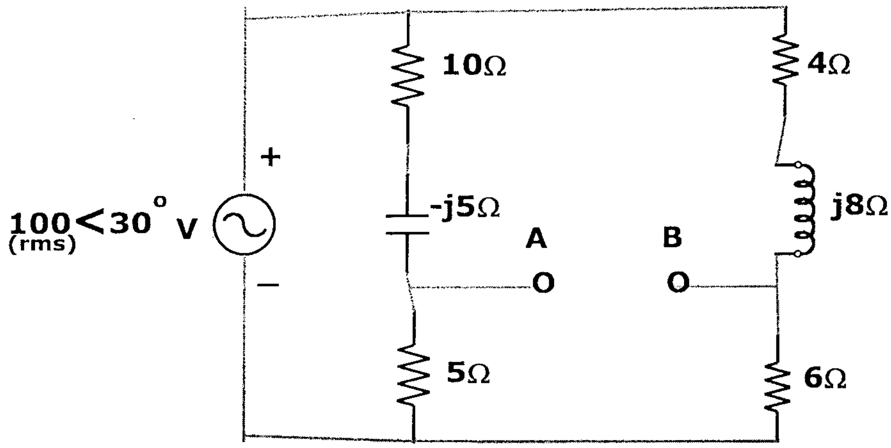

Figure-5

Q6: In Figure-6, the switch was initially at position A. It is moved to position B at t = 0.

(i) Draw the Laplace transformed circuit at $t \geq 0$. [10]

(ii) Solve from the Laplace transformed circuit, the current $i(t)$ in time domain. [10]

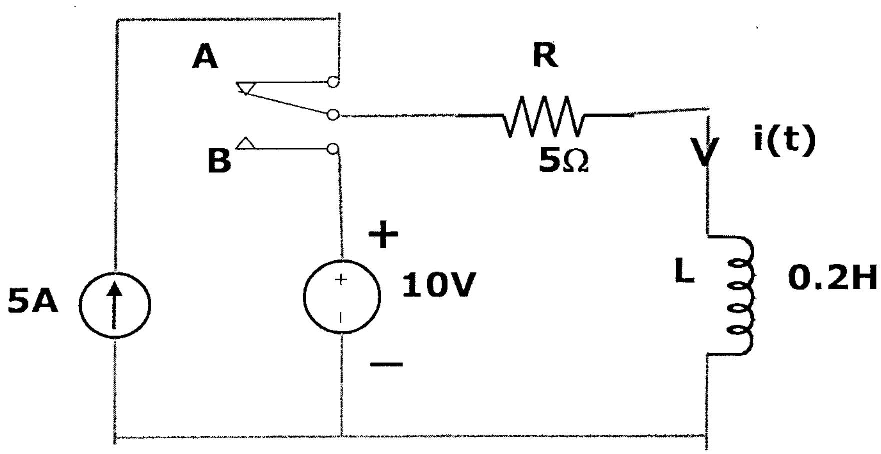

Figure-6

Appendix

Some useful **Laplace Transforms and equations:**

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)
$e^{-\alpha t} \sin \omega t$		$\frac{\omega}{(s+\alpha)^2+\omega^2}$
$e^{-\alpha t} \cos \omega t$		$\frac{(s+\omega)}{(s+\alpha)^2+\omega^2}$
$\frac{d f(t)}{dt}$		s F(s) – f(0^-)
$\frac{d^2 f(t)}{dt^2}$		s^2F(s) – s f(0^-) –$f^1(0^-)$
$\int_{-\infty}^{t} f(q)dq$		$\frac{F(s)}{s}+\int_{-\infty}^{0} f(q)dq$

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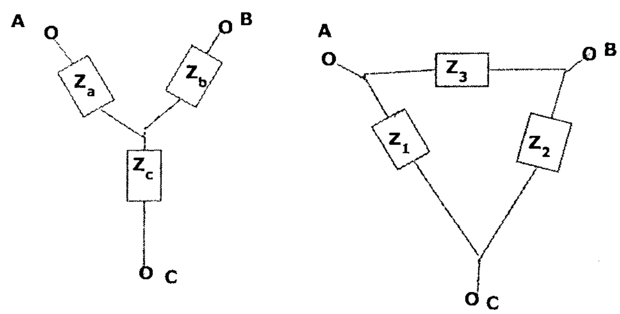

Y-connection Δ-connection

$$Z_a = \frac{Z_1 . Z_3}{Z_1 + Z_2 + Z_3}\ , \quad Z_b = \frac{Z_2 . Z_3}{Z_1 + Z_2 + Z_3}\ , \quad Z_c = \frac{Z_1 . Z_2}{Z_1 + Z_2 + Z_3}$$

$$Z_1 = \frac{Z_a.Z_b + Z_b.Z_c + Z_a.Z_c}{Z_b} \quad Z_2 = \frac{Z_a.Z_b + Z_b.Z_c + Z_a.Z_c}{Z_a} \quad Z_3 = \frac{Z_a.Z_b + Z_b.Z_c + Z_a.Z_c}{Z_c}$$