MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKE-UP EXAMINATIONS, APRIL 2022

ELECTRICAL CIRCUIT ANALYSIS [ELE 2153]

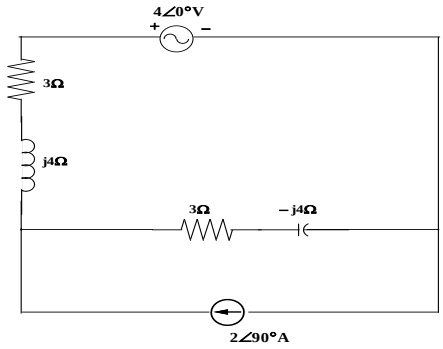
REVISED CREDIT SYSTEM

Time: 3 Hrs. **Date: 19 APRIL 2022** **Max. Marks: 50**

Instructions to Candidates:

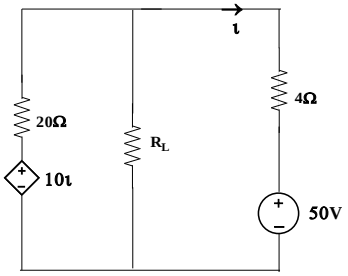
- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Determine the current in the capacitor branch by superposition theorem in the circuit shown.



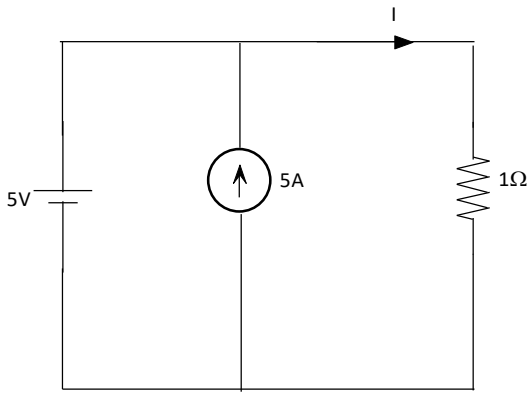
(04)

1B. In the network shown, find the value of R_L to which the maximum power can be delivered?



(04)

1C. Determine the current 'I' flowing in the 1Ω resistor in the circuit shown in figure.



(02)

2A. Evaluate the convolution integral $y(t) = x(t) * h(t)$ of the following signals:

$x(t) = 2\{u(t+1) - u(t-1)\}$ and $h(t) = t\,\{u(t+2) - u(t-2)\}$

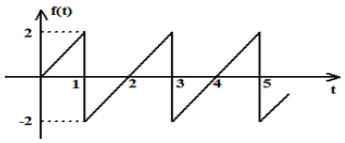
Plot the relevant waveforms for $x(t), h(t)$, and $y(t)$. ***(05)***

2B. The first derivative of a waveform f(t) is given by $f^1(t) = \delta(t) + u(t) - 3.5u(t-2) + 2.5u(t-4) + 2\delta(t-5)$.

Sketch *f(t) and $f^1(t)$.* ***(03)***

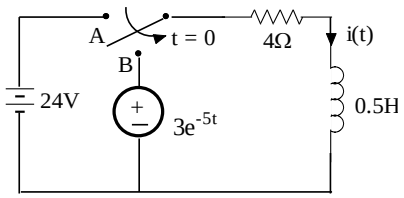
2C. Evaluate $\int_{-\infty}^{\infty} (e^{-t}\cos t\delta(t) + \sin 2t\delta(t - \pi/4))dt$ ***(02)***

3A Find the Laplace transform of the periodic waveform shown in figure



(03)

3B In the circuit shown, switch is moved from A to B at t = 0, after attaining steady state at position A. Find i(t) for t > 0 using time domain analysis.



(04)

3C A special generator has a voltage variation given by the equation $v(t) = t$, where t is the time in seconds and $t \geq 0$. This generator is connected to an RL series circuit where R = 2Ω L =1H at time $t = 0$, by the closing of a switch. Find the equation of the current as a function of time $i(t)$ using Laplace domain analysis. ***(03)***

4A Mention and prove the eigen function of CT-LTI systems. ***(02)***

4B Determine the Fourier series coefficients of the following signal:

$x(t) = e^{-2t}$; $0 \leq t \leq 2$ repeating in every 2 units of time.

Plot the magnitude and phase spectrum for 7 frequency samples following symmetry and antisymmetric property, respectively. ***(03)***

4C Consider an LTI system with frequency response

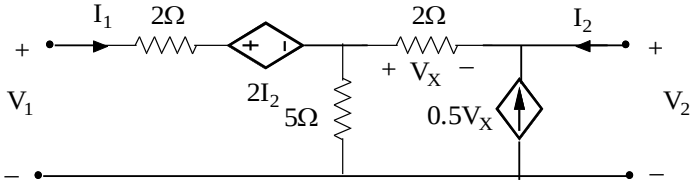
$$H(\omega) = \begin{cases} 1; & |\omega| < \omega_c \\ 0; & |\omega| > \omega_c \end{cases}.$$

The input to this filter is $x(t) = \frac{\sin at}{\pi t}$.

Find the output $y(t)$ using properties of Fourier transform for

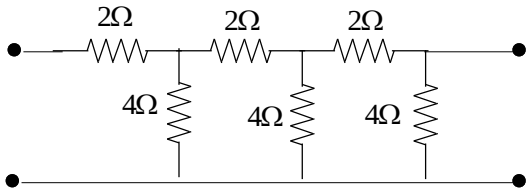
(i) $a < \omega_c$ and (ii) $a > \omega_c$. ***(05)***

5A Find the h parameters of the network shown.



(04)

5B Decompose the network shown into two, 2 port networks connected in cascade and hence find the overall T parameters.



(04)

5C A two port network is defined by the parameters: $Y_{21} = 6$, $Y_{22} = 8$, $h_{11} = 5$, $h_{12} = 2$. Find the T parameters. ***(02)***