UNIVERSITAS JENDERAL SOEDIRMAN FAKULTAS TEKNIK PROGRAM STUDI TEKNIK ELEKTRO
UJIAN TENGAH SEMESTER
Sinyal dan Sistem
Semester Gasal TA 2025/2026

Identitas MK

Kode MK	TKE222124
Nama MK	Sinyal dan Sistem
Dosen MK	Dinda Wahyu ,M. Syaiful Aliim, Imron Rosyadi, Agung Mubyarto

Capaian Pembelajaran MK Terkait

CPMK	Nomor Soal	Bobot
CPMK 2: Analisis Sinyal dan Sistem di Domain Frekuensi (Waktu-kontinu).	1,2,3,4,5	100%

Pelaksanaan Asesmen

Hari, Tanggal	Senin, 3 November 2025 (Kelas A,B)
	Selasa, 4 November 2025 (Kelas C,D)
Waktu	09.45-11.45
Durasi	120 menit
Bentuk	Tertulis
Bobot	26,25%
Sifat	Open sheet (1 lembar A4)
Alat Bantu	Alat tulis, kalkulator, sheet

Peraturan Ujian

- Saat ujian, peserta hanya diperkenankan membawa alat bantu ujian yang diizinkan.
- Letakkan peranti selain alat bantu ujian di bagian depan kelas.
- Peserta dilarang bekerja sama, menyontek pekerjaan peserta lain, menyontek dari sumber dan menggunakan alat bantu yang tidak diizinkan.
- Perbuatan curang dan pelanggaran aturan ujian akan mendapatkan sanksi akademik.

Kode Soal Ujian

A

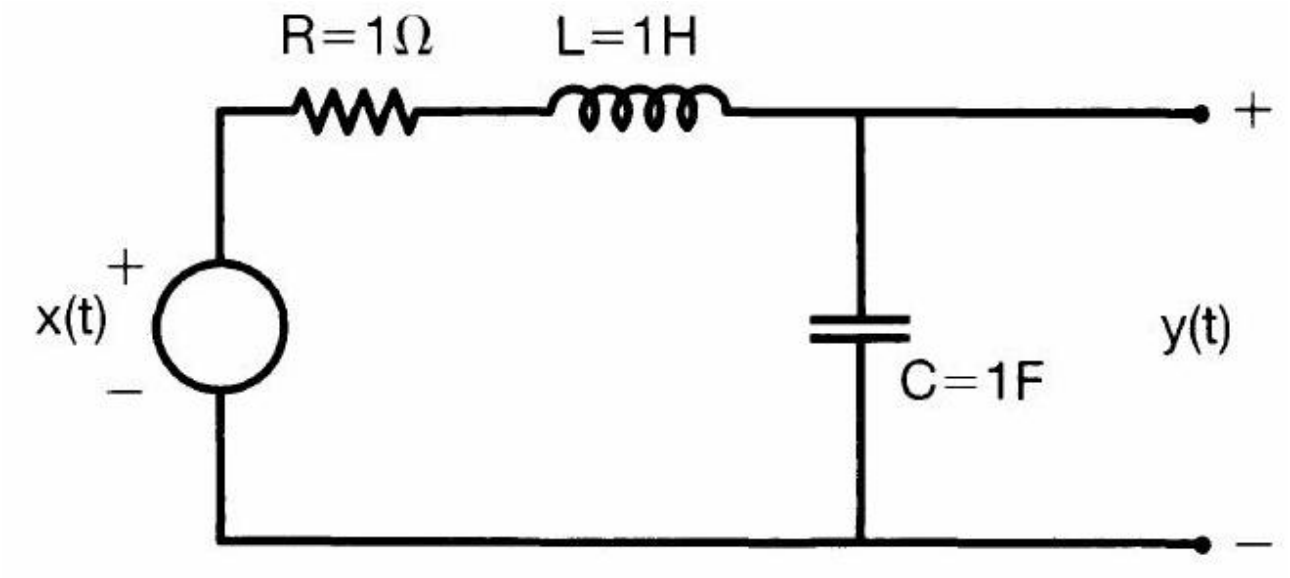
Identitas Peserta Ujian

Nama: _____

NIM: _____

Soal 1 [CPMK-2, 15%]

3.20. Consider a causal LTI system implemented as the *RLC* circuit shown in Figure P3.20. In this circuit, $x(t)$ is the input voltage. The voltage $y(t)$ across the capacitor is considered the system output.



(a) Find the differential equation relating $x(t)$ and $y(t)$.

(b) Determine the frequency response of this system by considering the output of the system to inputs of the form $x(t) = e^{j\omega t}$.

(c) Determine the output $y(t)$ if $x(t) = \sin(t)$.

3.20. (a) $\frac{d^2y(t)}{dt^2} + \frac{dy(t)}{dt} + y(t) = x(t)$

(b) $H(j\omega) = \left(\frac{1}{1+j\omega-\omega^2}\right)$

(c) $-\cos t$

4.20. Find the impulse response of the causal LTI system represented by the *RLC* circuit considered in Problem 3.20. Do this by taking the inverse Fourier transform of the circuit's frequency response. You may use Tables 4.1 and 4.2 to help evaluate the inverse Fourier transform.

4.20. $h(t) = \frac{2}{\sqrt{3}} e^{-t/2} \sin\left(\frac{\sqrt{3}}{2}t\right) u(t)$

9.18. Consider the causal LTI system represented by the *RLC* circuit examined in Problem 3.20.

(a) Determine $H(s)$ and specify its region of convergence. Your answer should be consistent with the fact that the system is causal and stable.

(b) Using the pole-zero plot of $H(s)$ and geometric evaluation of the magnitude of the Fourier transform, determine whether the magnitude of the corresponding Fourier transform has an approximately lowpass, highpass, or bandpass characteristic.

(c) If the value of R is now changed to $10^{-3}\Omega$, determine $H(s)$ and specify its region of convergence.

(d) Using the pole-zero plot of $H(s)$ obtained in part (c) and geometric evaluation of the magnitude of the Fourier transform, determine whether the magnitude of the corresponding Fourier transform has an approximately lowpass, highpass, or bandpass characteristic.

9.18. (a) $H(s) = \frac{1}{s^2+s+1}, \mathrm{Re}\{s\} > -\frac{1}{2}$

(b) Lowpass

(c) $H(s) = \frac{1}{s^2+10^{-3}s+1}, \mathrm{Re}\{s\} > -0.0005$

(d) Bandpass

Jawaban Ringkas: _____

Soal 2 [CPMK-2, 20%]

That's an excellent circuit for testing a student's grasp of linear time-invariant (LTI) system analysis across different analytical domains. The series **RLC circuit** with the output $y(t)$ taken across the capacitor provides a classic second-order system.

Here are four distinct, self-contained exam questions suitable for an undergraduate Signals and Systems course, each focusing on a different analytical tool.

Signals and Systems Exam Questions: RLC Circuit Analysis

The system under consideration is the causal LTI system shown in the figure, where the input is the applied voltage $x(t)$ and the output is the capacitor voltage $y(t)$. The circuit consists of a resistor R, an inductor L, and a capacitor C.

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1. Differential Equations in the Time Domain

Question: Derive the **linear constant-coefficient differential equation** that relates the output voltage, $y(t)$, to the input voltage, $x(t)$, for the given RLC circuit. Express your final answer in the standard form:

$$A\frac{d^2y(t)}{dt^2} + B\frac{dy(t)}{dt} + Cy(t) = D\frac{dx(t)}{dt} + Ex(t)$$

where A, B, C, D, and E are coefficients in terms of R, L, and C.

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2. Continuous-Time Fourier Transform (CTFT)

Question: Determine the **frequency response**, $H(j\omega)$, of the RLC circuit. The frequency response is defined as the ratio of the output voltage's Fourier Transform, $Y(j\omega)$, to the input voltage's Fourier Transform, $X(j\omega)$.

$$H(j\omega) = \frac{Y(j\omega)}{X(j\omega)}$$

Simplify the expression to a single rational function of $j\omega$ and the circuit parameters R, L, and C.

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3. Laplace Transform

Question: a) Find the **system transfer function**, $H(s)$, for the RLC circuit. b) Assuming the component values are $R = 2\ \Omega$, $L = 1\ H$, and $C = 1\ F$, determine the **natural frequencies (poles)** of the system. c) Sketch the **Region of Convergence (ROC)** for $H(s)$, given that the system is **causal**.

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4. Fourier Series

Question: Assume the component values are $R = 1\ \Omega$, $L = 1\ H$, and $C = 1/2\ F$. The input voltage is a periodic signal, $x(t)$, with a **fundamental period** of $T_0 = 2\pi$ seconds, described by the **Fourier Series** coefficients:

$$c_k = \frac{1}{jk(1 + |k|)}$$

Determine the **Fourier Series coefficients**, d_k, of the steady-state output voltage, $y(t)$. Your answer should be an analytic expression for d_k in terms of k. *(Hint: First find the system's frequency response $H(j\omega)$.)*

Jawaban Ringkas: _____

Purbalingga, 20 Oktober 2025

	PIC	Tanda Tangan
Dipersiapkan oleh (Dosen MK)	Aisyah Nur Aulia	1.
	Norma Amalia	2.
	Yogi Ramadhani	3.
	Imron Rosyadi	4.
Diperiksa oleh (Korprodi)	Winasis	5.