BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2024)

CLASS : BTECH **SEMESTER : IV**
BRANCH: ECE **SESSION : SP/2024**

SUBJECT: EC253 ANALOG COMMUNICATION

TIME: 02 Hours **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates**

			CO	BL
Q.1(a)	State and explain the complex exponential Fourier series of a periodic signal with suitable mathematical analysis.	[3]	CO1	BL1, 2
Q.1(b)	Find the exponential Fourier series for a periodic train of rectangular pulses $f(t)$ with amplitude A, pulse width τ, and repetition time T, as given below. Choose the origin of the pulse to coincide with the center of the pulse. $$f(t) = \begin{cases} A; & \frac{-\tau}{2} < t < \frac{\tau}{2} \\ 0; for\ the\ remainder\ of\ the\ period \end{cases}$$	[2]	CO1	BL4
Q.2(a)	State and explain Parseval's power theorem for a periodic signal with suitable mathematical analysis.	[3]	CO1	BL1, 2
Q.2(b)	A function $g(t)$ has a power spectral density $S_g(\omega)$. Find the power spectral density of (i) integral of $g(t)$ and (ii) time derivative of $g(t)$.	[2]	CO1	BL4
Q.3(a)	Define a linear time-invariant (LTI) system. Derive the condition on the impulse response of an LTI system for the system to be stable.	[3]	CO1	BL1, 2
Q.3(b)	For an LTI system, the impulse response is given as $h(t) = \{e^{-t}u(t) + e^{2t}u(-t)\}$, and the system is excited by $x(t) = e^{-2t}u(t)$. Find the output $y(t)$ for this system.	[2]	CO1	BL4
Q.4(a)	Define amplitude modulation. Derive the mathematical expression for a single-tone amplitude-modulated wave and explain, why the modulation factor should always be less than one.	[3]	CO2	BL2
Q.4(b)	A carrier wave of 10 MHz frequency and peak value of 10 V is amplitude modulated by a 5 KHz cosine-wave of 6 V amplitude. Determine the modulation index and draw the one-sided spectrum of the modulated wave.	[2]	CO2	BL4
Q.5(a)	Explain the quadrature null effect in coherent detection of DSB-SC waves with suitable block diagram schematic and mathematical analysis.	[3]	CO2	BL2
Q.5(b)	Calculate the power savings percentage for a DSB-SC signal with a modulation percentage of (i) 100% and (ii) 50%.	[2]	CO2	BL4

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