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TEL252E – SIGNALS&SYSTEMS MIDTERM 1

Duration: 2 hours
Do all parts of all problems. Show your work. Label and mark all sketches.

QUESTIONS

1. Determine whether the following signals are periodic. If they are determine their fundamental period
i) $x(t) = e^{\cos(t/8)}$. (4 pts)
ii) $x[n] = e^{j\frac{2\pi}{7}n} + e^{j\frac{1}{4}n}$ (6 pts)

2. Let $x(t) = e^{-t}\left[u(t) - u(t-1)\right]$
i) Draw this signal. (3 pts)
ii) Determine and draw $x(2-\frac{1}{2}t)\left[\delta(t) + \delta(t-3)\right]$ (7 pts)
iii) Determine $x(t) * x(t)$. (10 pts)

3. A discrete time LTI system with system response $h[n] = (0.3)^n u[n-1]$ is excited by input $x[n]$. Find the output $y[n]$ if
i) $x[n] = 0.5\delta[n+1] + \delta[n] + 0.5\delta[n-1]$ (5 pts)
ii) $x[n] = (0.5)^n$ (10 pts)
iii) $x[n] = nu[n]$ (10 pts)

4. A continous time LTI system with system response $h(t)=e^{-\beta t}u(t)$ is excited by input $x(t)= e^{-\alpha t}u(t)$.
i) Find the system output if $\alpha=\beta$ (10 pts)
ii) Find the system output if $\alpha\neq\beta$ (10 pts)
iii) Determine whether the system is causal or not. (2 pts)
iv) Determine the conditions for the system to be BIBO stable (3 pts)

5. Determine and sketch the Fourier Series coefficients of the periodic signal $x(t)$ given below. (20 pts)