Signal Processing (İkinci Öğretim)
Midterm Exam

Istanbul University - Computer Engineering Department - FALL 2016

November 3rd, 2016

PLEASE READ: The duration for this exam is **70** minutes. Please answer the questions in ENGLISH briefly and clearly. **Bad handwriting, unclear statements, ambiguous answers will result in credit loss**. You may bring one calculator, an A4 sized cheat-sheet and a copy of Appendix A from the book to the exam. The cheat-sheet MUST NOT contain any problems and solutions. (If you do not have a cheat-sheet, please let the attending Assistant know). Every other material is forbidden. Sharing of materials is not allowed and will be considered cheating if done so. Please read the questions before solving them. Please RETURN your exam papers and your A4 cheat-sheets at the end of the examination. This test has total of **100** points worth of questions. Anyone attempting to cheat, help someone else to cheat or make an effort to do these will receive 0 points for the exam and will be reported to the Dean's office. Good Luck. (Mustafa Dağtekin)

Q1: Consider the following CONTINUOUS TIME signals and answer the following questions.

$$x(t) = \begin{cases} 2t+2 & , \quad -2 \leq t < 0 \\ \dfrac{-t}{4} + 2 & , \quad 0 \leq t < 4 \\ 0 & , \quad \text{elsewhere} \end{cases}$$

(a) `(20 pts)` Please carefully sketch $x(2t-2) + x(\frac{t}{2}+4)$. Show your steps to receive credit.

(b) `(15 pts)` Please determine whether $x(t)$ is an energy or power signal. Calculate its power or energy, whichever applies.

Q2: Consider the following CT signal and answer the following questions.

$$x(t) = \cos^2(\frac{2}{3}\pi t)$$

(a) `(20 pts)` Is $x(t)$ periodic? If so, calculate its fundamental period, frequency and angular frequency.

(b) `(15 pts)` Please determine whether $x(t)$ is an even signal, odd signal or neither.

Q3: `(30 pts)` The systems below show the input as $x(t)$ or $x[n]$ and the output as $y(t)$ or $y[n]$. For each system, determine whether it is **(i)** `(2 pts each)` memoryless, **(ii)** `(3 pts each)` stable, **(iii)** `(2 pts each)` causal, **(iv)** `(4 pts each)` linear, and **(v)** `(4 pts each)` time-invariant.

$$y[n] = 2x[n]u[n-1]$$

$$y(t) = \frac{\mathrm{d}}{\mathrm{d}t}\{e^{-t}x(t)\}$$