VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
[Central Technological Institute, Maharashtra State]
Matunga, Mumbai – 400019

Mid Semester Test September 2020 | Date of Exam: 30/09/2020
Semester & Program: Sem. V, T. Y. B. Tech. EXTC | Time: 12 to 1 pm
Time Allowed: 60 minutes (45+15=60) | Max. Marks: 20
Course: Digital Signal Processing (R4ET3003T)

All the questions are compulsory. Figures to the right indicate full marks. Reason to the answers carry weightage, mere answers DON'T have credits.

Q1 a During our classroom sessions we have discussed the "fashion show" example and related it with the "four-step" process to find the processed output from actual input when applied to a *system*. Consider two signals $x_1(n) = x_2(n) = \{\underset{\uparrow}{1}, 2, 3, 4\}$. We know when we apply the "four-step" process to $x_1(n)$ and $x_2(n)$, we get another signal. Avnish tries to understand this problem and computes the result analytically. He misses the first step by mistake (unintentionally or otherwise!) Aryan catches the bug being attentive in the class. He points out the mistake to Avnish however could not convince him. Avnish rebuts him by giving similar arguments considered in our class. Neha participates in their argument, investigates the problem and shares her conjectures with them. ***06***

Identify the arguments made by each of them at each step. Enunciate its possible utility, mathematical and physical significance in case of existence otherwise about its viability. Would you like to explicate the entire process?

b Consider the following relation with usual notations. ***04***

$$y(n) = \sin\left(\frac{3}{4}\pi(n+1)\right)x(n)$$

Comment with REASONS on linearity, time-variance, causality and stability.

Q2 a Consider an LTI system described by $y(n) = x(n) + y(n-1) + y(n-2)$; Compute its impulse response by means of Z-transform. Recall, our understanding of "come tomorrow/*kal aana*" in our discussion. Identify the system (seed value can be considered as unity and input to be unit impulse!) and comment on its stability with proper reasons. ***05***

b Pranjal and Sarvesh have observed the following input $x_i[n]$ and output $y_i[n]$ pairs during the operation of a linear system. ***05***

$x_1[n] = \{\underset{\uparrow}{1}, 2, 3\} \leftrightarrow y_1[n] = \{3, \underset{\uparrow}{2}, -1, 1, 3\}$

$x_2[n] = \{-1, \underset{\uparrow}{-1}, 3, 0\} \leftrightarrow y_2[n] = \{2, \underset{\uparrow}{3}, -1, 0, 1\}$

$x_3[n] = \{0, 2, \underset{\uparrow}{4}, -6\} \leftrightarrow y_3[n] = \{6, \underset{\uparrow}{4}, 0, 4, 4, 0\}$

Sarvesh suggests bringing the problem in the transform domain and computes the transfer function and impulse response (Alas, he doesn't reveal his method!). Pranjal refuses as he is not very keen working in the transform domain (Probably he has a different taste being a different student!). Prove or disprove mathematically the proposal by Sarvesh. Does approval/disproval of this claim substantiate Pranjal's refusal implicitly? Or Is Pranjal justified in his personal choice?

********** All the best **********