UIET, Panjab University, Chandigarh (Session: July-Dec 2020)

BE (ECE) 5th sem (1st sess. test)

Time: 90 Min **Digital Signal Processing** M.M: 30

1. Find whether the following systems are Memory-less, Time- Invariant, Linear, Causal, and Stable. Justify your answer. (5)
   a. $y[n] = x[n]\sum_{k=-\infty}^{\infty}\delta[n-4k]$
   b. $y[n] = \log_{10}(|x[n]|)$
2. Classify the following signals as energy signals, power signals, or neither and find the energy or average power as appropriate: (5)
   a. $x[n] = \frac{1}{n^2}u[n-1]$
   b. $r[n] = e^{(j+1)n\pi/4}$
3. Consider the difference equation (6)

$$y[n] + \frac{1}{15}y[n-1] - \frac{2}{5}y[n-2] = x[n]$$

   (a) Determine the general form of the homogeneous solution to this equation.
   (b) Both a causal and an anti-causal LTI system are characterized by the given difference equation. Find the impulse response of the two systems.
   (c) Check the stability of the specified causal LTI system and the anti-causal LTI system.
   (d) Find a particular solution to the difference equation when $x(n) = \left(\frac{3}{5}\right)^n u(n)$.

4. Assuming right-sided signals, determine the ROC and compute the inverse Z-transform of signal: (5)

$$H(z) = \frac{z^2}{(z^2 + 0.25)^2}$$

5. By means of DFT and IDFT, determine the response of filter with impulse response $h(n) = \{2,4,6\}$, and input signal $x(n) = \{3,2,4,-7,1\}$ (6)
6. Describe the properties and spectrum of time-limited and band-limited signals. (3)