TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Chaitra

Exam.	Regular (New Course)		
Level	BE	Full Marks	60
Programme	BEL	Pass Marks	24
Year / Part	III / I	Time	3 hrs.

Subject: - Digital Signal Processing and Application (*ENEX 304*)

- ✓ *Candidates are required to give their answers in their own words as far as practicable.*
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Define energy signal and power signal. Is the signal $x[n] = \cos\left(\frac{\pi}{5}n\right)\sin\left(\frac{\pi}{3}n\right)$ periodic? If it is periodic, determine the fundamental period. [2+2]
2. Find the output of an LTI system having impulse response $h[n] = \{1,3,2,-1,1\}$ to the input $x[n] = 2\delta[n] - \delta[n-1]$. [4]
3. Determine the causal signal x(n) having the z-transform. [4]

$$X(z) = \frac{1}{(1+z^{-1})(1-z^{-1})^2}$$

4. Plot the pole-zero in Z-plane and draw magnitude response (not to the scale) of the system described by difference equation

$$y[n] - 0.4y[n-1] + 0.25y[n-2] = x[n] - 0.4\,x[n-1]$$ [2+4]

5. Compute the lattice-ladder coefficients for the given IIR system: [5+1+2]

$$H(z) = \frac{1 + 2z^{-1} + 2z^{-2} + z^{-3}}{1 + \frac{13}{24}z^{-1} + \frac{5}{8}z^{-2} + \frac{1}{3}z^{-3}}$$

Also, comment on the stability and draw the lattice-ladder structure for the system.

6. Define Gibb's phenomenon. The desired frequency response of a HPF is given bys [2+6]

$$H_d(e^{jw}) = \begin{cases} e^{-j3\omega} & \omega_c \le |\omega| \pi \\ 0 & |\omega| < \omega_c \end{cases}$$

Design a linear phase FIR filter using hamming window for M =7 and ω_c = 2 rad/sample.

7. What do you understand by optimum filter? Describe Remez exchange algorithm for FIR filter design using a flowchart. [1+3]
8. Compare and contrast between impulse invariance method and bilinear transformation method. Design a digital IIR low pass filter using bilinear transformation based on Butterworth approximation to meet the following specifications: passband magnitude characteristics that is constant to within 1 dB for recurrences below $\omega=0.2\pi$ and stopband attenuation of at least 15 dB for frequencies between $\omega = 0.3\pi$ and π. Use bilinear transformation. [2+10]
9. Find 8-point DFT using DIF-FFT of the sequence $x[n] = \{1, 2, 3, 2, 1\}$. [5]
10. Discuss the application of DSP in Power System Monitoring and Diagnostics. Perform the circular convolution of the following two sequences $x_1[n] = \{1, 2, 3\}$ and $x_2[n] = \{1, 2, 3, 4\}$ [2+3]

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