

Con. 5922-08.

RC-7004

(REVISED COURSE)

(3 Hours)

[Total Marks : 100]

- N.B. : (1) Question No.1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining **six** questions.
 (3) Assume **suitable data** if **required**.

1. (a) Implement the second order digital filter from difference equation, 5

$$y(n) = 2 r \cos(\omega_0) y(n-1) - r^2 y(n-2) + x(n) - r \cos(\omega_0) x(n-1)$$

 (b) Find the transfer function and sketch magnitude and phase spectra 5
 whose unit sample response is given by,

$$h(0) = 1, h(1) = -1, \text{ and } h(n) = 0 \text{ otherwise}$$

 (c) Find N-point DFT of— 5

$$x(n) = e^{j2\pi nKN}$$

 (d) Check the stability of first order recursive filter— 5

$$y(n) = a y(n-1) + x(n)$$
2. (a) Find the convolution of two sequences— 10

$$x(n) = 1 \quad \text{for } -3 \leq n \leq 3$$

$$= 0 \quad \text{otherwise}$$

$$h(n) = 1 \quad \text{for } 0 \leq n \leq 6$$

$$= 0 \quad \text{otherwise}$$

 (b) Find 8-point DFT using DITFFT algorithm with butterfly diagram for— 10

$$x(n) = \{1, -1, -1, -1, 1, 1, 1, -1\}$$
3. (a) Determine the Z-transform with ROC for— 5

$$x(n) = \alpha^n u(n)$$

 (b) Give the steps in designing digital filter. 5
 (c) Determine the order and poles of low pass Butterworth filter that has -3 dB 10
 bandwidth of 500 Hz and attenuation of 40 dB at 1000 Hz.
4. (a) Implement the digital filter in Z-domain whose unit sample response is 5
 given as—

$$h(n) = r^n \cos(\omega_0 n) \quad \text{for } n \geq 0$$

$$= 0 \quad \text{otherwise}$$

 (b) Sketch the pole-zero pattern for— 5

$$H(z) = 1 - z^{-8}$$

 (c) Explain in detail various methods of converting analog filters into 10
 digital filters.

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5. (a) For the following magnitude and phase function compute Z-transform. 10
Sketch the pole-zero pattern and draw the filter block diagram.

$$|H(e^{j\omega})| = [5 + 4 \cos(2\omega)]^{1/4}$$

$$\text{Arg}[H(e^{j\omega})] = \arctan(-\sin 2\omega/2 + \cos 2\omega)$$

- (b) Convert the following filter using impulse invariant transformation— 10

$$H_a(s) = s + 0.1 / ((s + 0.1)^2 + 9)$$

into digital IIR filter.

6. (a) Explain various discrete time sequences which come across in the 5
analysis of digital filter.

- (b) Prove that convolution operation is commutative. 5

- (c) Give the difference between structures of Direct Form I and Direct 10
Form II of digital filters.

7. (a) With the help of neat block diagram explain any one DSP processor 10
in detail.

- (b) Write short notes on (any two) :— 10

- (i) Overlap add and overlap save method.
- (ii) Unilateral Z-transform
- (iii) Hilbert Transform.