

Total No. of Questions : 12]

SEAT No. :

P2163

[Total No. of Pages : 3

[4659] - 504

B.E. (E & TC)

ADVANCED DIGITAL SIGNAL PROCESSING

(2003 Pattern) (Elective - I)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) Answer 3 questions from Section - I and 3 questions from Section - II.
- 2) Answer to the two sections should be written in separate books.
- 3) Figures to the right indicate full marks.
- 4) Use of electronic calculator is allowed.
- 5) Assume suitable data, if necessary.
- 6) Draw neat diagrams wherever necessary.

### SECTION - I

- Q1)** a) Explain and differentiate between decimation and interpolation. [6]  
b) Explain sampling - rate conversion by non - integer factors, with the help of a neat block diagram and waveforms. [12]

OR

- Q2)** a) Define random signals. Explain the characteristics of random signals. [6]  
b) Explain multi-stage approach to sampling rate conversion. [6]  
c) Explain poly-phase filter structures. [6]

- Q3)** a) Explain concept of adaptive filtering with the help of noise - canceller. [6]  
b) The estimate of the desired signal at the output of an adaptive noise canceller is given as,  $\hat{S}_k = S_k - \hat{n}_k = s_k + n_x - \hat{n}_k$ . Show that minimizing the total power at the output of the canceller, maximizes the output SNR. [10]

OR

P.T.O.

**Q4)** a) Starting from the basic Wiener filter theory, derive the Wiener - Hopf equation,  $W_{opt} = R^{-1}P$ . What are its limitations? [8]

b) Derive the basic LMS algorithm and explain the implementation. [8]

**Q5)** a) Define and explain AR, MA and ARMA processes. [8]

b) Explain innovations process with the help of a neat sketch. [8]

OR

**Q6)** a) What do you mean by forward prediction? Explain Levinson-Durbin algorithm. [8]

b) Explain optimum filter along with the common algorithm and applications. [8]

## **SECTION - II**

**Q7)** a) Explain power spectrum estimation (PSE). Enlist the limitations of traditional methods of PSE. [8]

b) Explain the periodogram method and its properties. [8]

OR

**Q8)** Explain the Welch and Blackman - Tukey method of PSE. [16]

**Q9)** a) Explain the hardware architecture used for signal processing with the help of block diagram. Compare it with general purpose microprocessor architecture. [10]

b) Explain the concept of pipelining with the help of an example. [8]

OR

**Q10)** Explain the implementation of FIR and IIR filter with a digital signal processor. [18]

- Q11)** a) Describe the mechanism of human speech production with a neat sketch. **[10]**
- b) Explain channel vocoders and sub-band coding. **[6]**

OR

- Q12)** Explain the following terms in the context of speech processing: **[16]**
- a) Cepstrum.
- b) Pitch and Pitch detection.
- c) Formants.
- d) Vowels, consonants and nasals.

