

B.TECH SEM - VI (2007 COURSE) (E & TC ENGG.) :
WINTER - 2017

SUBJECT : DIGITAL SIGNAL PROCESSING

10.00 AM TO 01.00 PM

Day : **Tuesday**
Date : **21/11/2017**

W-2017-2539

Time :
Max. Marks : 80

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- N. B.** 1) **Q. No. 1 and Q. No. 5** are **COMPULSORY** out of the remaining attempt any **TWO** questions from each section.
2) Figures to the right indicate **FULL** marks
3) Answers to both the sections should be written in **SEPARATE** answer book.
4) Use of non – programming electronic **CALCULATOR** is allowed.
5) Assume suitable data if necessary.
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SECTION – I

- Q.1** a) What are the limitations of digital signal processing with reference to processing in analog domain? **(05)**
b) How much saving in the amount of computation do FFT algorithms achieve? **(05)**
c) What are the advantages of FIR filters and how are they achieved? **(04)**
- Q.2** a) What are the criteria for stability of an LTI system in z-domain? **(07)**
b) The output of the system is $y(n) = 4 \left(\frac{1}{2}\right)^n u(n)$ when the input is $x(n) = 2\delta(n)$. **(06)**
i) Determine the system function $H(z)$
ii) What is the output of the system $y(n)$ when the input $x(n) = \left(\frac{1}{4}\right)^n u(n)$
iii) Is the system stable? Justify your answer
- Q.3** a) How do we improve resolution in the frequency analysis using DFT? **(07)**
b) Find the circular convolution of the following two sequences **(06)**
- $$\begin{array}{cccc} x_1(n) & = & \{2, & 1, & 3, & 4\} \\ & & \uparrow & & & \\ x_2(n) & = & \{1, & 2, & 3, & 4\} \\ & & \uparrow & & & \end{array}$$
- Q.4** a) When do we encounter Gibb's phenomenon ? What do we observe in the Gibb's phenomenon? **(07)**
b) Determine the impulse response of a linear phase FIR filter of length $M=4$ for which frequency response at $\omega = 0$ and $\omega = \frac{\pi}{2}$ is specified as $H_r(0) = 1$, $H_r\left(\frac{\pi}{2}\right) = \frac{1}{4}$ **(06)**

SECTION – II

- Q.5** a) For which type of filter, the impulse invariance method is not appropriate for design? Justify your answer. **(05)**
b) What is the advantage of multistage decimation over single stage decimation? **(05)**
c) In which type of filters, limit cycles occur? Explain. **(04)**
- Q.6** a) Convert the analog transfer function **(07)**
- $$H(s) = \frac{1}{(s+2)(s+3)}$$
- into a digital IIR filter if the impulse invariance method is used. Assume $T=0.1$ second.
b) Justify that a stable analog filter is converted into a stable digital filter when the approximation of derivative method is used? **(06)**
- Q.7** a) Draw the block diagram of a phase shifter in the context of Multirate DSP and explain its working. **(07)**
b) Draw the block diagram of decimator and indicate the spectra of the different signals in the diagram. **(06)**
- Q.8** a) Enumerate all the errors which occur in DSP due to finite word length. **(07)**
b) What are DSP Processors? What are their main characteristics? **(06)**
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