T.E. (Electronics \& Telecommunication Engineering) DIGITAL SIGNALPROCESSING (Elective - I)
(2019 Pattern) (Semester - I) (304185)
Time : $2^{1 ⁄ 2} 2$ Hours]
[Max. Marks : 70
Instructions to the candidates:

1) Neat diagrams must be drawn wherever necessary.
2) Figures to the right indicate full marks.
3) Use of Dogarithmic tables slide rule, Mollier charts, electronic pocket calculator and Stieam tables is allowed.
4) Assume suitable data, if necessary.

Q1) a) $\star$ Compute DFT of $x[n]=\{1,2,0,1 \sqrt{1}$ sing direct computation method and matrix method.
b) Compute FFT of $x[n]=\{1,1,0,0\}$ using decimation in time (DIT) FFT algorithm and decimation in frequency (DIF) FFT algorithm.
[10]

Q2) a) Compute circular convolution of $x_{1}[n]=\{1,2,3,4\}$ and $x_{2}[n]=\{1,2,3\}$ using graphical method and nhatrix method.
b) Derive decimation in time.fFT algorithm for 8 point DFT and explain how butterfly structure is used in FFT.

Q3) a) Design analog Butterworth filter to have magnitude of 0.9 at 100 Hz and magnitude of 0.2 at 300 Hz .
b) Write transfer function of second order analog Butterworth low pass filter with cutoff frequency $0.8 \mathrm{rad} / \mathrm{sec}$ and convertit into digital Butterworth filter using bilinear transformation method with sapipling period of 0.1 second.
c) Realize the following IIR filter using directformªnd direct form II

$$
\begin{equation*}
H(z)=\frac{1+2 z^{-1}+3 z^{-2}}{1+4 z^{-1}+5 z^{-2}+7 z^{-3}} \tag{5}
\end{equation*}
$$

Q4) a) Design digital Butterworth filter to méet the following specifications using bilinear transformations with sagpling period of 0.5 seconds.
$0.8 \leq\left|\mathrm{H}\left(\mathrm{e}^{\mathrm{jw}}\right)\right| \leq 1,0 \leq \mathrm{w} \xlongequal{\circ} \xlongequal{2} .3 \pi$
$\left.\left|H\left(e^{j w}\right)\right| \leq 0.1 \quad\right), \dot{b} \quad 2 \pi$
b) Realize the following IIR filter using cascade realization


Q5) a) Design FIR filter with order 10 to meet the followingspecifications using Hamming window.

$$
\begin{aligned}
& \left|H\left(e^{j w}\right)\right|=1, \quad|w| \leq 0.5 \pi \\
& \left|H\left(e^{j w}\right)\right|=0, \quad|w|>0.5 \pi
\end{aligned}
$$

b) Design FIR filter to meet following specifications using Hamming window.
$\operatorname{Hd}\left(\mathrm{e}^{j w}\right)=\mathrm{e}^{-3 j w},|\mathrm{w}| \geq 0.4 \pi$
$\operatorname{Hd}\left(e^{j w}\right)=0,|w|<0.4 \pi$
OR
Q6) a) Design FIR filter to meet following specifications using Blackmann window.

$$
\begin{aligned}
\operatorname{Hd}\left(\mathrm{e}^{\mathrm{jw}}\right) & =\mathrm{e}^{-4 j \mathrm{w}} & , \quad 0.2 \pi \leq|\mathrm{w}| \leq 0.5 \pi \\
& =0 \quad, \quad & \text { otherwise }
\end{aligned}
$$

b) Design FIR filter to meet following specifications usingrectangular window.

$$
\begin{aligned}
\operatorname{Hd}\left(\mathrm{e}^{j w}\right)=\mathrm{e}^{-5 j w} & , 0 \leq|w| \leq 0.3 \pi & , 0.5 \pi \leq \mid w \pi \\
& =0 & , \text { otherwise }
\end{aligned}
$$

Q7) a) Draw the diagram of human speech,production system and explain the role of vocal cords, velum and voéal tract.
b) What is artifact? What are different artifacts in ECG? State their reasons and suggest methods to supress these artifacts.

Q8) a) Draw the diagram of standard ECG signal and explain different waves and segments in EGG signal with reference to heart activity.
b) Explain 8 CR and autocorrelation methods for pitch detection of speech signal.

