

**Government College of Engineering, Amravati**  
(An Autonomous Institute of Government of Maharashtra)

**Sixth Semester B. Tech.**  
**(Electronics and Telecommunication)**

**Summer – 2016**

**Course Code: ETU604**

**Course Name: Digital Signal Processing**

**Time: 2 hr. 30min.**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory. Solve any two sub-questions from Q1 and Q2.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

**Q1**    **a**    What is region of convergence (ROC) in case of Z-transform? Explain the nature of ROC for right sided, left sided and both sided sequences with finite and infinite durations. **6**

**b**    Compute 4-point and 8-point discrete Fourier transform (DFT) of following signal **6**

$$X[n] = \frac{1}{8}; 0 \leq n \leq 3 \\ = 0; \text{else}$$

**c**    Compare decimation in time (DIT) and decimation in Frequency (DIF) fast Fourier transform (FFT) **6**

Q2 a Enlist the windows with their window sequence available for finite impulse response (FIR) filter design; explain any one with its frequency response. 6

b Determine the coefficient of linear phase FIR filter of length  $N=15$  with symmetric unit sample response and frequency response that satisfies the condition. 6

$$H\left(\frac{2\pi k}{15}\right) = 1; \text{ for } k = 0,1,2,3$$

$$= 0.4; \text{ for } k = 4$$

$$= 0; \text{ for } k = 5,6,7$$

c Draw the direct form-I and direct form -II representation of following IIR (Infinite Impulse Response) low-pass filter. 6

$$H(Z) = \frac{0.1 Z^{-1} + 0.5 Z^{-2}}{1 - 0.75 Z^{-1} + 0.5 Z^{-2} - Z^{-3}}$$

Q3 Design a Butterworth digital IIR (Infinite Impulse Response) high-pass filter using bilinear transformation by taking  $T = 0.1$  second, to satisfy following specifications 12

$$0.6 \leq |H(e^{jw})| \leq 1.0; \text{ for } 0.7\pi \leq w \leq \pi$$

$$|H(e^{jw})| \leq 0.1; \text{ for } 0 \leq w \leq 0.35\pi$$

Draw the equivalent Direct Form-I and Direct Form-II structures.

Q4 a What is interpolator? Show that it is time invariant and linear system. 6

b What are the applications of multi-rate DSP? Explain sub band coding in details. 6

Q5 a Explain the instruction set of TMS320 family processors. 6

b Write short note on following related to DSP processors 6

- Pipelining
- MAC (Multiply/Accumulate)