Reg. No.									

MANIPAL UNIVERSITY
SCHOOL OF INFORMATION SCIENCES

SECOND SEMESTER MASTER OF ENGINEERING – **ME** (EMBEDDED SYSTEMS) /
FOURTH SEMESTER MSc Tech (VLSI DESIGN / EMBEDDED SYSTEMS)
DEGREE EXAMINATION (MAKE-UP) – JULY 2016

SUBJECT: **ESD 602** / EDA 602 / **ESD 602 – DIGITAL SIGNAL PROCESSING**

Saturday, July 9, 2016

Time: 10.00 – 13.00 Hrs. Max. Marks: 100

1. Explain Radix-2 DIT-FFT algorithm with N = 8. Comment on number of complex multiplication and addition (10 marks)

2. Realize the following system functions using Direct form-I, Direct form-II and Cascade form
$H(z) = [(1 - 0.25z^{-1})(z^{-2} - 5z^{-1} + 6)] / [(z^{-2} - 2z^{-1} + 2.5)(1 - 0.75z^{-1})]$ (10 marks)

3. Design an ideal linear phase FIR filter with the following specification, using frequency sampling technique. $H_d(e^{jw}) = e^{-j5w}$; for $0 \leq |w| \leq \pi/2$ and $H_d(e^{jw}) = 0$; $\pi/2 < |w| < \pi$.
(10 marks)

4. Design an ideal FIR filter with the following specification using Hamming window. $H_d(e^{jw}) = e^{-5jw}$; for $\pi/6 \leq |w| \leq \pi/2$ and $H_d(e^{jw}) = 0$; elsewhere. (10 marks)

5. Design using bilinear transformation technique, a digital Butterworth lowpass filter for the following specifications.
$|H(j\Omega)| \geq -1$ dB $\quad 0 \leq \Omega \leq 100$ rad/sec
$|H(j\Omega)| \leq -40$ dB $\quad \Omega \geq 2000$ rad/sec.
Sampling frequency = 8000 rad/sec. Realize the filter structure. (20 marks)

6. What is Multirate Signal Processing? Obtain the expressions both in time domain and frequency domain for the signal which is down sampled by a factor D. (10 marks)

7. Design a phase shifter that shifts the phase of the spectrum of a signal by a value less than one unit. Also explain how a phase shift of more than one unit, can be achieved.
(10 marks)

8. Explain analytically, how optimum filter coefficients are obtained on Mean Square Error sense in Wiener Predictor Configuration. (10 marks)

9. Why in PDSPs MAC operation is implemented in hardware? Explain with necessary figures, how convolution is performed using a single MAC unit in PDSPs. Give the difference between a MAC instruction and MAC with data shift instruction.
(10 marks)

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