



M.E DEGREE EXAMINATIONS: JUNE 2018

(Regulation 2015)

Second Semester

EMBEDDED SYSTEM

P15EST205 : DSP for Embedded System

COURSE OUTCOMES

CO1: Learn the various types of signal and signal conversion techniques.

CO2: Acquire the knowledge of transformation of the signal and analyze the spectrum.

CO3: Describe the architecture of DSP and design digital and analog filters.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The system $y(n)=\cos[x(n)]$ is CO1 [K₂]

- a) stable b) unstable
c) BIBO stable d) Both a and c

2. The Nyquist Frequency for the signal $x(n) = 3 \cos 50\pi n + 10 \sin 300\pi n - \cos 100\pi n$ is CO1 [K₂]

- a) 50 Hz b) 100 Hz
c) 200 Hz d) 600Hz

3. Match the following signal with ROC CO2 [K₂]

Signal	ROC
A. $(0.5)^n u(n)$	1. $Z < 2$
B. $(2)^n u(n)$	2. $Z > 2$
C. $u(-n)$	3. $Z > 1$
D. $u(n)$	4. $Z < 1$

- a) A-1 B-2 C-3 D-4 b) A-2 B-1 C-3 D-4
c) A-1 B-2 C-4 D-3 d) A-2 B-1 C-4 D-3

4. Assertion (A): $x(n) = u(-n)$ is an stable system CO2 [K₂]

Reason (R) : The poles of $X(Z)$ does not encloses the unit circle .

- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true

5. Which of the following statements are correct? CO2 [K₃]
1. Linear convolution of two sequence is equal to multiplication in Z domain
 2. Circular convolution of two sequence is equal to multiplication in fourier transform
 3. Linear convolution can be obtained by circular convolution by appending zeros
- a) 1,2 b) 2,3
c) 1,2,3 d) Only 1
6. Arrange the sequence in appropriate order to calculate IDFT using DIF algorithm CO2 [K₃]
1. Complex conjugate of input sequence
 2. Arrange the sequence in bit reversed order
 3. Multiply the sequence by twiddle factor
 4. perform multiplication and addition operation
- a) 1-3-4-2 b) 1-2-3-4
c) 1-4-3-2 d) 2-4-3-1
7. The sequence of process involved in IIR butterworth filter design is CO3 [K₂]
1. Obtain the transfer function in analog domain
 2. Find the order of the filter
 3. Calculate the cut-off frequency
 4. Convert using bilinear transform
- a) 2-3-4-1 b) 2-3-1-4
c) 3-1-4-2 d) 3-1-2-4
8. Match the following CO3 [K₂]
- | Filter | Characteristics |
|-----------------------|---------------------------------|
| A. IIR filter | 1. linear phase |
| B. FIR filter | 2.non linear phase |
| C. Butterworth filter | 3.Ripples in pass and stop band |
| D. Chebyshevfilter | 4.Monotonic |
- a) A-1 B-2 C-3 D-4 b) A-1 B-2 C-4 D-3
c) A-2 B-1 C-3 D-4 d) A-2 B-1 C-4 D-3
9. _____ is specifically inbuilt module used to reduce the device power consumption in Blackfin processor CO3 [K₁]
- a) Dynamic Power Management b) Sleep mode
c) Serial port d) Watch dog timer

10. The parallel operation performed in DSP is termed as CO3 [K₂]
- a) sequencing b) MAC operation
 c) Pipelining d) Rigging

PART B (10 x 2 = 20 Marks)

11. Compute the energy and power of the signal $x(n) = 2^{-n} u(n)$. Find whether it is energy CO1 [K₂]
 or power signal.
12. What is an aliasing? How to overcome this effect? CO1 [K₁]
13. Find the Z transform and ROC of $x(n) = nu(n-2)$ CO2 [K₃]
14. Obtain the inverse Z transform of $x(z) = \log(1+z^{-1})$ CO2 [K₃]
15. Mention the real time applications of fourier transform and spectral analysis. CO2 [K₂]
16. Distinguish DIT and DIF algorithms. CO2 [K₁]
17. Determine the order of the analog butterworth filter that has a 3db pass band CO3 [K₂]
 attenuation at a frequency of 1000 rad/sec and atleast 15db stop band attenuation at 500
 rad/sec.
18. Distinguish characteristic features of butterworth and chebyshev filter. CO3 [K₃]
19. What is the purpose of MOST and SPORT in blackfin processor? CO3 [K₂]
20. What is the function of watchdog timer? CO3 [K₁]

PART C (6 x 5 = 30 Marks)

21. Determine whether the following signals are energy signal or power signal. CO1 [K₂]
- i) $X(n) = (2)^n u(n)$ ii) $X(n) = \cos(n) u(n)$
22. Find the inverse z-transform of the system using partial fraction method CO2 [K₃]

$$X(Z) = \frac{Z^2 + Z}{(Z - 1)(Z - 3)} \text{ for } |Z| > 3$$

23. Find the Z transform of $x(n) = r^n \cos \omega n u(n)$ CO2 [K₂]
24. Compute the DFT using DIF-FFT algorithm for $X(n) = \{1, 2, 3, 4\}$ CO2 [K₂]
25. Transform an analog filter with the transfer function into a digital filter using impulse - CO3 [K₂]
 invariant technique.

$$H(S) = \frac{0.5(S + 4)}{(S + 5)(S + 6)}$$

26. Explain the various modes of operation of dynamic power management unit for CO3 [K₁]
 reducing power dissipation.

Answer any FOUR Questions
PART D (4 x 10 = 40 Marks)

27. Check whether the given systems are linear, time invariant, causal and static CO1 [K₃]
a. $y[n] = \delta(n) + \sin \pi n$
b. $y[n] = \cosh [nx(n) + x(n-1)]$
c. $y[n] = x[n] + nx[n+1]$
d. $y[n] = \log [x(n+1)]$
e. $y[n] = x^2(n)$
28. A discrete time system is defined by the differential equation CO2 [K₂]
 $y(n) + 3y(n-1) + 2y(n-2) = 2x(n) - x(n-1)$.
a) Find H(Z) b) Plot its poles and zeros. c) Find stability of system
d) Find the impulse response h(n)
29. Obtain the 8 point DFT of given sequence $X(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT-FFT CO2 [K₂]
algorithm
30. Obtain direct form II and cascade direct form II realization of CO3 [K₂]
$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n) + \frac{1}{3}x(n-1)$$
31. Explain the architecture and important features of Blackfin Digital Signal CO3 [K₁]
Processor and its general purpose I/O interface.
