Department of Computer Systems Engineering

University of Engineering & Technology

Peshawar, PAKISTAN

Subject: Digital Signal Processing (5th Semester)

Exam: Final Term (Fall 2021)

Max Marks: 24

Attempt All Questions. **Time allowed : 3 hours**

Question 1: (CLO 2)

1) Sketch the **pole-zero** plot for the following causal system and determine if this is a **stable** or **unstable** system. Also find the impulse response of the system. **(2+1+2 Marks)**

$$y[n] = y[n-1] - \frac{1}{2}y[n-2] + x[n] + x[n-1]$$

2) Let the z-transform of a discrete time signal x[n] is X(z). Signal $x_1[n]$ is made by shifting x[n] two units to the right and multiplying the shifted signal by 2^n. Signal $x_2[n]$ is made by convolving x[-n] with $x_1[n]$. Use properties of the z-transform to determine the z-transform $X_1(z)$ of signal $x_1[n]$, and the z-transform $X_2(z)$ of $x_2[n]$ in terms of X(z). Also mention the properties of the z-transform used in each step. **(3 Marks)**

3) Find the frequency response function of the FIR system described by the following difference equation and, find the output y[n] when the signal x[n] given bellow is passed through this system. **(3 Marks)**

$$y[n] = \frac{1}{2}[x[n] + x[n-1]]$$

$$x[n] = 2 + 3\cos\left(\frac{\pi}{3}n + \frac{\pi}{6}\right) + \frac{1}{2}\cos\left(\frac{2\pi}{3}n + \frac{\pi}{4}\right)$$

Explain the filtering behavior of this system based on its response to the frequencies present in x[n].

Question 2: (CLO 3)

1) Draw the direct form structure for the following linear-phase FIR system. **(2 Marks)**

$$y[n] = \frac{1}{4}x[n] - 2x[n-1] + 2x[n-2] + \frac{1}{4}x[n-3]$$

$$y[n] = x[n] - 3x[n-1] + 5x[n-2] - 3x[n-3] + x[n-4]$$

P.T.O

2) Determine the direct form I, direct form II and transpose structure for the following LTI system. Also compare these structures. **(3+1 Marks)**

$$2y[n] - \frac{1}{2}y[n-1] = 5x[n] - \frac{2}{3}x[n-2] + \frac{1}{2}x[n-3]$$

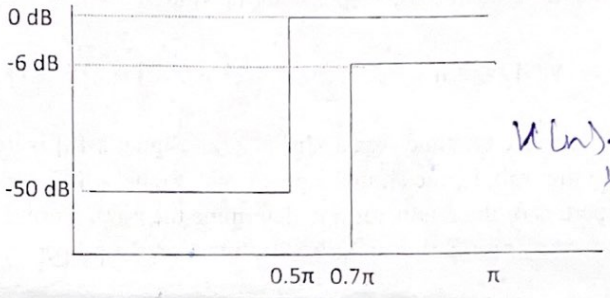
3) Why the second order sub-systems are used in series/parallel form structures instead of first order sub-systems? **(1 Mark)**

$y[n] = \frac{1}{4}y[n-1] + \frac{5}{2}x[n] - \frac{2}{3}x[n-2] + \frac{1}{4}x[n-3]$

Question 3: (CLO 4)

1) What makes the ideal filters practically not realizable? In which way the spectral response H(w) of the real filters differs from those of ideal filters. **(2 Marks)**

2) Design a high pass FIR filter that meets the specifications given in Figure-1 bellow. **(4 Marks)**
Note: The characteristics of different windows are given below.



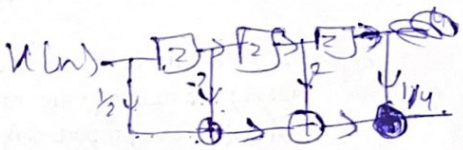


Figure-1

Window	Main-lobe width	Stop-band attenuation	Equation $0 \le n \le M-1$
Rectangular	$\frac{4\pi}{M}$	-21	1
Hanning	$\frac{8\pi}{M}$	-44	$0.5\left(1+\cos\frac{2\pi\left(n-\frac{M-1}{2}\right)}{M-1}\right)$
Hamming	$\frac{8\pi}{M}$	-53	$0.54-0.46\cos\frac{2\pi\left(n-\frac{M-1}{2}\right)}{M-1}$
Blackman	$\frac{12\pi}{M}$	-74	$0.42-0.5\cos\frac{2\pi\left(n-\frac{M-1}{2}\right)}{M-1}+0.08\cos\frac{4\pi\left(n-\frac{M-1}{2}\right)}{M-1}$

Name: _____ Registration# _____

Department of Computer Systems Engineering
University of Engineering & Technology
Peshawar, Pakistan

Dated: March 11th, 2022

Subject:	**Engineering Economics**
Exam:	**Final Term**
Marks:	**60**
Time Allowed:	**3 Hours**

1. *Be clear and precise in your answers. Avoid unnecessary details.*
2. *You are expected to have brought a calculator and necessary stationery only, anything else found in possession would be tantamount to cheating.*
3. *No sharing of calculators is allowed during the exam.*
4. *Assume 1 dollar = 180 Rupees and Draw cash flows wherever required.*
5. *Pages are numbers from 1- 2. Make sure you have all of them.*

Question 01 [Marks 10] **[CLO-2]**

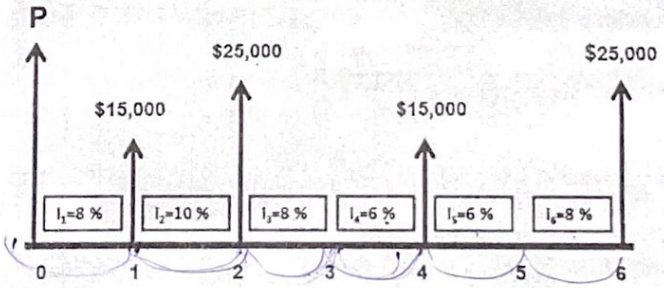
Microsoft Inc. lends promotional **$12,570,000** for student projects at the local colleges. The loan must be returned at an **8%** interest rate compounded annually. Repayment should be made in such a way that an amount **A** must be paid for the first **8 years,** amount **3A** for the next 5 **years,** and amount **5A** for the remaining years, keeping the interest rate **8%.** The total time for which the loan is allotted is **20 years.** Evaluate the value of **A**?

Question 02 [Marks 10] **[CLO-3]**

Little Justin is given an **$86,700** amount by a student scholarship that he aims to put in a saving account. Justin's father wants to choose three different offers provided by the saving institutions i.e.: (a) **5.375% compounded annually for 5 years, (b) 5.125% compounded quarterly for 32 quarter years (8 years), (c) 5.175% compounded monthly for 48 months (4 years),** and **(d) 5.325% compounded continuously for 3 years.** He wishes to select the saving account that will give him the highest return on his investment. Which package should he select and why?

Question 03 [Marks 10] **[CLO-2]**

a. Solve the following cash flow for **P:**



b. Mr. Kamran had some savings that he placed in a bank account ten years ago. He earned an amount of **$2, 968,000** from an initial investment at the end of 11 years.

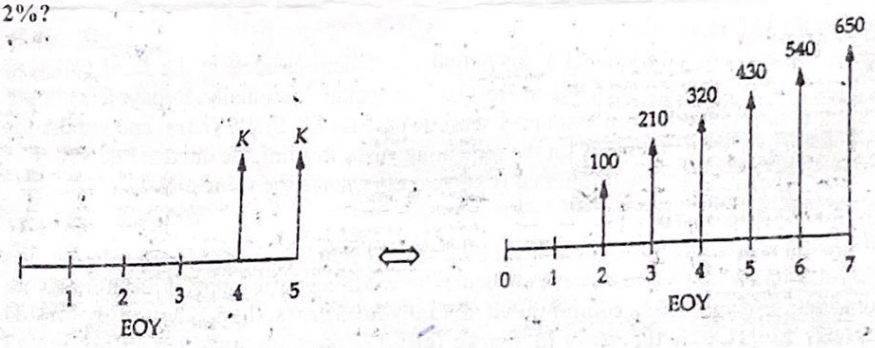
The investment plan he chose was such that it earned an interest of **6.5%** for the first three years, **4.5%** for the next two years, **7.4%** for the next four years and **8%** for last two years. He also made a withdrawal of **Rs. 990,000** at the end of year 5. Draw the cash flow for this scenario and evaluate the initial investment that Mr. Kamran had made.

Question 04 [Marks 15] [CLO-2]

Alkaram is planning to invest in a shopping mall near the industrial estate of Karachi. The initial investment includes land costs **$500,000**, working capital **$650,000,** building costs **$550,000** and other materials required costs **$250,000.** It is expected that the sales of the mall will reach up to **$600,000** per year for **12 years.** At this time the land can be sold for **$500,000,** the building for **$250,000,** the materials for **$60,000** and all the working capital (**$650,000**) will be recovered **(Salvage values).** The annual expenses for the labor and other items will sum up to **$435,000** per year. If the investment **MARR** is **9%,** determine if this investment in the mall is worth it? Use **AW** method to support your argument.

Question 05 [Marks 15] [CLO-3]

For what value of **K** will the following cash flows be equal for an interest rate equal to **12%?**



Good Luck

$$(P/G,i,N) = \frac{(1+i)^N - iN - 1}{i^2(1+i)^N}$$

$$(A/G, i, N) = \left[\frac{1}{i} - \frac{N}{(1+i)^N - 1}\right]$$

$$(F/G, i, N) = \frac{1}{i}(F/A, i\%, N) - \frac{N}{i}$$

$$CR(i\%) = I(A/P, i\%, N) - S(A/F, i\%, N)$$

$$CR(i\%) = (I - S)(A/F, i\%, N) + I(i\%) \qquad CR(i\%) = (I - S)(A/P, i\%, N) + S(i\%)$$

Department of Computer Systems Engineering,
University of Engineering and Technology, Peshawar,
Pakistan

Exam: Final term (Fall 2021) **Time:** 3 Hours
Paper: CSE-304 Computer Organization and Architecture (5th Semester) **Marks:** 60

Note: Attempt all questions on answer sheet.

Question No. 1 (Marks=10):

i. What is the difference between Opcode and Operand? Give examples to explain.
ii. What is the purpose of the Control Sequencer (Control Unit)? And what is the use of 12 bit CON word or sequence?

Question No. 2 (Marks=10)

i. What do flags represent in computer architecture? Explain at least four flags briefly with examples?
ii. Briefly explain the "Handshaking" concept?

Question No. 3 (Marks=10)

i. What is Stack? How is it related to Stack Pointer?
ii. If the size of the program counter is 16 bits, what can be the maximum size of the memory in computer architecture, provided the data width is 8 bits?

Question No. 4 (Marks=10)

i. How does the carry bit act as an extension to the arithmetic and logic unit (ALU)? Explain briefly with examples?
ii. What is the difference between Register-Register instructions and Immediate instructions? Explain briefly with examples?

Question No. 5 (Marks=10)

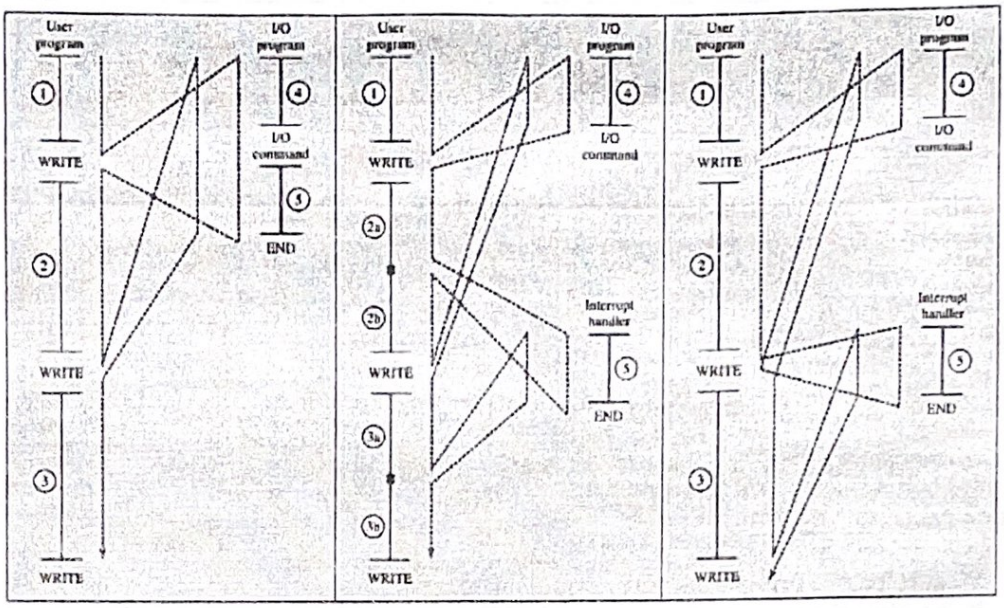
You have to design instructions for a particular processor, whose characteristics are;

- 16 different operations (ADD, SUB, OUT, HLT etc.)
- 12-bit address (program counter (PC), a memory address register (MAR) etc.)
- 16-bit data registers (accumulators, B, Temp etc.)
- 16-bit instruction register (IR)

i. What will be the instruction size?
ii. Opcode size?
iii. Operand size?
iv. A number of locations in memory?
v. Memory data size?

Question No. 6 (Marks=10)

Write the sequence of codes for the following flow of code?



UNIVERSITY OF ENGINEERING AND TECHNOLOGY PESHAWAR

Final Term Exam (Fall 2021)

Department of Computer Systems Engineering

PART TWO (Marks 55)

↳ Part one was 15 short ques

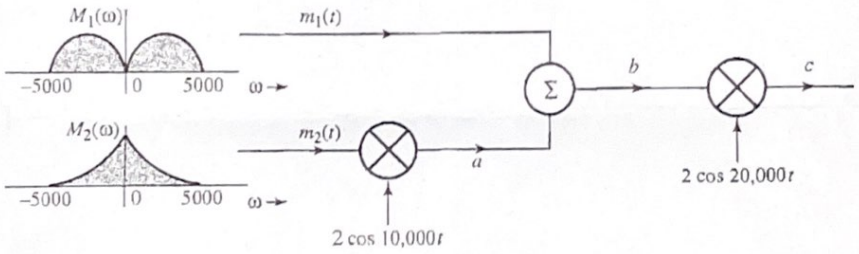
Instructor: Dr. Zahid Wadud Mufti
Subject: Communication Systems

Time Allowed: 135 Min
Semester: 5th

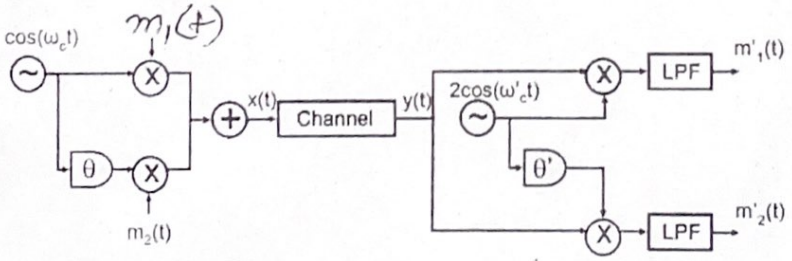
1) What are the *BW* efficient variants of the *AM* signals? Describe *SSB* in detail and the role of Hilbert transformation to overcome *BW* inefficiency. **(Marks 10)**
2) Two signals $m_1(t)$ and $m_2(t)$ both band limited to *5000 rad/s*, are to be transmitted simultaneously over a channel by the multiplexing scheme shown in figure below. The signal at point b is the multiplexed signal, which now modulates a carrier of frequency *20,000 rad/sec*. the modulated signal at point c is transmitted over a channel.

(Marks 10)(CLO-3, PLO-3)

a. Sketch and briefly describe signal spectra at point *a, b* and *c*.
b. What must be the bandwidth of the channel?
c. Design a receiver to recover signals $m_1(t)$ and $m_2(t)$ from the modulated signal at point *c*.



3) Consider the following Quadrature Amplitude Modulation Link. **(Marks 15)**

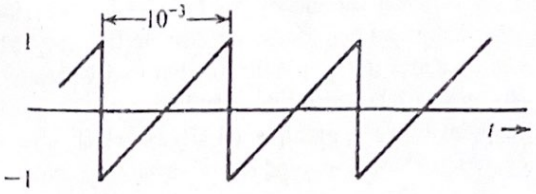


I. If the system is ideal, confirm that $m_1'(t)$ and $m_2'(t)$ are faithful representations of $m_1(t)$ and $m_2(t)$. In this ideal case $\theta = -\frac{\pi}{2}$ and $\theta' = \frac{\pi}{2}$, $\omega_c' = \omega_c$ and there is a unity transformation in the channel so that $x(t) = y(t)$.

II. Analyze the system if there is a slight mismatch between the transmitter local oscillator frequency and the receiver local oscillator frequency $\omega_c' = \omega_c + \delta_\omega$.

III. Analyze the system if there is a slight phase error, $\theta' = \pi/2 + \delta_\theta$ in the receiver.

4) A baseband signal *m(t)* is the periodic sawtooth signal shown in figure below. Sketch $\varphi_{FM}(t)$ and $\varphi_{PM}(t)$ for this signal *m(t)* if $\omega_c = 2\pi\, X\, 10^6, k_f = 2000\pi, and\ k_p = \pi/2$. **(Marks 10)**



5) Write a detail note on Wide Band *FM* wave with appropriate figures and mathematical expressions. **(Marks 10)**

OR

The process of reconstruction a continuous time signal *g(t)* from its samples is known as Interpolation. Explore reconstruction process in detail. **(Marks 10)**