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

Final Term Examination Fall 2018

Subject: Digital Logic Design **Total Marks: 50** **Weightage: 50%**

1. **Attempt ALL FIVE questions.**
2. **Maximum allowed time is 120 minutes.**
3. **Programmable calculators and mobiles phones are strictly prohibited.**

Q1: CLO-3 Cognitive-5 (Synthesis) mapped with PLO-3 (Design/Development of Solutions) **(5+5)**

a) **Design a combinational circuit with three inputs, x , y, and z, and three outputs, A, B , and C . When the binary input is 0, 1, 2, or 3, the binary output is one greater than the input. When the binary input is 4, 5, 6, or 7, the binary output is two less than the input.**

b) **Design a *4-to-1-line multiplexer* using a *2-to-4 decoder* and *tri-state* buffers.**

Q2: CLO-2 Cognitive-4 (Analysis) mapped with PLO-2 (Problem Analysis) **(6)**

Draw the logic diagram of a Sequential Circuit that includes two *D* flip-flops *A* and *B*, two inputs *x* and *y*, one output *z* and is specified by the following next state and output equations:

$$A(t+1) = xy' + xB,$$
$$B(t+1) = xA + xB'$$
$$z = A$$

Q3: **(5+6)**

a) **The contents of a 4-bit register is initially 1010. The register is shifted five times to the right with the serial input being 101110. What is the content of the register after each shift?**

b) **Design a serial adder using two 4-bit shift registers (Register A & Register B), a full adder and a carry flip flop. Register A holds the binary number 1010 and Register B holds 0101. The carry flip flop is initially reset to 0. List the binary values in Register A and the carry flip flop after each shift.**

Q4: **(4+4+5)**

a) **Design a synchronous counter with T flip-flops that goes through the following binary repeated sequence: 0, 1, 3, 7, 6, 4. If the counter ever finds itself in an unused state (2 or 5), it should transition to state 0 with the next clock trigger to avoid being stuck in an unused state. Clearly list all the steps involved in the design procedure.**

b) The memory units that follow are specified by the number of words times the number of bits per word. How many address lines and input-output data lines are needed in each case? *(i)* $8K \times 16$ *(ii)* $2G \times 8$

c) Define the following terms:
(i) **FPGA** *(ii)* **IOB** *(iii)* **CLB** *(iv)* **LUT** *(v)* **BRAM**

Q5: CLO-4 Cognitive-5 (Synthesis) mapped with PLO-3 (Design/Development of Solutions) (4+3+3)

a) It takes six T States to fetch and execute an instruction in SAP-1 i.e. T1, T2, T3, T4, T5 and T6. Now for execution cycle (T4, T5, and T6) of the ADD instruction, which blocks will be active and what will be the source and the destination of data during each state? (See Figure 1)

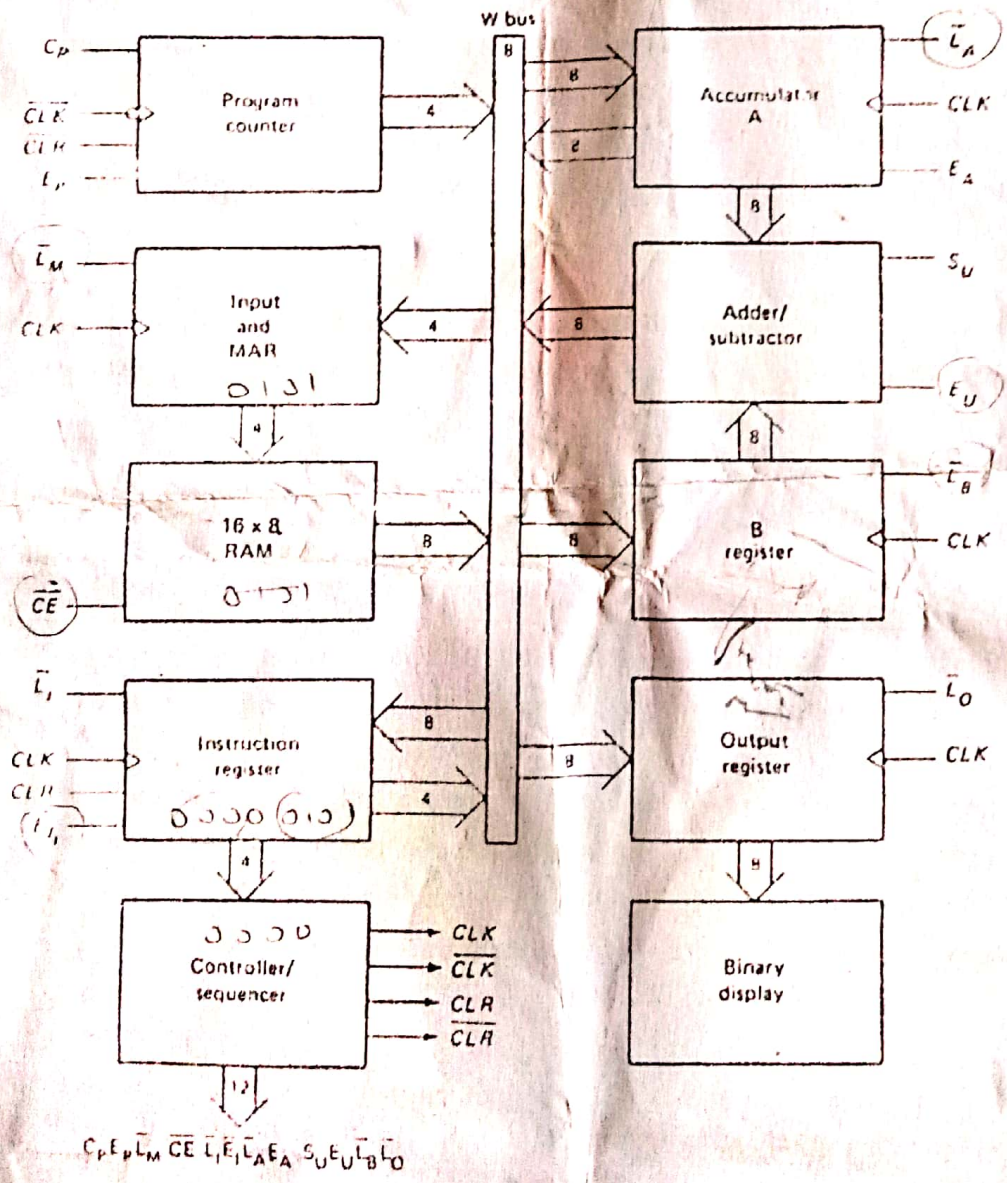

Figure 1: SAP-1 Architecture

b) What will be the values of the control word (CON Word) out of the controller for the above T4, T5 and T6?

Cycle	CON	C_P	E_P	$\overline{L_M}$	$\overline{CE}$	$\overline{L_I}$	$\overline{E_I}$	$\overline{L_A}$	E_A	S_U	E_U	$\overline{L_B}$	$\overline{L_O}$
Execute	T4												
	T5												
	T6												

c) How would you program SAP-1 to solve this arithmetic problem? 18 + 22 + 26 – 34

All the numbers are in decimal form.

16 | 24
1 | 8

$1 \times 16^1 + 8 \times 16^0$

$1 \times 16 + 8 \times 16^0$

24 , 34 , 38 , 52

16
16
1

$2 \times 16^1 + 2 \times 16^0$

16 | 34
2 | 2

$2 \times 16^1 + 6 \times 16^0$

38
26

$3 \times 16^1 + 4 \times 16^0$

16 | 52
3 | 4

3-1
16
3
48

DEPARTMENT OF BASIC SCIENCES AND ISLAMIAT

University of Engineering and Technology, Peshawar

PAPER: Linear Algebra (BSI-111)

Final -Term Examination Fall-2018

(3rd semester Computer System Engineering)

Time Allowed: 2 hours — Max Marks: 50

Note: Attempt all questions:

Q1. **CLO-1 (Cognitive Domain 2)**

a) Let $L: R^3 \to R^3$ be the linear operator defined by

$$L\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} x+y \\ y-z \\ x+z \end{bmatrix}.$$

Find the standard matrix A representing L and verify $L(x) = Ax$.

b) Let $L: \Re^3 \to \Re^3$ be the linear transformation defined by $L\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} x+z \\ y+z \\ x+2y+2z \end{bmatrix}$. Is

$w = \begin{bmatrix} 2 \\ -1 \\ 3 \end{bmatrix}$ in range L?

Q2. **CLO-3 (Cognitive Domain 6)**

a) Verify which of the following subsets of R^3 are subspaces of R^3

(i) $(a,b,2)$

(ii) (a,b,c), Where $c = a+b$

(iii) (a,b,c), where $c > 0$.

b) Consider the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 2 \\ 0 & 1 & 2 \end{bmatrix}$.

Decode the message 67 44 41 49 39 19 113 76 62 104 69 55.

Q3. **CLO-2 (Cognitive Domain 3)**

a) Let V be the vector-space B^3 and let $\underline{v_1} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}, \underline{v_2} = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}, \underline{v_3} = \begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$. Compute

$\underline{v_1}, \underline{v_2}, \underline{v_3}$. Is Span V?

b) Determine whether the given set V is the set of all ordered pairs of real numbers (x, y) is closed under the operation $\oplus$ and $\otimes$

$(x,y) \oplus (x',y') = (x+x', y+y')$

$c \otimes (x,y) = (cx, cy)$

Q4. **CLO-2 (Cognitive Domain 3)**

Find the characteristic polynomial, Eigen values, and Eigen vectors of the matrix

$$A = \begin{bmatrix} 2 & 2 & 3 \\ 1 & 2 & 1 \\ 2 & -2 & 1 \end{bmatrix}.$$

University of Engineering and Technology Peshawar

Final- Term Examination Fall 2018

3rd Semester Computer System Engineering

Complex Variables and Fourier Transforms (BSI- 362)

Note: Attempt all questions.

Maximum Marks: 100 Weightage: 50% Maximum Time: 2 hours

Q1. [CLO1/PLO1] (Knowledge) C1

(a) Find the principal value of the given expression $(1+i)^{-1+i}$ at i. [marks=10].

(b) Find the center and radius of convergence of the power $\sum_{n=0}^{\infty} \frac{n+5i}{(2n)!}(z-i)^n$. [marks=10]

Q2. [CLO1/PLO1] (Knowledge) C1

(a). Find the residue of the given function $f(z)=\frac{30z^2-23z1+5}{(2z-1)^2(3z-1)}$. [marks=15].

(b). Find the Laurent series of $f(z)=z^2e^{\frac{1}{z}}$ with center 0. [marks=5].

Q3. [CLO2/PLO2] (Application) C3

Show that

(a) The Fourier transform is the linear operation. [marks=15]

(b) Show that fourier transform of $f(z)=\begin{cases} e^{-x} & if \quad x>0 \\ 0 & if \quad x\le 0 \end{cases}$

is $\frac{1}{\sqrt{2\pi}}\frac{1-i\omega}{1+\omega^2}$. [marks=15]

Q4. [CLO2/PLO2] (Application) C3

(a). Show that $\oint_C \frac{\sin \pi z}{z^4}dz=\frac{\pi^4}{3}i$, $C:|z-i|=2$ counterclockwise.. [marks=15]

(b). Show that $\oint_C \frac{1}{z}dz=2\pi i$ and $C:|z|=1$ counterclockwise. [marks=15]

Circuits and Systems 2
Final term Exam Fall 2018

Q1. (Marks 20)

The input to the circuit shown in Figure 1 is the voltage of the voltage source, $v_s(t) = 7.28\cos(4t+77°)$V. The output is the voltage across the inductor, $v_o(t) = 4.254\cos(4t+311°)$V

Determine the following:

(a) The average power supplied by the voltage source.

(b) The average power received by the resistor.

(c) The average power received by the inductor.

(d) The power factor of the impedance of the series connection of the resistor and inductor.

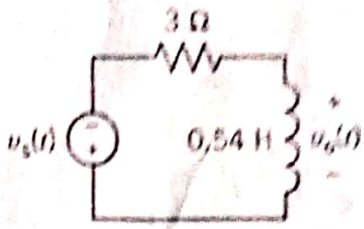

Figure 1

Q2. (Marks 20)

Prove that, the maximum power transfer from a circuit with a Thevenin equivalent circuit with an impedance Z_t is obtained when Z_L is set equal to Z_t^*, the complex conjugate of Z_t.

Q3. **CLO2 (C4)** (Marks 20)

The input to the circuit shown in Figure 2 is the voltage of the voltage source $v_i(t)$. The output is the voltage $v_o(t)$ across the series connection of the inductor and 60 Ω resistor. The network function that represents this circuit is

$$H(\omega) = \frac{V_o(\omega)}{V_i(\omega)} = (0.6)\frac{1+j\frac{\omega}{12}}{1+j\frac{\omega}{24}}$$

Analyze the circuit and determine the values of the inductance L and of the resistance R.

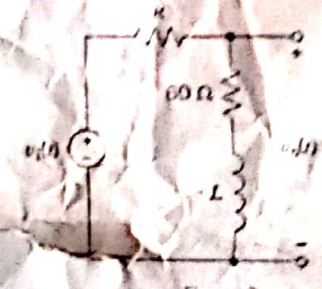

Figure 2

Q4. (Marks 20)

a) If $\mathcal{L}[f(t)] = F(s)$, then derive an expression for $\mathcal{L}[df/dt]$

b) Using the transform of first derivative of $f(t)$ find the Laplace transform of $\cos\omega t$.

Q5. (Marks 20)

In the circuit of Figure 3 determine the voltage $v_C(t)$ and the current $i_C(t)$ for t >= 0.

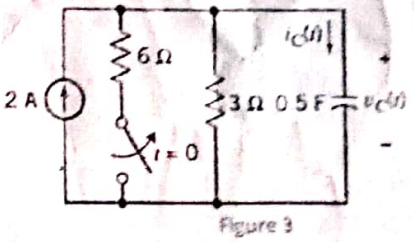

Figure 3