Course Title	Digital Communication Systems	Course Code	EEC 3220
Year / Level	2022-2023 / Second Semester	Missed Exam	120 Marks
Day / Date	Tuesday: 4/6/2023	Allowed Time	3 hrs.
Repoints	Answer from left to right using blue pen and do not use pencil or red pen		

Select only 18 sub-questions from the following questions

Question No 1

[20 Marks]

a. Explain mathematically with the aid of drawing the generation of PAM signal, indicating the basic concepts for doing so in order to be recoverable at the receiving end. [5 Marks]

b. Comment about the difference between PPM and PWM as compared to PAM from various aspects, then indicate their performance with communication channel noise. [5 Marks]

c. What are the advantages of PCM digital transmission as compared to the traditional analogue transmission. [5 Marks]

d. Show whether the companding process could be applied to delta modulation to overcome its well-known drawbacks (Investigate or illustrate your opinion). [5 Marks]

Question No 2

[20 Marks]

a. Define and comment briefly about crosstalk, quantization error, ISI, and noise. [5 Marks]

b. Compare between different line codes from bandwidth, ac or dc coupling, BER, self synchronization, and transparency point of view. [5 Marks]

c. Illustrate the difference between synchronous and asynchronous line in digital transmission while giving some examples for each. [5 Marks]

d. Compare between ASK, PSK, and FSK concerning the output waveform, bandwidth, and noise effect. [5 Marks]

Question No 3

[24 Marks]

a. Deduce the truth table and draw constellation diagram for QPSK, then drive the values of transmitted signal when applying the binary sequence "11001001". [5 Marks]

b. Define and differentiate between carrier and clock recovery? Does both of them should be used in any system? Why? Explain a simple example for clock recovery? [5 Marks]

c. What do you know about the Costus loop, when it could be used, then explain its operation in details. [5 Marks]

d. Explain an example for polling using the binary tree search algorithm. [5 Marks]

Question No 4

[20 Marks]

a. How to increase the throughput of a communications resource. Explain the difference between fixed, demand, random, and spread spectrum multiplexing techniques. [5 Marks]

b. Explain the demand assignment multiple access operation showing flow of control. [5 Marks]

c. Follow up the well-known arrival statistics to analyze the pure ALOHA scheme to estimate the normalized throughput characteristics, then draw it. [5 Marks]

d. Show how to extend the above analysis to the case of slotted ALOHA, then comments on both schemes. [5 Marks]

Question No 5 [20 Marks]

a. Explain the merits of spread spectrum communication as compared to the traditional narrow band schemes. [5 Marks]

b. What are the conditions for SS communication and its classifications. [5 Marks]

c. Draw the general block diagram of DSSS and explain its operation. [5 Marks]

d. Explain and comment about both the transmitted and stored references synchronization concepts. [5 Marks]

Best Wishes

Course Examination Committee:

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Tanta University | Department: Electronics and Electrical Communication Eng. | Faculty of Engineering

Total Marks: 75 Marks

Course Title: Microprocessor Applications in Communication Systems
Course Code: EEC3215 **Year: 3rd year**
Date: 7/6/20223 **Allowed time: 3h** **No of Pages (4)**

Remarks: (This question paper must be submitted with your answer form.

Question (1) Choose the correct answer.

1) Which bus is a bidirectional bus?
a) address bus b) data bus
c) address bus and data bus d) none of the above

2) Which control signal causes the memory to perform a write operation?
a) $\overline{MRDC}$ b) $\overline{IOWC}$
c) $\overline{IORC}$ d) $\overline{MWTC}$

3) Which of the following is true about stack pointer?
a) Stack pointer contains the address of the top of the stack memory
b) Stack pointer is an 8-bit register
c) Stack pointer stores data permanently
d) Stack pointer is initialized after stack operation

4) Simple arithmetic and logic operations is the task of the ----------.
a) Data buses. b) CPU.
c) I/O devices. d) Memory device.

5) Which bus transfers the memory address to the I/O device or to the memory?
a) Data bus. b) Address bus.
c) Control bus. d) None of the above.

6) Single-bit indicators that may be set or cleared to show the results of logical or arithmetic operations are the:
a) flags b) registers
c) monitors d) decisions

7) In PUSH instruction, after each execution of the instruction, the stack pointer is
a) incremented by 1 b) decremented by 1
c) incremented by 2 d) decremented by

8) ----------language is a type of low-level programming language that is intended to communicate directly with a computer's hardware.
a) Machine b) Software
c) Assembly d) None of the above

9) The Stack follows the sequence
a) first-in-first-out b) first-in-last-out
c) last-in-first-out d) last-in-last-out

10) The program in Figure (1) represents ---------- circuit
a) Demultiplexer. b) Half adder.
c) Counter. d) Multiplexer.

11) The instruction that stores the contents of the specified 32 bits register on to the stack is
a) PUSHA b) POPA
c) PUSH AD d) POP AD

12) The program in Figure (1) has one mistake.
a) True b) False

13) The control signals in microprocessor are active high.
a) True False

14) The number 301 is presented into packed BCD form as ----------.
a) 00000011 00000001. b) 00000011 00000000 00000001.
c) 00000001 00000011 d) 10000001 00000001.

15) The general propose registers R8-R15 are available in ----------mode.
a) 64-bit. b) 8-bit.
c) 16-bit. d) 32-bit.

16) ---------- indicate the condition of the microprocessor and control its operation.
a) Registers. b) Flags.
c) Data buses. d) None of the above.

17) PUSH 73H
a) True b) False

18) AND AL, BL
a) True b) False

19) $\overline{IOWC}$ is the control signal that causes the I/O ports to perform a write operation.
a) True b) False

20) Auxiliary Flag is used as carry flag but when working ----------.
a) between bit position 3 and 4 b) double-word sized data
c) word-sized data d) None of the above

21) Verilog and VHDL are two standard software description languages.
a) True b) False

22) The difference between unsigned form and signed is the weight of the leftmost bit position.
a) True b) False

23) The standard ASCII code is ---------- a code.
a) 16-bit b)32-bit
c) 7- bit d)64- bit

24) One entity can have many different architectures.
a) True b) False

25) Name of the VHDL file should be the same as the entity name.
a) True b) False

26) Entity Declaration describes an interface of the component.
a) True b) False

27) The memory representation of 6.625 is (30D40000 H)
a) True b) False

28) The presentation of (-6) using the two's complementary is (FA H)
a) True b) False

29) The statements in between the keyword BEGIN and END are called _____
a) Concurrent statements b) Netlist
c) Declaration statement d) Entity function

30) The operators like =, /=, <, >, >= are called _____
a) Arithmetic operators b) Concatenation operators
c) Logical operators d) Relational operators

31) Which of the following is the default mode for a port variable?
a) IN b) OUT
c) INOUT d) BUFFER

32) Which of the following can't be declared in the declaration part of the architecture?
a) Signals b) Subprograms
c) Components d) Libraries

Question (2) Complete the missing words.

1) VHDL terms (steps) are ----------, ----------, and ----------.
2) The microcomputer system includes ----------, ---------, and ----------.
3) Comments in VHDL are indicated with --------
4) VHDL design styles include ----------,----------, and ----------.
5) Fundamental sections of a VHDL code are --------, ---------, and ---------.
6) -------- describes an implementation of a design entity.
7) VHDL is case --------.

```
LIBRARY ieee ;
USE ieee.std_logic_1164.all ;

ENTITY example IS
PORT ( w0, w1, s : IN STD_LOGIC ;
        f : OUT STD_LOGIC ) ;
END example ;

ARCHITECTURE dataflow OF myprog IS
BEGIN
      f <= w0 WHEN s = '0' ELSE w1 ;
END dataflow ;
```

Figure (1)

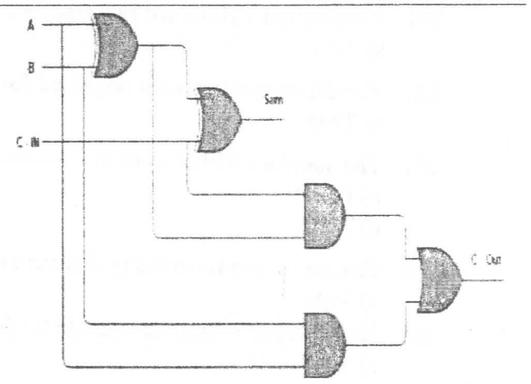

Figure (2)

Question (3)

1. Determine the addressing mode for each of the following instructions:
   a) Mov [1234H], BX
   b) Mov AX, DS:[1235]
   c) Mov AL,{BP]
   d) Mov AL, [BP+SI]
   e) Mov AX, 345FH

2. Write the VHDL program that describes the combinational circuit in figure(2).
3. Write the VHDL program that describes the comparator circuit compares between two binary numbers, each number contain from 4 bits and output is greater, less, or equal.
4. Write the VHDL program that describes the process of rising edge D flip flop with an asynchronous reset.

5. Draw the block diagram of a computer system.
6. Describe the content of the flag register (CF, PF, AF, ZF, SF, OF), if the register AH=8BH and the instruction XOR AH, 3 is executed.

Tanta University

Department of Electronics and Communication Engineering
Total Marks:75 Marks

Faculty of Engineering

Course Title: Optical Communications	Course code: EEC3213	Year: 3rd
Date: 11 June, 2023	Allowed Time: 3 Hours	No. of pages:(4)

Answer all the following Questions and assume any missing data.

Question (1):

(1) The fixed optical ..... is a traditional wavelength arrangement device that can only add or drop one or more new wavelength channels to an existing multi-wavelength WDM signal.

a) filter b) tunable sources c) OADM

(2) ..... is WDM utilizing closely spaced channels, in which the channel spacing in S, C, and L-bands is 12.5-100 GHz (0.1-0.8 nm at 1550 nm).

a) DWDM b) CWDM c) TDM

(3) The number of bits that are corrected in (255, 223) RS code, while only two bits in each incorrect bytes are corrupted, are .....

a) 16 b) 32 c) 8 d) 48

(4) ..... receivers are the most sensitive receiving Systems.

a) Heterodyne detection b) Homodyne detection c) Direct detection.

(5) For large optical signals incident on a pin photodiode, the SNR at 5 MHz receiver bandwidth is ..... the SNR at 25 MHz receiver bandwidth.

a) greater than b) same as c) smaller than

(6) For very large optical signal levels, the ..... term dominates the receiver noise. In this case, the ..... photodiode serves no advantage since the detector noise increases more rapidly than the signal level.

a) thermal noise, APD b) thermal noise, PIN
c) quantum noise, PIN d) quantum noise, APD

(7) A key feature of ..... code is their ability to correct burst errors, where a sequence of bytes is received incorrectly. While ..... code can correct only one bit error.

a) hamming, reed-solomon (RS) b) reed-solomon (RS), hamming

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c) CRC, Parity check d) hamming, parity check

(8) The transmission distance is .....-limited up to about 40 Mb/s, after which it becomes ..... -limited for the short-wavelength band (770–910-nm), when using the PIN/Led combination.

a) modal dispersion, attenuation b) material dispersion, modal dispersion
c) attenuation, modal dispersion d) attenuation, material dispersion

(9) In eye diagram, the best time to sample is dependent on the ..... of eye opening.
a) height b) width c) slope d) timing jitter

(10) If the depletion layer of the light detector is too wide, and the photodiode capacitance is larger, the detector response time becomes limited by .....

a) The diffusion component b) the RC time constant c) system rise time

(11) In eye diagram, ... may cause a receiver to lose synchronization with the incoming bit stream thereby incorrectly interpreting logic 1 and 0 pulses.

a) the height of the eye-opening b) the width of the eye-opening
c) timing errors d) timing jitter

(12) The performance of the optical digital receiver is measured by ....., while the performance of the analog receiver is defined by.....

a) BER, SNR b) SNR, BER c) sensitivity, quantum limit

(13) The sensitivity of most receivers is ..... the quantum limit because of various nonlinear distortions and noise effects in the transmission link.

a) smaller than b) higher than c) same as

(14) The high impedance amplifier with high load resistance R_L results in ..... noise but also gives a ..... receiver bandwidth.

a) low, high b) high, low c) low, low d) high, high

(15) In designing the digital optical systems, the Link power budget analysis is essential to define....., while the rise-time budget analysis defines .....

a) the system losses, the transmission distance

b) the system data rate, the transmission distance

c) the transmission distance, the system data rate

Question (2):

a) Explain Briefly the following: Power Penalty, Burst Mode Receiver.

b) For an InGaAs photodetector operating at $1550\ nm$, $R = 0.90\ A/W$. What is the NEP in the thermal-noise limited case if the load resistor is $R_L = 1000\ \Omega$ and $T = 300°K$?

c) A high-speed $In_{0.53}Ga_{0.47}As$ pin photodetector is made with a depletion layer thickness of $0.15\ \mu m$. What percent of incident photons are absorbed in this photodetector at $1310\ nm$ if the absorption coefficient is $1.5\ \mu m^{-1}$ at this wavelength?

Question (3):

a) A $90 - Mb/s$ NRZ data transmission system that sends two DS3 ($45 - Mb/s$) channels uses a GaAlAs laser diode that has a $1 - nm$ spectral width. The rise time of the laser transmitter output is $2\ ns$. The transmission distance is $7\ km$ over a graded-index fiber that has an $800 - MHz \cdot km$ bandwidth-distance product. (i) If the receiver bandwidth is $90\ MHz$ and the mode-mixing factor $q = 0.7$, what is the system rise time? Does this rise time meet the system design criteria?

b) Draw the link power budge indicating the possible transmission distance L. Specify $a\ 20\ Mb/s$ data rate and a $BER = 10^{-9}$. For a receiver we choose Si PIN photodiode at $850\ nm$, the required receiver input signal is $-42\ dBm$. Select a GaAlAs LED that couples $50\ \mu W$ into a $50\ \mu m$ core diameter fiber flylead. Assume a $1 - dB$ loss occurs at each cable interface and $a\ 6dB$ system margin. Assume $\alpha = 3.5\ dB/km$.

c) Consider an analog optical fiber system operating at $1550\ nm$, which has an effective receiver noise bandwidth of $5\ MHz$. Assuming that the received signal is quantum noise limited, what is the incident optical power in dBm necessary to have a signal-to-noise ratio of $50\ dB$ at the receiver? Assume the responsivity is $0.9\ A/W$ and that $m = 0.5$.

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Question (4):

a) A homodyne ASK receiver has a $100 - MHz$ bandwidth and contains a $1310 - nm$ pin photodiode with a responsivity of $0.6\ A/W$. It is shot noise limited and needs a signal-to-noise ratio of 12 to achieve a 10^{-9} BER. Find the photocurrent that is generated if the local oscillator power is –3 dBm and the phase error is 10°. Assume that both the signal and the local oscillator have the same polarization.

b) Verify that 10 photons per bit are required to get a bit error rate of 10^{-9} for a direct-detection OOK system. Then show that for an ideal OOK homodyne system, one needs 36 photons per pulse to achieve a 10^{-9} BER.

c) Consider the generator polynomial $x^3 + x + 1$. Find the CRC for the data unit 1001. Then if the resulting code word has an error in the third bit when it arrives at the destination, what is the CRC calculated by the receiver?

Question (5):

a) Consider a spectral band of 0.4 nm at a 1550-nm wavelength within which lasers with narrow linewidths are transmitting. How many of such signal channels fit into (a) the C band, and (b) the combined S- and C-bands?

b) Draw the Bi-directional dense wavelength-division multiplexing (DWDM) system operating at C-band, indicating the wavelengths assigned for the transmitting and for the receiving.

c) State the types of wavelength-division multiplexing, indicating the application of each type.

Constants:

Electron charge, $q = 1.602 \times 10 - 19\ C$

Planck's constant, $h = 6.625 \times 10 - 34\ J.s$

Boltzmann's constant, $kB = 1.38 \times 10 - 23\ J/K$

With my best wishes

Dr. Basma Eldosouky