

TELC2103 Control Assignment II

Section A (40 marks)

Tick all the correct answer(s) to each of the following questions. Choose all that apply.

1. Most cordless phone frequencies operate in the following frequency range?
 - A) 450 MHz – 1880 MHz
 - B) 2400 MHz – 5825 MHz
 - C) 824 MHz – 1990 MHz
 - D) All of the above
2. Deflection takes place when the wavelength of the obstacle is _____ than the wavelength of the signal.
 - A) Much larger
 - B) Much smaller
 - C) equal
 - D) None of the above
3. Middle Earth Orbit (MEO) satellites usually operate at an altitude of _____ kms.
 - A) 1000
 - B) 2000
 - C) 10000
 - D) 39000
4. _____ encoding has a transition at the beginning of each bit representing space.
 - A) NRZ-I
 - B) Manchester
 - C) AMI
 - D) Differential Manchester
5. Which of the following led to the downfall of Infra-red as a transmission technology?
 - A) Slow transfer speed
 - B) Unidirectionality
 - C) Short range
 - D) None of the above
6. In IEEE 802.11b (US), the channel numbers of the 3 non-overlapping channels are ?
 - A) 1, 6, 11
 - B) 1, 7, 13
 - C) 1, 6, 13
 - D) None of the above.
7. In a Bluetooth piconet, the maximum number of slaves allowed per master is? .
 - A) 1
 - B) 7
 - C) >200
 - D) None of the above
8. _____ are used for cellular phone, satellite, and wireless LAN communications.
 - A) Long-waves
 - B) Micro-waves
 - C) Infra-red waves
 - D) All of the above
9. For a _____ channel, the Shannon-Hartley equation defines the channel capacity.
 - A) noisy
 - B) noise-less
 - C) error-free
 - D) low-pass
10. The period of satellite orbiting at an altitude of around 36,786 Km is approximately
 - A) 4 Hours
 - B) 12 Hours
 - C) 24 Hours
 - D) None of the above

11. What should be the orbiting velocity of a satellite at an altitude of 9,000 Km over sea level?
A) 20,000 km/h
B) 12,000 Km/h
C) 25,000 Km/h
D) 1,000 Km/h
12. What is the path-loss in dB for a satellite at an altitude of 2,000 km using a downlink frequency of 900 MHz?
A) 337.54 dB
B) 157.54 dB
C) 38.69 dB
D) 213.69 dB
13. Identify one advantage of FHSS over DSSS.
A) It is simple to detect
B) Simple implementation
C) It is reliable and robust
D) None of the above
14. Which modulation scheme is used by IEEE 802.11a?
A) OFDM
B) DSSS
C) FHSS
D) None of the above
15. Which modulation scheme is used by IEEE 802.15.1?
A) OFDM
B) DSSS
C) FHSS
D) None of the above
16. Which of the security mechanism is/are nowadays considered safe for wireless LANs?
A) WPA
B) WPA2
C) WEP
D) None of the above
17. Which of the following statement is/are false?
A) Wireless LANs are generally more resilient than wired LANs.
B) QAM is a form of Amplitude Shift Keying only.
C) MEO satellites needs more transmit power than LEO satellites.
D) None of the above
18. Which of the following is/are the drawbacks for cordless telephony?
A) Security.
B) Wireless technology.
C) Limited coverage area.
D) None of the above.
19. Which modulation scheme is used by Bluetooth?
A) MSK.
B) DQPSK.
C) GFSK.
D) None of the above.
20. Which of the following is/are true for first-generation wireless systems?
A) Efficient.
B) High data rate.
C) Digital technology.
D) None of the above.

(2 marks for each MCQ)

Section B (25 marks)

21. What is meant by the elevation of a communication satellite? Why must satellites usually have an elevation greater than 10° ? [2+2 marks]
22. Figure 1 shows a prototype vehicle to navigate on the Moon. The vehicle is fitted with an array of sensors which gathers lunar information and relays it down to Earth. The vehicle contains four Infra-red analogue distance sensors on each side of the vehicle to measure the distance from an obstacle. The sensors derive their power from photovoltaic cells mounted on the vehicle itself and the sensors have an operating bandwidth of 100 Hz. The sensors can measure distances between 180 cm to 20 cm by varying the output voltage signal from +3 to +5 Volts respectively. The four signals are then time-division multiplexed with each sensor being given a time slot of 0.25 second. The output of the multiplexer is then fed to a PCM encoder.

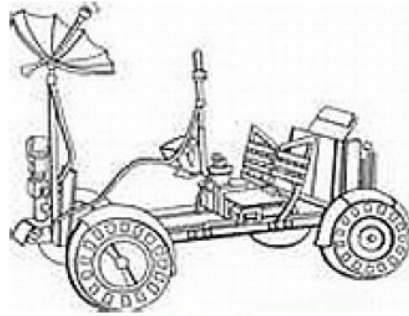
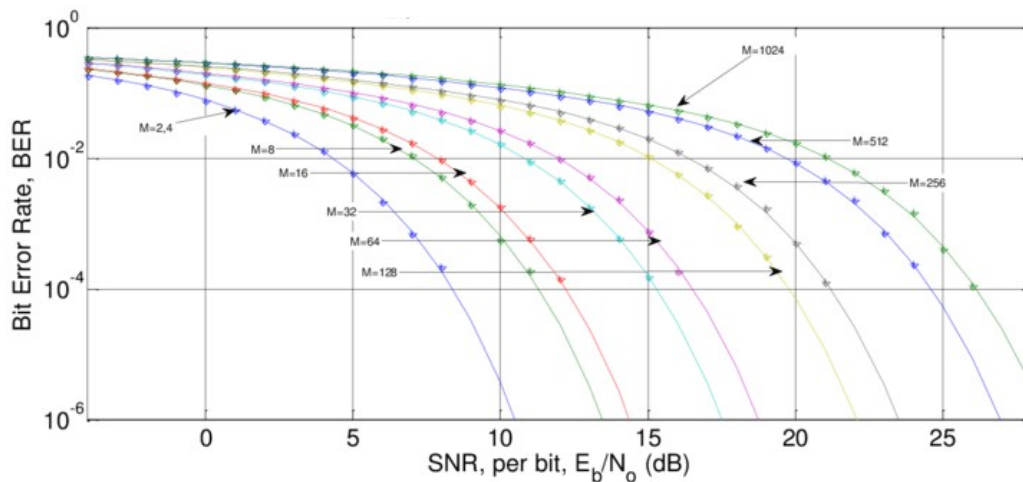


Figure 1

The resultant digital output data stream is then transmitted as a powerful, 10 GHz carrier frequency, 256-QAM microwave signal back to Earth.

- (a) Calculate the minimum sampling frequency needed to fully characterize the analogue sensor signals?
- (b) How many quantization levels are needed in the PCM if sensors need to have a sensitivity of 5 cm?
- (c) Calculate the bit rate and the quantization error in dB of this PCM?
- (d) Assuming a bandwidth of 75 kHz, calculate the maximum Nyquist output data rate achievable using 256-QAM downlink signal?
- (e) Calculate the maximum allowable SNR_{dB} of the downlink if the data rate has to be at least 150 kbps?
- (f) Now suppose that the downlink becomes error-prone as well, what is the minimum signal power in dBW that is needed to sustain a data rate of 300 kbps with a BER of 10^{-4} at -25 degrees celsius?



- (g) The Moon is 375,000 kms from Earth, calculate the free space loss in dB of the downlink signal.

[2+2+4+3+3+4+3 marks]

Section C (35 marks)

23. You are expected to implement a small campus wireless system in Cisco Packet Tracer 8.0. Your network should consist of the following **minimum** components and configurations:
- A. 1 WLC-3504 Wireless LAN Controller
 - B. 6 Light-weight Access Points (LAP-PT) deployed over the campus.
 - C. 1 server running AAA and DNS services.
 - D. 1 PC for WLC management, 1 multi-layer switch and 6 layer-2 switches.
 - E. 3 wireless clients (staff, student and guest) per Access Point.
 - F. 12 different user accounts (6 for staff and 6 for student) using 802.1x authentication.
 - G. All guests should authenticate using PSK with a common password set as: **Password!23**
 - G. 3 SSIDs per Access Point: staff-wifi, student-wifi and guest-wifi.
 - H. 4 VLANs: one for each staff, student and guest; one for management of servers and controllers.

Deliverables:

- 1. Fully configure the system in Packet Tracer so that after stabilization: one staff, one student and one guest should each connect to one AP. (screenshot need to be provided)
- 2. Provide the username/password for all accounts. (12 user accounts and WLC admin account)
- 3. Give the network configurations for the server and the WLC.
- 4. You will have to attach your PT file together with the assignment report. (sectionc.pkt)

Deadline: 8pm Monday 21st February 2022

***** END *****