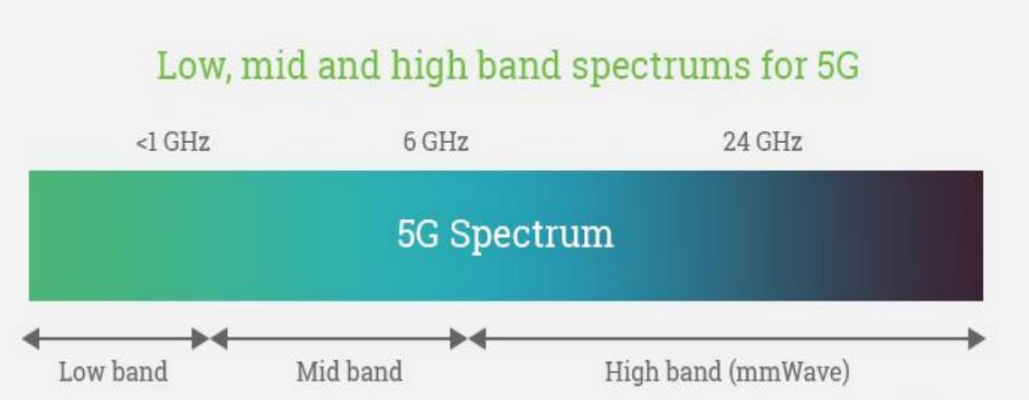
Introduction to System-on-Chip and its Applications

Final Test 12/26/2022

1. (2%) (a) What is the spectrum and channel bandwidth used in 5G?



   (2%) (b) Describe one advantage and one disadvantage of using 5GNR(New Radio) mmwave for transmission data.

   mmWave reduces latency.

   mmWave devices use more power.

   (1%) (c) Which of the following technologies are used in 5G? (a) Precoding (b) MIMO (c) beamforming (d) directional antenna

   Answer: (a)(b)(c)(d)

   (3%) (d) Describe the operational principle for the answers in (c).

2. (i) (2%) Which of the following sensors will be selected for scientific space telescope applications (a) CCD (b) CMOS?

   Answer: (a) CCD

   (ii) (2%) What are the reasons for that? (a) longer wavelength performance (b) time delay (c) higher readout speed (d) higher fill factor

   Answer: (a) longer wavelength performance、(d) higher fill factor

3. (i) (2%)For a depth estimation in HMD targeted for fast hand tracking, which of the following depth sensors will be selected(a) structured light (b) stereo matching (c) time of flight?

   Answer: (c) time of flight

   (ii) (2%)What are the reasons for that?

4. (6%) Describe the operation principle of TN, VA and IPS in LCD.

5. (3%) (i) Which of the following interconnect interface is suitable for connecting graphic chip to main core in the motherboard (a) SATA (b) USB (c) PCI-E (d) DDR..

   Answer: (c) PCI-E

(ii)Which kind of transmission is used for answer in (i) ? (a) Serial (b) parallel.

Answer: (a)Serial

(iii)What are used the clock generated for the answer in (ii)?(a) clock synchronous circuit (b) DC balanced code (c) CDR (d) gated clock

Answer: (b) DC balanced code (c) CDR

6. (2%) (i) Which of the following will be selected in touch panel targeted for shorter response time and higher accuracy? (a) capacitor-based (b) resistor-based ?

   Answer: capacitor-based

   (4%)(ii)What are the reasons for (i)?

7. (2%)(i) For a television designed for high dynamic range and high response time, which of the following will be selected (a) OLED (b) LCD (c) LED (d) VCESL

   Answer: (a) OLED

   (ii) (2%)What are the reasons for the answer in (i)? OLED does not have backlight so it could be pure black so have high dynamic range, it does not depend on the twist of liquid crystal so faster in response time

8. (4%) Describe the reason that AMOLED can produce continuous light but PMOLED can't?

9. (2%) Describe what is the inter-symbol interference issues in high speed serial data transmission?

   Answer

   ➢If the rectangular multilevel pulses are filtered improperly as they pass through a communications system, they will spread in time, and the pulse for each symbol may be smeared into adjacent time slots and cause ***Intersymbol Interference.***

   (2%) describe the method to overcome the problem.

   Answer:

   Equalization-Overcome the high-frequency signal losses of the transmission medium or inter-symbol interference

10. (1%) (i) What kind of indoor position technique is suitable for applications in shopping mall with low position errors (a) WiFi (b) Bluetooth Beacons (c) SLAM (d) Light house station

    Answer: (a)WiFi

    (ii) (2%) Brief describe the operation principle of the answer in (i).

    (iii) (2%) Compare the operation principle of answer in 1(b) with GPS.

11. (2%) Compare the light emitting schemes and semiconductor structures for IR sensors and Lidar sensors.

12. (1%) (i) What kind of a sensor is suitable for wearable devices to measure the pace count? (a) Barometric Altimeter (b) Pressure sensor (c) IMU (d) Proximity sensor

Answer: (c)IMU

(ii) (2%) Brief describe the operation principle of the answer in (i).

(iii) (2%) Compare the semiconductor structure of answer in (i) with piezoresistive pressure sensor.

13. (1%) (a) Describe the operational principle of OFDM.

(1%) (b) Compared to FDM, what is the reason that OFDM has better bandwidth efficiency ?

(1%) (c) Describe the effect of Peak-to-Average Power Ration (PAPR).

(1%) Describe the reasons that multiple carrier system is better than single carrier system in terms of channel fading.

(1%) Describe the reasons that multiple carrier system is better than single carrier system in terms of ISI.

14. (1%) (a) Describe the operational principle of direct sequence CDMA.

(2%) (b) Describe the operational principle of frequency hopping CDMA.

(1%) (c) List one technology in personal area network that use direct sequence CDMA and frequency hopping CDMA.

(1%) Describe the reason that CDMA has robust to channel noise effect.

15. (1%) (a) Describe the operational principle of MIMO.

(1%) (b) Describe the operational principle of Beamforming and its advantage.

(1%) Compare with CDMA and OFDM in terms of bandwidth efficiency.

(1%) What is the function of IFFT in OFDM hardware implementation.

(1%) What two techniques are used to avoid ICI and ISI in OFDM and describe the operation principles.

16. (2%) (a) Describe the operational principle and required hardware components used in smart watch for detecting heart rate using PPG.

(2%) Describe the operation principle and main functions in the hardware diagram that can used for designing ECG in wearable devices.

17. (1%) (a)For the following application on connecting the all water meters(水表) in the city by the concept of Internet of Thing, which kinds of wireless technology is more suitable (a)Wi-Fi (b) RFID (c) Bluetooth,(d) Zigbee (e)NFC

Answer: (d) Zigbee

(2%) (b) Explain the reason.

(2%) (c) Which of the communication scheme is used and describe it operation principle.

Answer: IEEE 802.15.4　低速率無線個人區域網制定的標準，定義一種廉價的，固定、可攜式或行動裝置使用的，低複雜度、低成本、低功耗、低速率的無線連接技術

18. (2%) Describe the reason that Zigbee consumes less power than Bluetooth for

their wireless communication technologies?

Answer: Because of Zigbee's low bandwidth requirements, a Zigbee node can sleep most of the time, thus saving battery power.

19. (2%) To connect a wearable device with cell phones, which of the following technology is better (a)Wi-Fi (b) RFID (c) Bluetooth,(d) Zigbee (e)NFC

    Answer: (c)Bluetooth

    (2%) List three reasons for that.

20. (2%) Which of the following materials are manufactured by the process of MOCVD? (a) Alq3 (b) Spiro-NPB (c) AlGaAs (d) ZnSe

    Answer:(c)AlGaAs (d) ZnSe

21. (4%)List four advantages of RFID compared to the other identification technology.

22. (2%)(i) If you have cellphone in high mountain without connection, which of the following position scheme will be selected? (a) GPS (b) Base station (c) Wifi (d) Bluetooth beacon

    Answer: (a) GPS

    (2%)(ii)Describe the operation principle of the answer in (i).

23. (2%) (i) Which of the following circuit component is used in MENS Gyro for reducing the noise from nonrotational movements? (a) differential pair output signal (b) variable gain amplifier (c) programmable gain amplifier (d) driver

    Answer: (a) differential pair output signal

24. (i) (1%)In a MEMS accelerator, what is the purpose of mounting inner frame spring 90 degrees to the outer frame spring (a) balance (b) reduce noise (c) produce multi-axis movement

    Answer: (c) produce multi-axis movement

25. (2%) Compare the cost of the following three depth sensors: stereo type, structure light and time of flight and what is the reason.

    Answer: structure light > time of flight > stereo type,