1. What is quantization noise for a A/D converter? How does it relate to the resolution of the converter?

2. How does a delta-sigma modulator obtain improved noise performance?

3. What is the role of the sample/hold circuit? What is the meaning of aperture window?

4. How can we determine the best possible dynamic range associated with an ADC? What is effective dynamic range?
5. What mechanisms in a DAC generate spurious responses?

6. For a real-time digital filter what are the 2 most important performance parameters?

7. State 4 advantages that a digital filter has over a standard nonsampling analog filter.

8. What are 3 standard hardware implementation approaches for components of the digital portion of a radio?
9. What is meant by decimator? Describe the major components of a decimator?

10. What is meant by interpolator? Describe the major components of an interpolator.

11. Show how an interpolator can be used, prior to a DAC, to improve the spectral quality of the resulting continuous time signal. Note that there is still some analog filtering after the DAC. Show using spectral plots.

12. How can a decimator be used to obtain an improved antialiasing filter? Show using spectral plots.
13. What is meant by symbol synchronization and why is it important? What is a simple method that can be used for tracking of the symbol timing? Show in the form of a block diagram.

14. In addition to filtering, symbol synchronization, demodulation and detection (decision) functions, list 5 different operations that are commonly found in a digital radio (apart from simple input/output user control functions).

15. Why isn’t a Class A amplifier, operated over the linear portion of its response, well suited, i.e., desireable, as a power amplifier?

16. What is load pull analysis and what does that have to do with improving the capability of a Class A or Class B to act as a power amplifier?
17. Describe the operation of a Class C power amplifier. Why is it not desireable as a power amplifier, particularly for mobile devices?

18. Describe the operation of an ideal Class D amplifier, i.e., show a block diagram and voltage and current waveforms associated with the active device(s). Although it is useful for lower frequencies, what limitations exist that make implementation of Class D unattractive at VHF frequencies and above?

19. Although the configuration is different, in terms of its operation a Class F amplifier is similar to that of Class D. Describe operation of a Class F amplifier. Use block diagrams and waveforms as needed.

20. What is feedforward linearization? Show how it works in improving linearity of a power amplifier. Why isn’t this approach used in all power amplifiers?
21. What is feedback linearization? Due to the high potential for instability the feedback is not generally done at the highest rf frequency. Indicate, using a block diagram, how the feedback is done.

22. Another technique for linearization is called predistortion linearization. Show how this technique works.

23. A single antenna is generally used for mobile devices, both for transmitting and receiving. Describe how the transmitter and receiver are isolated, either with a diplexing filter or with a switch, and when each technique is used.

24. Briefly describe differences in operation between the three major resource sharing schemes being used in cellular systems today.
25. What are 3 critical issues dealing with time in a time division multiple access scheme?

26. In code division multiple access there are issues with orthogonality of the codes. What are the codes and what is meant by orthogonality? Why is orthogonality important?

27. What is an important difference between long PN sequences and shorter sequences such as Barker codes or Walsh codes?

28. Using the sequence 010110100 show the output of a sliding correlator for this sequence for shifts of 0, 1 and 2 bits for this sequence.
29. Once the receiver finds the maximum correlation point for the sequence(s) it tracks it (them) so as to retrieve the bits or symbols being transmitted. Show, using a simple figure, how a symbol sequence is spread at the transmitter, and how it is despread at the receiver.

30. Show spectra associated with spread and despread signals.

31. What is meant by a chip? Why is chip synchronization important in a CDMA receiver?

32. What is power control and why is it important to proper operation of a CDMA system?
33. In GSM systems, slow frequency hopping is used. In this case the main purpose is not to spread the spectrum to permit resource reuse. What is the main purpose of this?

34. In the strictest sense of the term “spread spectrum” what is the relationship between information being transmitted and the method in which the spectrum is spread?

35. The idea of license-free spectrum is to facilitate the development of products that use wireless technologies. These are intended only for short range applications such as wireless internet access and cable replacement applications. Existing products utilize spectrum designated for ISM applications. What is ISM and roughly what frequencies are part of the ISM bands?
36. Two major issues with license-free bands are: 1) users must share the spectrum in a fair manner, and 2) users must not interfere with licensed users of the spectrum. How are these two goals achieved in practical systems?

37. The existing ISM bands are limited in the bandwidth and so very high speed data rates are not possible within these bands. For very high speed data rates two competing approaches are being considered that make use of the spectrum from 3.6 to 10.7 GHz (currently being considered by FCC for license-free use). These are OFDM and impulse UWB. What is OFDM and how does it make efficient use of the spectrum? What is impulse UWB and how does it utilize the spectrum?

38. Describe three types of receivers for impulse UWB.
39. What are two approaches for resource sharing with impulse UWB?

40. How is the spectrum shared with OFDM?

41. What effect does the antenna normally have on an impulse?

42. How can impulses be generated?
43. What are trade-offs between the OFDM and impulse UWB approaches?

44. How is OFDM implemented in practice?

45. Describe two types of modulation that can be used for impulse UWB.

46. Why is a type of OOK modulation normally used for practical (long-distance) radar?
47. Draw a block diagram of a system suitable for short-range doppler radar.

48. How is range determined for a pulse-doppler radar? How is velocity determined for pulse-doppler radar?

49. How does the maximum unambiguous range relate to pulse repetition frequency? At what ranges is a constant pulse repetition frequency radar blind?

50. What is FMCW radar and why is it popular for short range studies? How is step-frequency radar different than FMCW radar?
51. What does a radiometer measure? What is the meaning of brightness temperature?

52. What is the purpose of calibration for a radiometer? What is the purpose of calibration for a radar?

53. Why is integration necessary for a radiometer? Why is integration used for radar?

54. How does a conventional radiometer obtain an image?
55. How does SAR work? A SAR generates an imaging consisting of a map of what?

56. What is the difference between a total power radiometer and a Dicke switched radiometer?

57. What is a Moving Target Indicator? How is it different than a Pulse-Doppler radar?

58. Illustrate the difference in pixel dimensions for the beamwidth-limited case versus the bandwidth limited radar case.
59. How is focusing achieved for a stripmap synthetic aperture radar? You may describe either in terms of pathlengths or in terms of doppler beamsharpening.