Examination report – June 2014 series

2730-023 Advanced Radio Systems

Section 1 – Areas of good performance
Syllabus reference: 1.58 / 1.59 – Explain how multiple path propagation can be used to advantage in CDMA systems. Describe the operation of the Radio Activated Key Entry (RAKE) receiver. A section that was well done by many candidates. However, too many candidates failed to provide sufficient detail for the operating principle of Maximal Radio Combining (MRC). Syllabus reference: 1.81 – Sketch the block (system) diagram of a microwave radio (line-of-sight) repeater system and explain the function of each stage. This question was generally done well with many candidates. Syllabus reference: 1.89 – Evaluate the advantages and disadvantages of communicating by means of geosynchronous satellites rather than satellites in low earth orbits. This section gave no difficulty to most candidates. Syllabus reference: 1.90 – Explain why the angle of elevation is an important factor in satellite communications. Many candidates missed the essential point in this section. The elevation angle determines the distance travelled by the radio wave in the earth's atmosphere and hence the amount of attenuation, noise and distortion it is subjected to.
Section 2 – Areas for development
Syllabus reference: 1.4 – Explain what is meant by 'ducting' and its causes. There were generally good explanations for radio ducts. However, candidates had not read what was required correctly in regards to how three quantities changed with height under given conditions. Thus under normal atmospheric conditions, for example, all three quantities decrease with increase in height. Syllabus reference: 1.17 – Explain the operation of parabolic dish antenna when used on ultra high frequency (u.h.f.) bands and above. While the parabolic equation appeared to be unknown to most candidates, the focal point and the location of the radiating element were known. Detail was required in terms of how a spherical wavefront from the radiating element is converted to a plane wavefront and the phase relationship between the rays of the plane wavefront to give adequate explanations which was lacking in the majority of cases. Syllabus reference: 1.25 / 1.29 – Sketch the block diagram of a simple AM transmitter and describe the function of each stage. Explain why the class of bias used is an important factor in radio transmitters. Many candidates expressed muddled views in their responses to this section. As the transmission frequency is fixed, the only correct identification of unit A is a crystal oscillator. Likewise unit B must be a modulating power amplifier. The complete r.f. chain can be operated in class C bias with the exception of the power amplifier. This cannot be in class C otherwise the modulated envelope from the modulator would be distorted. Syllabus reference: 1.35 – Evaluate the major differences in the design of the receivers - a double

superheterodyne receiver designed to receive amplitude modulated signals and a double superheterodyne receiver designed to receive frequency modulated signals.
Candidates lost marks through lack of detail. For bandwidth, some detail is expected as to what parameters determined its value in both systems. For demodulation, some mention is expected of amplitude limiting and de-emphasis in the case of FM.

Syllabus reference: 1.44 – Describe the forms of spread spectrum techniques; frequency hopping, time hopping and direct sequence.
Detail was lacking in this section, particularly for time hopping.

Syllabus reference: 1.47 – Describe the introduction of multimedia services as a key commercial driver for the evolution of 3G systems.
The increasing demand for data transmission lay at the heart of the answer.

Syllabus reference: 1.66 – Describe the composition of the frame structures of the major physical channels in UMTS.
Many candidates gave correct answers to a part of this section but very few candidates gave the correct answer to how the DPDCHs are transmitted in the up-link and in the down-link.
Nonetheless many candidates knew the four possible fields for DPCCH.

Syllabus reference: 1.51 – Describe how in CDMA – Direct Sequence (CDMA-DS), marrowband information signals are multiplied by unique high-speed codes, effectively spreading the signal bandwidth.
Most candidates struggled with this section.

Section 3 – Recommendations
Candidates should read questions carefully and correctly and provide sufficient detail when required.