WORKFORCE DEVELOPMENT AUTHORITY

P.O. BOX 2707 Kigali, Rwanda Tel: (+250) 255113365

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2017, TECHNICAL AND PROFESSIONAL STUDIES

EXAM TITLE: TELECOMMUNICATION SYSTEMS

OPTION: Electronics and Telecommunication (ETL)

DURATION: 3 hours

INSTRUCTIONS:

The paper is composed of **the following sections**:

Section I: Sixteen (16) compulsory questions.   **55 marks**

Section II: Attempt **any three (3)** out of five questions.   **30 marks**

Section III: Attempt **any one (1)** out of three questions.   **15 marks**

Note:

Every candidate is required to carefully comply with the above instructions. Penalty measures will be applied on their strict consideration.

Section I. Sixteen (16) Compulsory questions   **55 marks**

01. Explain the impedance of antenna. *ω*   **3 marks**

02. Define LPDA.   **4 marks**

03. List any two requirements to be satisfied for compatibility in television systems.   **2 marks**

04. Name the three regions of the atmosphere in order of their relative heights.   **3 marks**

05. What are the limitations of rhombic antenna?   **3 marks**

06. What are the different types of horn antennas?   **4 marks**

07. What is parabolic reflector? What are its applications?   **4 marks**

08. Why space wave propagation is called as well line of sight propagation?   **3 marks**

09. Which layer is suitable for propagation of high frequency signals and why?   **4 marks**

10. Distinguish between low level and high level modulation.   **4 marks**

11. Explain the disadvantages of single side band transmission?   **3 marks**

12. What is multiplexing?   **2 marks**

13. State sampling theorem.   **3 marks**

14. What are the advantages of digital transmission?   **4 marks**

15. List the disadvantages of frequency hopping systems.   **3 marks**

16. In a broadcasting studio, a 1000 kHz carrier is modulated by an audio signal of frequency range, 100-5000Hz. Find:

     a) Width or frequency range of side bands,

     b) Maximum and minimum frequencies of USB,

     c) Maximum and minimum frequencies of LSB and

     d) Width of channel

     6 marks

$$Bw = \frac{FH - FL}{FC\, 2}$$

Bw
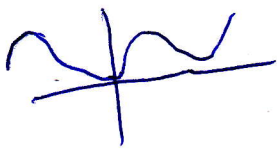
Section II. Choose and answer any three (3) questions   30 marks

17. Classify the antennas:
    a) According to the way they radiate.
    b) According to the range of frequencies of which they operate.
    c) According to the band on which they can operate.
    d) According to the way they are made.

    10 marks

18. **A.** A half-wave dipole is required to transmit a 300 MHz broadcast. Determine the electrical and the optimum length of the dipole.

    B. What are the names of the signal separation in frequency and signal separation in time?

    10 marks

19. **A.** Give the names of the two main form of multiplexing in communication systems.

    B. What are the two basic types of radiation?

    C. What is the sampling rate of analog signal used to change it to digital signal?

    10 marks

20. **A.** List out the types of analog/digital modulation schemes?

    B. Identify the three characteristics for any colour to specify its visual information.

    10 marks

21. **A.** A carrier of 100V and 1200 kHz is modulated by a 50 V, 1000 Hz sine wave signal. Find the modulation factor.

    B. A carrier wave of 500 watts is subjected to 100% amplitude modulation. Determine:

    (1) Power in sidebands; **(2)** Power of modulated wave

    10 marks

Section III. Choose and answer any one (1) question   **15 marks**

22. **A.** Shows the radiation patterns of some resonant dipoles of different lengths.

      (1) $l = \lambda /2$ **(2)** $l = \lambda$ **(3)** $l = 3\lambda/4$

  B. What is the expression of calculating the effective aperture of a receiving antenna?

                                                         15 marks

23. **A.** An FM broadcast-band transmitter has a peak deviation of ±60 kHz for a particular input signal. Determine the percentage of modulation.

  B. Show the typical FM broadcast-band receiver/ FM superheat receiver block diagram.

  C. A 25 MHz carrier is modulated by a 400 Hz audio sine wave. If the carrier voltage is 4V and the maximum frequency deviation is 10 kHz, write down the voltage equation of the FM wave.

                                                         15 marks

24. A frequency modulated voltage wave is given by the equation: e = 12cos (6 × 108t + 5 sin 1250 t). Find:

         (a) carrier frequency

         (b) signal frequency

         (c) modulation index

         (d) maximum frequency deviation

         (e) power dissipated by the FM wave in 10-ohm resistor.

                                                             15 marks