EAST AFRICAN SCHOOL OF AVIATION EXAMINATION

END TERM II EXAMS

DIPLOMA IN AERONAUTICAL ENGINEERING AVIONICS

Communication and Telecommunication systems

STREAM: MODULE 2 Avionics **Duration: 3.00hrs**

DAY/DATE: 5/4/2017/Wednesday **TIME: 0900 – 1200 HRS**

INSTRUCTION TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Mathematical tables/ Electronic calculator.

Answer **ALL** questions

All questions carry equal marks.

Maximum marks for each part of a question are as shown

This paper consists of 4 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A – TELECOMMUNICATION PRINCIPLES

1. (a) Compare a wireless radio system with a fiber-optic communication system for digital data communications over a distance of 1 km. Assume a desired data rate of 75 Mbps. Give advantages and disadvantages of each. Which one would be better? **(5 marks)**

   (b) State FIVE benefits of fiber optic cables over conventional cables. **(5 marks)**

   (c) Name FIVE areas of application of fiber optics. **(5 marks)**

   (d) With aid of a diagram, explain the fiber optic communication system. **(5 marks)**

2. (a) An amplifier operating over the frequency range from 18 to 20 MHz has a 10-kilohm (l0-kΩ}) input resistor. What is the nos noise voltage at the input to this amplifier if the ambient temperature is 27^0C? **(4 marks)**

   (b) List, separately, the various sources of random noise and impulse noise external to a receiver. How can some of them be avoided or minimized? What is the strongest source of extraterrestrial noise? **(6 marks)**

   (c) Define signal-to-noise ratio and noise figure of a receiver. When might the latter be a more suitable piece of information than the equivalent noise resistance? **(5 marks)**

   (d) Discuss the types, causes and effects of the various forms of noise which may be created within a receiver or an amplifier. **(5 marks)**

3. (a) List SEVEN Merits of Digital Communication. **(7 marks)**

   (b) With aid of waveforms, explain how PAM, PWM, PPM are generated from analogue signal. **(8 marks)**

   (c) Using block diagrams, explain the Pulse Amplitude Modulator **(5 marks)**

SECTION B: COMMUNICATION SYSTEMS

4. (a) Define the following with respect to Radar systems:

   i) 2^{ND} echo returns **(2 Marks)**

   ii) Angle resolution **(2 Marks)**

   (b) A radar system, operating at 900 MHz over a 60 Km range, has an antenna capture area of $8m^2$. If the target cross-sectional area is 12 m^2 and the peak pulsed power radiated is 12 KW, determine the minimum receivable power. **(5 Marks)**

   (c) Short range radar scans a target using a pulse repetition time of 600 µS. Determine its maximum unambiguous range. **(2 Marks)**

   (d) A Radar system has the following parameters: -

   Peak pulse power - 500KW, Operating frequency - 10GHz, Minimum receivable power - 1×10^{-13} Watts, Antenna capture area – $5m^2$. If the Radar cross-sectional area of target is $20m^2$, calculate the maximum range of the Radar. **(5 Marks)**

   (e) With the aid of a labeled diagram, describe a plan-position indicator (PPI) radar display **(4 Marks)**

5. (a) Define amplitude modulation **(2 Marks)**

   (b) A given double-sideband-full-carrier amplitude modulator has two input signals namely, a carrier signal of the form $v_c = E_c \, Sin\omega_c t$ and the modulating signal is of the form $v_m = E_m \, Sin\omega_m t$. If the two signals have the following characteristics: -

   Carrier signal: $v_c = 7 \, Sin \, 18{,}849{,}556t$

   Modulating signal: $v_m = 2.1 \, Sin \, 15{,}708t$

   i. Calculate the percentage modulation **(2 Marks)**

   ii. Draw a well labelled frequency spectrogram illustrating all the frequencies of the DSB-FC transmission **(3 Marks)**

iii. Calculate the bandwidth of the resulting DSB-FC transmission **(2 Marks)**

iv. Calculate the power in the carrier **(2 Marks)**

v. Calculate the power in the two sidebands **(2 Marks)**

N.B. Assume and Antenna impedance of 3Ω

(c) (i) Define frequency modulation. **(1 Mark)**

(ii) An FM channel broadcasts a frequency modulated test tone with a voltage wave of the following equation:

$$e = 250 \cos (630{,}203{,}487t + 7.5 \sin 6{,}284\ t)$$

Find:

(i) Carrier frequency of the station **(2 Marks)**

(ii) The frequency of the test tone **(2 Marks)**

(iii) Maximum frequency deviation **(2 Marks)**

***************END**************