TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

UNIVERSITY EXAMINATION FOR:

THIRD YEAR EXAMINATION FOR THE DIPLOMA OF SCIENCE IN ELECTRICAL ENGINEERING (DTIE 6)

ETI 2304: COMMUNICATION SYSTEMS II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2HOURS

DATE: 2016/2017

Instructions to Candidates

You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of 5 questions. Attempt ANY THREE QUESTIONS
Do not write on the question paper.

You are provided:

$Boltzmann's\ constant,\quad K = 1.38 \times 10^{-23} J/K$
$Room\ temperature,\quad T_o = 290\ Kelvin$

Question one

a) Define noise and state the sources of noise in a communication system [4marks]
b) Describe 3 types of noise and how they can be reduced in a communication system [5 marks]
c) A noise output of a resistor is amplified by a noiseless amplifier having a gain of 60 and a bandwidth of 20Khz. Ammeter connected to the output of the amplifier reads 1mv R.M.S

i. If the bandwidth of the amplifier is reduced to 5 KHz, gain remaining constant. What is the new meter reading?
ii. If the resistor is operated at 80'C, what is the resistance value?
iii. For the same resistor, what bandwidth of amplifier with a gain of 180 is needed for a reading of 300uv? [6marks]

Under the same conditions, two resistors give readings of 3mv and 4.5 mv respectively

i. what is the ratio of the values of the two resistors
ii. if the first resistor is 15MΩ, what is the value of the second resistor [5marks]

Question two

a) Calculate the noise voltage at the input of a TV RF amp using a device that has 220 Ω equivalent noise resistance and a 300 Ω input resistance. The bandwidth of the amp is 6 MHz and the temperature is 17ºC. Repeat the question for a case where the input resistor is connected in parallel.[4 marks]
b) Given the following details for a two stage amplifier:

R1	10MΩ	A1=10dB
R2	5MΩ	A2 =13dB
R3	2MΩ	

Calculate the equivalent noise resistance of the system. Also calculate the equivalent input noise if the temperature of the system is 17ºC and B= 2MHz [5 marks]
c) In a satellite communication system, free space conditions may be assumed. The satellite is at a height of 36000 km above the earth. The frequency used is 4MHz. The transmitting antenna gain is 15dB and the Rx gain is 45dB

Calculate

i. Free space transmission loss [3 marks]
ii. The received power when the transmitted power is 200 Watts [3 marks]
d) Calculate the carrier to noise density ratio at the earth receiving station from a satellite transmitting an EIRP of 49.5dB on a frequency of 12 GHz. The earth station antenna distance is 40973 km and the receiving figure of merit(M) is 40.7 dB [5 marks]

Question Three

a) Calculate the power that must be transmitted from a geostationary satellite to give a power of 116 dB at a receiver on the earth. Assume F = 10 GHz, Gr = 40dB, Gt = 30dB and in addition losses of 5 dB. H = 35855 km[5 marks]
b) Discuss the three types of multiple access methods used in communication systems [6 marks]
c) Define a Radar system and explain its operation[3 marks]

d) Derive the radar range equation[3 marks]
e) Calculate the maximum range of a radar system which operates at 3cm with a peak pulse power of 500 kW, if the minimum receivable power is 10-13W,Ao = $5m^2$ and S = $20m^2$
Ao – capture area of antenna
S- Radar cross-section area of the target [3 marks]

Question Four

a) Low power short range radar is solid state throughout including a low noise RF amplifier which gives an overall noise figure of 4.77dB. If the antenna diameter is 1m, the IF Band 500 kHz, operating frequency 8 GHz and the radar set is supposed to be capable of detecting targets $5m^2$ cross-section areas at a maximum distance 12 km, what must be the peak transmitted pulse power? P_t = 1.1 W [5marks]
b) Describe functions of radio receivers [3 marks]
c) Briefly describe the types of antennas in satellite communication [5marks]
d) A parabolic dish antenna used to transmit a radio signal of power 3kW at a frequency of 3GHz has a diameter of 20m and an efficiency of 60%. if the signal is received by an identical antenna sited 20km away, determine the;
   (i) Effective aperture of each of antennas.
   (ii) directivity of each of the antennas
   (iii) Gain of each of the antennas
   (iv) EIRP of the transmitting antenna
   (v) HPBW of the transmitting antenna
   (vi) Power received by the receiving antenna. [7 marks]

Question Five

a) Explain four merits of digital TV [3marks]
b) Explain pulse code modulation in communication systems [3 marks]
c) Find the signal to noise ratio in a baseband system with a bandwidth of 5 kHz and noise power spectral density $\frac{N_o}{2} = 10^{-12}W/Hz$ given that a transmission power of 2 kW is used and channel attenuation is 40dB.
[4 marks]

d) Using a suitable diagram, explain the construction and operation of a superhetrodyne radio receiver.
[10 marks]