NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOMKAMPUS

Requirements for this paper:			
Multi choice cards:	☐	Programmable calculator:	☐
Graphic paper:	☐	Laptop:	☐

Open book examination	☐

EKSAMEN/ EXAMINATION:	**Semestertoets 2** **Semester test 2**	KWALIFIKASIEPROGRAM/ /QUALIFICATION PROGRAM:	**BIng / BEng**
MODULEKODE/ MODULE CODE:	**EERI 423**	DUUR/ DURATION:	**1 uur / 1 hour**
MODULE BESKRYWING/ MODULE DESCRIPTION:	**Telekommunikasie / Telecommunication**	MAKS / MAX:	**50**
EKSAMINATOR(E)/ EXAMINER(S):	**Prof J.E.W. Holm**	DATUM / DATE:	**2015-09-21**
		TYD / TIME:	**8:00**
MODERATOR:	**Mnr Christo van der Merwe**		

TOTAAL / *TOTAL*: 50

VRAAG 1 / QUESTION 1 - [20]

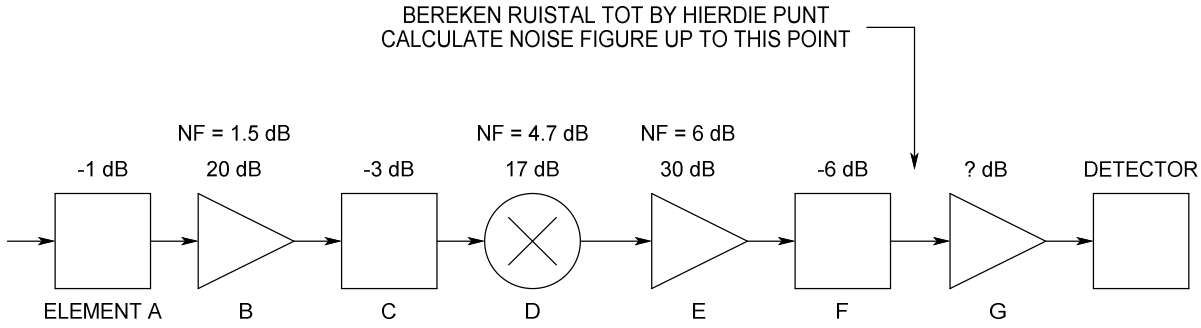
1.1) Teken die blokdiagram van 'n moderne ontvanger en benoem elke element duidelik. / *Draw the block diagram of a modern receiver and name each element clearly.* [10]

1.2) Gee twee oplossings vir die beeldfrekewensie probleem by RF ontvangers. / *Give two soutions to the image frequency problem of RF receivers.* [2]

1.3) Noem al die bronne van interne en eksterne ruis by ontvangers. / *List all the sources of internal and external noise in receivers.* [8]

VRAAG 2 / QUESTION 2 - [11]

'n Radio ontvanger het die volgende komponente met geassosieerde winste en verliese: / *A radio receiver has the following components with associated gains and losses:*



a) Bereken die saamgestelde ruistal van die ontvanger in dB. / *Calculate the combined noise figure of the receiver in dB.* [6]

b) Wat moet die wins van element G wees om 1 Vrms vir die 1 kΩ detektor te lewer indien die drywing by die inset van element A -95 dBm is? / *What must the gain of element G be to provide a voltage of 1 Vrms to the 1 kΩ detector if the input power to element A is -95 dBm?* [3]

c) Watter element lewer die grootste bydrae om ruis te beperk, en waarom? / *Which element contributes the most to limit noise, and why?* [2]

VRAAG 3 / QUESTION 3 - [10]

'n Ontvanger met 'n 50 Ω insetimpedansie werk by 'n temperatuur van 25 ºC. 'n RF sein word ontvang met 'n bandwydte van 50 kHz. Die seinvlak by die ontvanger is 1 μV_{RMS} en die ontvanger het 'n saamgestelde ruistal van 4 dB. / *A receiver with a 50 Ω input impedance works at a temperature of 25 ºC. A signal is received with a bandwidth of 50 kHz. The signal level at the receiver is 1 μV_{RMS} and the receiver has a noise figure of 4 dB.*

a) Bereken die ruisdrywing. / *Calculate the noise power.* [2]
b) Bereken die seindrywing. / *Calculate the signal power.* [2]
c) Wat is die sein-tot-ruis verhouding voor die ontvanger? / What is the signal-to-noise ratio before the receiver? [2]
d) Wat is die sein-tot-ruis verhouding by die uitset van die ontvanger? / *What is the signal-to-noise ratio at the output of the receiver?* [2]
e) Sal hierdie ontvanger digitale data kan ontvang en demoduleer sonder foute – waarom? / *Will this receiver be able to receive and demodulate digital data without error – why?* [2]

VRAAG 4 / QUESTION 4 [9]

4.1) Noem drie soorte multipleksering wat in RF omgewings toegepas word. / *List three types of multiplexing used in an RF environment.* [3]
4.2) Verduidelik FDM aan die hand van 'n diagram met 'n sender en ontvanger. / Explain FDM with reference to a diagram containing a transmitter and receiver. [6]

LYS VAN FORMULES / LIST OF FORMULAS

$$NR = NR_1 + \frac{NR_2 - 1}{A_1} + \frac{NR_3 - 1}{A_1 A_2} + \cdots + \frac{NR_n - 1}{A_1 A_2 \cdots A_{n-1}}$$

$$NR = \frac{S/N_{INPUT}}{S/N_{OUTPUT}} \qquad v_n = \sqrt{4kTBR}$$

$$P_n = kTB \qquad T_N = 290(NR - 1)$$