

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR  
OF SCIENCE (PHYSICS).

PHYS 419: COMMUNICATION ELECTRONIC II

STREAMS:

TIME: 2 HOURS

DAY/DATE: THURSDAY 7/12/2017

11.30 A.M - 1.30 P.M.

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INSTRUCTIONS:

- Answer Question ONE and any other TWO Questions.

QUESTION ONE [30 MARKS]

- (a) (i) What do you understand by sideband frequencies in an AM wave? [2 Marks]  
(ii) What are the essentials in demodulation? [3 Marks]
- (b) The r.m.s value of carrier voltage is 100V. After amplitude modulation by a sinusoidal voltage, the r.m.s value becomes 110V. Calculate the modulation index [3 Marks]
- (c) Explain why modulation is necessary in communication systems. [2 Marks]
- (d) A carrier of peak voltage 0.05 V and frequency 200 kHz is amplitude modulated by a signal of peak voltage 10 V and frequency 1 kHz. Find  
(i) Frequencies in the output spectrum. [3 Marks]  
(ii) The peak values of output components if  $m=0.5$  and voltage gain  $A=100$ . [3 Marks]
- (e) Explain the components of a transmitter. [4 Marks]
- (f) Give the difference between AM and FM receivers. [5 Marks]
- (g) A transmitter radiates a total power of 10 kW. The carrier is modulated to a depth of 60%. Calculate  
(i) The power of the carrier  
(ii) Power in each sideband. [5 Marks]

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### QUESTION TWO [30 MARKS]

- (a) A 50 kW carrier is to be modulated to a level of 85%. What is the carrier power after modulation? What is the sideband power? [7 Marks]
- (b) A 500 Hz modulating voltage produces a frequency deviation of 2.25 kHz. What is the modulation index? If the amplitude of the modulation voltage is kept constant but its frequency is raised to 6 kHz, what is the new deviation? [7 Marks]
- (c) Derive the voltage equation of an AM wave. [6 Marks]

### QUESTION THREE [30 MARKS]

- (a) A frequency modulated voltage wave is given by the equation  $e = 12 \cos(6 \times 10^8 t + 5 \sin 1250 t)$

#### Find,

- (i) Carrier frequency [2 Marks]  
(ii) Signal frequency [2 Marks]  
(iii) Modulation index [2 Marks]  
(iv) Maximum frequency deviation [2 Marks]  
(v) Power dissipated by the FM wave in 10-ohm resistor. [2 Marks]
- (b) In an FM system, when the audio frequency (AF) is 500 Hz and the AF voltage is 2.4 V, the frequency deviation is 4.8 kHz. If the AF voltage is now increased to 7.2 V, what is the new frequency deviation? If the AF voltage is raised to 10 while the AF is dropped to 200 Hz, what is the deviation? Find the modulation index in each case. [6 Marks]
- (c) Explain the essentials in demodulation. [4 Marks]

### QUESTION FOUR [30 MARKS]

- (a) (i) Explain the stages of superhetrodyne radio receiver. [5 Marks]  
(ii) State the advantages of superhetrodyne circuit. [5 Marks]
- (b) Explain how a detector performs its function as a rectifier to the modulated wave. [6 Marks]
- (c) Draw a diode detector circuit and explain its action. [4 Marks]

### QUESTION FIVE [30 MARKS]

- (a) Using a block diagram explain the various sections of an FM receiver. [10 Marks]
- (b) The lead current in the transmitting antenna of an unmodulated AM transmitter is 8A. What will be the antenna current when modulation is 40%? [6 Marks]

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- (c) A 25 MHz carrier is modulated by a 400Hz audio sine wave. If the carrier voltage is 4 V and the maximum frequency deviation is 10 kHz, write down the voltage equation of the FM wave. [4 Marks]

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