CRAWFORD UNIVERSITY

FAITH CITY, IGBESA, OGUN STATE

COLLEGE OF NATURAL AND APPLIED SCIENCES

B.Sc. EXAMINATION RAIN SEMESSTER 2021/2022 SESSION

ICT420: SIGNAL PROCESSING FUNDAMENTALS

TIME ALLOWED: 2 HOURS

INSTRUCTIONS: **ANSWER 4 QUESTIONS ONLY**

1(a) what is Signal Processing? (2mks)
Mention any 4 processes that are common in signal processing. (4 mks)

(b) Outline any four areas of human Endeavour that has benefited from advances in signal processing **and** state the **benefit** in each case. (4 mks)

(c) State any 3 advantages of digital signal processing over the analog option. (3 mks)

(d) Write a short note on the contribution of Fourier to signal processing (2 mks)

2 (a) Draw the diagram of a sinusoid signal and indicate on it a time period T and the amplitude A. Calculate the frequency of this signal when T=5mS (5 mks)
Draw a second sinusoid in the same diagram above with a phase difference of 90° (2 mks)

(b) A certain signal has a series expansion of f(t) = $20 + 30(sin12\pi t + \frac{1}{3}sin36\pi t + \frac{1}{5}sin60\pi t + \cdots)$
Assume that f(t) is in millivolts while t is in seconds. Determine the magnitude and the unit of:

i. The D.C. level of the signal (2 mks)
ii. The amplitude and the frequency of the 3 other terms listed. (6 mks).

3(a) State any 3 rules you need to follow in drawing the line spectrum. (3 mks).

(b)We wish to analyze a signal given as f(t) = 75cos(18πt) +25sin(54πt+π/6) -5cos(90πt+π/3). The time t is in Second while f(t) is in millivolts.

i. Draw a table showing the 3 terms above, the corresponding amplitude, frequency and phase. (6 mks)
ii. Draw the line diagram showing amplitude versus frequency and then phase versus frequency. (6 mks)

4(a) State any 5 differences between analog filters and digital filters. (5mks)

(b) Draw a Bode plot of an **ideal high pass filter** having a cutoff frequency of 30KHz. Indicate clearly the pass band, the stop band and the cutoff frequency (5 mks):

(c) Define the term Octave as used in signal processing. (1 mk). How many octaves are in the following frequency ranges? (4 mks) (i) 10Hz – 160Hz) (ii) 1.5KHz – 12KHz (iii) 45Hz – 180Hz (iv) 500KHz – 8MHz

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5 A certain **low** pass filter is made of a 100nF capacitor in series with 1KΩ resistor.

a. Draw a circuit diagram of this filter and indicate clearly the capacitor, resistor, input voltage and output voltage (5mks)

b. Derive the transfer function in dB for the filter for signal frequencies of (i) 100Hz (ii) 500Hz (iii) 1600Hz (iv) 3000Hz (v) 5000Hz (10 mks)

6. (a) Describe a notch filter and state one major area of its application. (3 mks)

(b) Draw a Bode plot of an **ideal band pass filter** having a lower cutoff frequency of 3KHz and an upper cutoff frequency of 12KHz. Indicate clearly the pass band, the stop band and the cutoff frequencies (7 mks):

(c) Define the cut off frequency of an analog filter. An analog low pass consists of a 100nF capacitor in series with 1KΩ resistor. Calculate the cut off frequency. State if the output will increase or decrease if the frequency of the input signal increases above the cut off level while the amplitude remains the same. (5 mks)

END

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