



CRAWFORD UNIVERSITY

FAITH CITY, IGBESA, OGUN STATE

COLLEGE OF NATURAL AND APPLIED SCIENCES

B.Sc. EXAMINATION RAIN SEMESSTER 2023/2024 SESSION

ICT317: TRANSMISSION PROPAGATION AND ANTENNA THEORY

TIME ALLOWED: 2¹/₂ HOURS

INSTRUCTIONS: ANSWER 4 QUESTIONS ONLY

- (a) i. What is a wave? ii..How is a mechanical wave produced? iii.. How is an electromagnetic wave produced? Iv.. In a tabular form, compare and contrast the two types of waves in terms of frequency, propagation media, propagation speed, maximum propagation distance and range of possible wavelengths. (8 mks)

(b) Classify the following waves as either electromagnetic or mechanical: (i) Ripples on water surface (ii) radiated heat (iii) ultrasound (iv) X-rays (v) sunlight (vi) radio waves. (3 mks)

(c). Electromagnetic waves can be classified as visible light, Ultra-High Frequency (UHF), Microwave, Medium Frequency (MF), Low Frequency (LF) and Very High Frequency (VHF). Starting with the smallest, arrange these waves in the correct order of wavelength.(4 mks)
- (a) What is a transmission line? State any 3 roles it plays in an antenna system. (4 mks)

(b) Draw the standing waves in a transmission line indicating the minimum and the maximum voltages. Label the maximum voltage as V_{MAX} and the minimum voltage as V_{MIN} . If their values are 5 Volts and 4 Volts respectively, calculate (i) VSWR (ii) Reflection Coefficient (iii) reflected power (iv) incident power (11 mks)
- Four different waves are characterised by the following wave equations:

 - $E_1 = 10 \cos (3\pi t + \pi/15)$
 - $E_2 = 2 \cos (8\pi t)$
 - $E_3 = 24 \cos (6\pi t + \pi/3)$
 - $E_4 = 40 \cos (14\pi t + 2\pi/3)$

If the field intensity, E is in millivolts mV and the time t is in microseconds μS , calculate the following parameters for all the four waves: Amplitude, Frequency, Phase in radians, and phase in degrees (15 mks).
- (a) What is antenna polarization? (1 mk)

(b) Mass Communication Department of Crawford University intends to install a radio broadcast transmitter to cover the whole campus equally in all directions. For each of the following antenna types determine if the antenna will work as required. For each antenna described below state in capital letters IT WILL WORK or IT WILL NOT WORK. Give 3 reasons in each case for your answer. (14 mks)

 - Quarter wavelength antenna vertically polarised.
 - Half-wave antenna horizontally polarised in the East – West direction
 - Half-wave antenna horizontally polarised in the North – South direction
 - Horn antenna pointing at the sky

5 (a) Using a suitable diagram, describe how a transmission can be turned into a transmission line and a half-wave antenna. (4 mks)

5(b) Define the following in relation to an antenna: (6 mk)

i (ii) Antenna Gain (iii) Radiation Pattern (iv) Directivity

5(c) Draw an equivalent circuit diagram of an antenna as a load with resistance Z_L connected to the radio transmitter electronics through a transmission line with characteristic impedance Z_0 . Calculate the VSWR and the reflection coefficient if Z_L is 53Ω and Z_0 is 47Ω (5 mks)

6 (a) (i). What is the meaning of FM in radio broadcasting? (1 mk)

(ii). Faaji FM broadcasts at 106.5. Indicate if the 106.5 is in Hz, KHz, MHz or GHz. (1 mk)

(iii). From your answer, calculate the wavelength of their radio signal and the length of a half-wave dipole antenna suitable for receiving the station. (3 mks)

(iv) Calculate the length of the antenna if a quarter-wavelength antenna is used (2 mks)

6(b) (i) what is a transverse wave? What is a longitudinal wave? Electromagnetic waves are they longitudinal or transverse? (3 mks)

6(c) for each of the statements below, write TRUE or FALSE (5 mks)

- i. In all waves, the particles of the medium travel in the same direction as the wave.
- ii. The particles of a medium travel at the same velocity as the wave.
- iii. Electromagnetic waves travel faster in vacuum than in material medium.
- iv. An antenna can produce current flow from an electromagnetic wave.
- v. If Sunami happens at the bottom of an ocean, the disturbed water at the bottom reaches the sea shore at the same time as the wave.

END