MASINDE MULIRO UNIVERSITY OF SCIENCE & TECHNOLOGY
ECE 524E – MICROWAVE ENGINEERING
ASSIGNMENT 1
To be Handed in On Monday 24th March 2025

Answer All Questions

QUESTION ONE

1. (a) With the aid of a diagram, explain the principle of operation of a reflex Klystron

(b) Give THREE reasons why modern Klystron amplifiers employ more than two cavities.

(c) State and briefly describe THREE applications of multi-cavity Klystrons.

QUESTION TWO

(a)(i) With the aid of a diagram, describe the principle of operation of a magic-T junction.

(ii) Name and discuss THREE applications of magic-T waveguide junction.

(b) An air-filled rectangular waveguide with inside dimensions a=3cm and b=2 cm operates in the dominant mode. Find the following:

(i) cutoff frequency

(ii) phase velocity of wave at a frequency of 3.5Ghz

(iii) guided wavelength at frequency 6.0 GHz.

QUESTION THREE

(a)(i) With the aid of a diagram, describe the principle of operation of a 2-hole directional coupler.

(ii) Name and discuss TWO applications of a directional coupler

(b)(i) What is a cavity resonator?

(ii) Discuss the applications of cavity resonators.

(iii) Derive the expression for resonator frequency of rectangular cavity resonator.

QUESTION 4 (10 MARKS)

Write (A,B,C,D) in the Answer Sheet

4.1. Klystron operation is based on the principle of .....

A. Velocity modulation

B. Amplitude modulation

C. Frequency modulation

D. Phase modulation

4.2. Slotted line with tuneable probe is not used to measure ....

A. VSWR

B. Wavelength

C. Power

D. Impedance

4.3. In a microwave magic-T, E plane and H plane are .....

A. in phase

B. out of phase

C. isolated

D. 90 degrees out of phase

4.4. Baretters and bolometers are used for measurement of ....

A. VSWR

B. transmission losses

C. microwave power

D. frequency

4.5. Which device can detect the presence of both forward and backward waves in a Wave guide

A. filter

B. detector

C. directional coupler

D. magic T

4.6. Which principle of operation of cavity wave meters is used in microwave networks

A. Phase shift

B. Resonance

C. Polarization shift

D. Gyration

4.7. In a magnetron oscillator the improvement of stability and efficiency is achieved by .....

A. strapping

B. cross coupling

C. bunching

D. bouncing

4.8 Which one of the following is used for amplification of microwave signals

A. gunn diode

B. magnetron

C. reflex klystron

D. double cavity klystron

4.9 If a rectangular waveguide of internal dimensions a = 4 cm and b = 3 cm is to be operated in TE_{11} mode, the minimum operating frequency is .....

A. 5 GHz

B. 6.0 GHz

C. 4 GHz

D. 3.75 GHz

4.10. What are the applications of low Q-oscillators and amplifier circuits?

A. Final output stage of FM telecommunication transmitter

B. Up converter pump

C. CW Doppler radar transmitter.