

FIJI NATIONAL UNIVERSITY

College of Engineering, Science & Technology

**SCHOOL OF ELECTRICAL & ELECTRONICS
ENGINEERING**

BACHELOR IN ELECTRONIC (Telecom & Networking) ENGINEERING

EEB761 – RADIO FREQUENCY PRINCIPLES

FINAL EXAMINATION – Semester 1, 2018

DURATION: 3 HOURS

INSTRUCTIONS TO STUDENTS

- 1 You are allowed 10 minutes reading time during which you are **NOT** to write.
- 2 **BEGIN** each **QUESTION** on a fresh page and use both sides of the sheet.
- 3 Write your candidate number at the top of each attached sheet.
- 4 Insert all written foolscaps, graph paper etc. in their correct sequence and secure with a string.
- 5 For all sheets of paper on which rough/draft work has been done, cross it through and you must attach all of them to your answer scripts.
- 6 Write clearly the number(s) of the question(s) attempted on the top of each sheet.
8. Attempt all questions

Section A:**Short answer****(10 marks)**

- 1 Explain the term "skin effect" on charge carriers in wire conductors as frequency changes from low to high?
- 2 Discuss the reason why "standing waves" occur in a transmission line?
- 3 In AM, discuss why SSB (Single sideband) is normally used in transmission other than DSB?
- 4 Comment on the quality of the received signal if the modulation index for AM is too high.
- 5 In a Rectangular waveguide, what other modes are allowed for transmission if TE_{11} is not possible?
- 6 What is the frequency range of UHF Band in the Electromagnetic spectrum and list a service that is allocated to this band?
- 7 Discuss why the divergence of the magnetic flux density is always "zero".
- 8 Draw an equivalent circuit of say 0.5 meter transmission line and label the primary constant of the line.
- 9 Explain why it is important to match the transmission line to the Load?
- 10 Discuss how a single stub is connected to a transmission line to match the load.

Section B:**[TotalMarks:90]****Answer ALL Questions****Question 1:**

List the point form of Maxwell's equations and discuss their meanings.

Total marks: 10]**Question 2:****Total marks: 15]**

Passive components like a capacitor change its characteristics when exposed at higher frequencies. Explain using equivalent circuits together with frequency responses the behaviour of a capacitor an inductor and a resistor at high frequencies.

Question 3:**[Total marks: 5]**

The Characteristic impedance of a transmission line is given by

$$Z_0 = \sqrt{\frac{R' + j\omega L'}{G' + j\omega C'}}$$

i). Determine Z_0 , given a lossless line? (2.5 marks)

ii) Determine Z_0 , given a distortion less line? (2.5 marks)

Show all working and calculations

Question 4**[Total marks: 10]**

A 3.3λ transmission line of 75 ohms Characteristic impedance has a $100 - j150$ load connected to it

- i) Use Smith Chart to determine the following line parameters?
- a) VSWR
 - b) Reflection Coefficient
 - c) Input Impedance
 - d) Input Admittance

Question 5**[Total marks: 15]**

A 50 ohms lossless line is to be matched to a normalized load of $0.4 - j0.3$ ohms with a short circuit stub.

Use Smith Chart to find the following parameters:

- a). The distance of the stub from the Load
- b). Length of the stub
- c). The load admittance
- d). VSWR

Question 6**[Total marks: 10]**

- a). Discuss the difference between amplitude modulation and frequency modulation and the reasons why signals are modulated? Use waveforms to illustrate your answer **(2.5 marks)**
- b). Explain the differences of a Modulating signal (intelligence) and the Carrier and their relationship in terms of modulation index. **(2.5 marks)**
- c). In AM, the output of the "modulator is the sum and difference of the two signals. Explain 3 reasons why DSB is not normally used in AM transmission? **(2.5 marks)**
- d). If the Carrier of an AM radio transmitter is 2KWatts and is 80% modulated, calculate the total power and the power of one side band. **(2.5 Marks)**

Question 7**[Total marks: 15]**

The greatest use of multiplexing in our everyday lives is in the use of telecommunication system where millions of calls are multiplexed on cables, long distance fiber optic and satellite to name a few;

i) Explain in your own words what multiplexing is and the advantages of multiplexing in telecommunication systems? **(3 marks)**

ii) Discuss the main differences between FDM and TDM **(4 marks)**

iii) From VF Band of 0.3 – 4 KHz, derive switch E1. **(3 marks)**

iv). A coaxial cable could accommodate several thousand 4 KHz voice channels. The fundamental basis is framing 30 time slots multiplexed to form E2 then E3 and so forth. Illustrate in a diagram how several "30 time slots "can be connected together to form an E4 carrier? **(5 marks)**

Question 8**[Total marks: 10]**

i). List down 3 main differences between a transmission line and a waveguide. **(4 marks)**

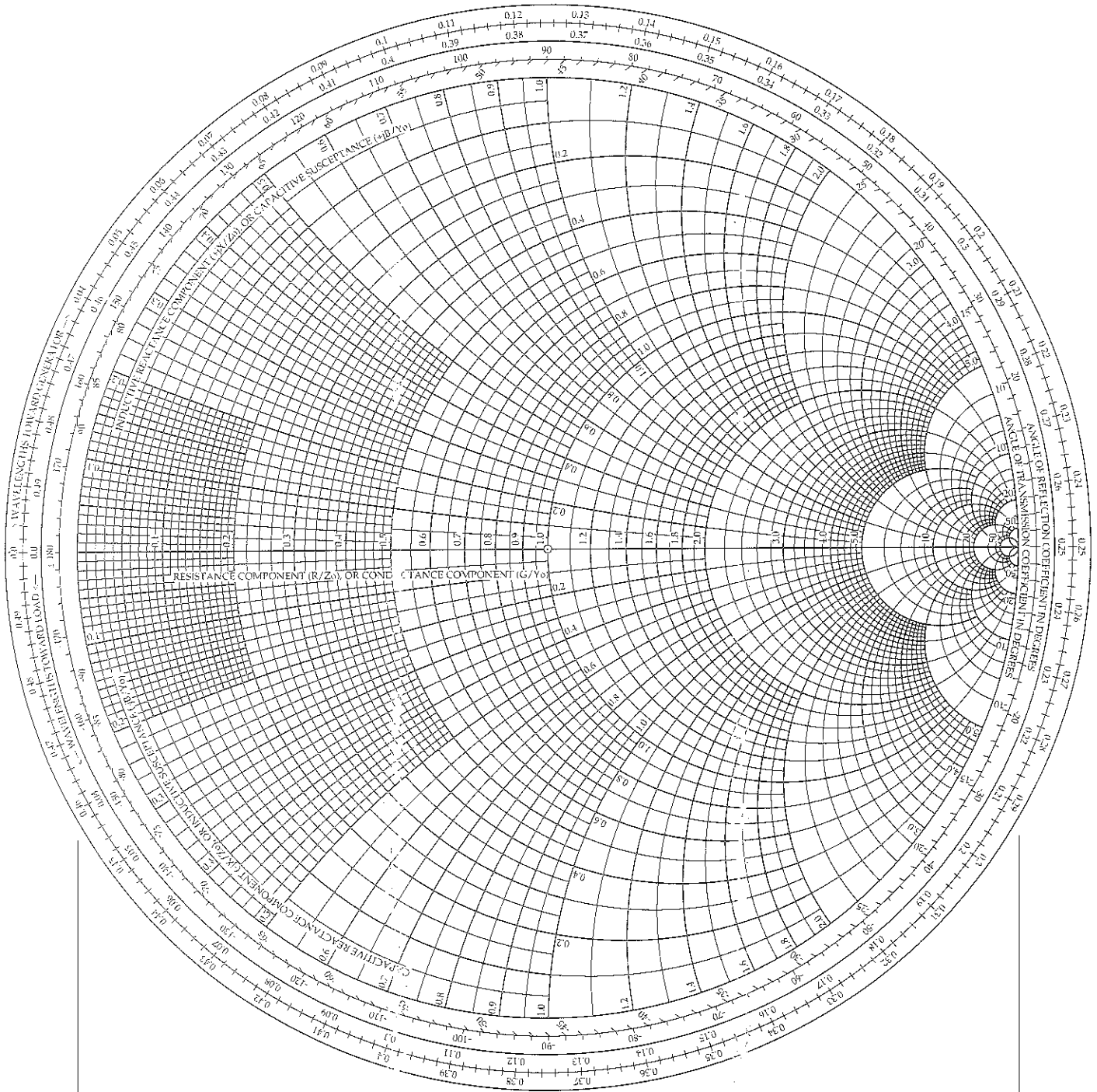
ii) What is the condition for wave propagation in a rectangular waveguide? **(2 marks)**

iii). An air-filled waveguide operates at a frequency of 10GHz. If the dimensions of the rectangular waveguide are $a = 2\text{cm}$ and $b = 1\text{cm}$, determine the mode of propagation in the waveguide? **(4 marks)**

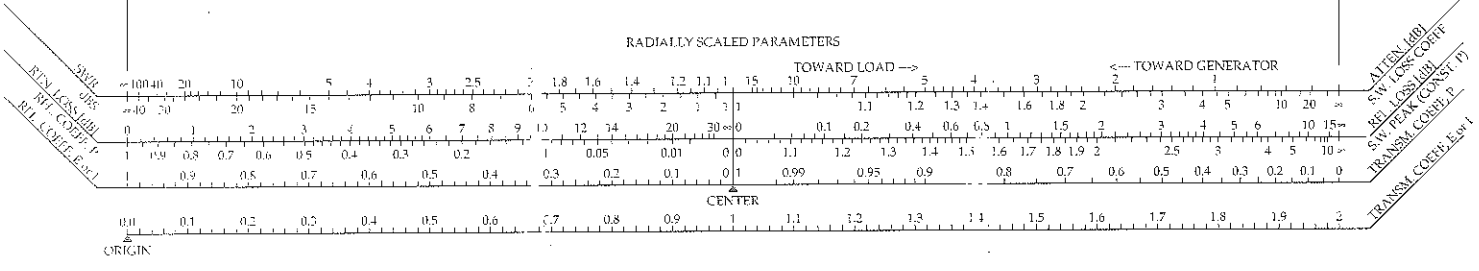
-----The End-----

The Complete Smith Chart

Black Magic Design



RADIALLY SCALED PARAMETERS



ORIGIN

CENTER

TOWARD LOAD →

← TOWARD GENERATOR

ATTEN 100
 SW LOSS COEFF
 REF LOSS COEFF
 SW PEAK CONST P
 TRANSM COEFF P
 TRANSM COEFF E-1

The Complete Smith Chart

Black Magic Design

