FIJI NATIONAL UNIVERSITY
College of Engineering, Science & Technology

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

BACHELOR OF ENGINEERING
(Telecom & Networking)

EEE794 – MOBILE AND PERSONAL COMMUNICATION SYSTEMS
(Supplementary Examination)
SEMESTER 1, 2016

DAY/DATE: As timetabled DURATION : Three hours
ROOM: As timetabled

INSTRUCTION TO STUDENTS

1. You are allowed 10 minutes extra reading time during which you are **NOT** to write.
2. Answer **ALL** questions in Section A and in Section B
3. **Begin the answer to each Question** on a fresh page and use both sides of the sheet.
4. Write clearly the number of the question attempted on the top of each sheet
5. Write your candidate number at the top of each sheet & attach them.
6. Insert all written foolscaps, graph paper etc. in their correct sequence and secure with a string.
7. All sheets of paper on which rough/draft work has been done, cross it through and attach all of them to your answer scripts.
8. Where ever possible, draw clear neat diagrams

Total number of pages - 5

SECTION A

Answer ALL Questions

A1. *a*) Define "*Uplink*" and "*Downlink*" as applied to communication by cellular phones (mobile phones)

b) Give the reason why uplink frequency f_U and downlink frequency f_D are different

c) State, giving the reason, which of these frequencies is greater

(5 marks)

A2. What is a MTSO in a mobile communication network and explain its functions.

(3 marks)

A3. Draw a block diagram of a mobile communication network. Indicate and name the different RF links associated with the network.

(5 marks)

A4. *a*) The *shift parameters* in a cellular system are 1and 2. If the radius of a cell is 2,5 km, calculate the maximum area that would be covered by an allocated frequency bandwidth.

b) Draw the cluster of cells using the allotted frequency band bandwidth.

(7 marks)

A5. Mobile radio systems can be classified as *simplex*, *half-duplex*, and *full-duplex*. Explain how these systems work. State an example for each of these systems

(5 marks)

A6. As a service engineer, you have been provided with a channel scanning mobile receiver. In an effort to analyze the signal quality and co-channel interference, explain what measurements you will take

(5 marks)

A7. Briefly explain what the concepts *Vertical handoff*, *Horizontal handoff*, *Hard handoff* refer to in mobile technology.

(5 marks)

A8. Briefly discuss <u>two</u> features of CDMA.

(5 marks)

Section B
Answer ALL Questions

B1. *a*) Explain the core concept of mobile communication

(3 marks)

b) List few technical issues for proper design and planning of a cellular network.

(3 marks)

c) A mobile service provider using FDD system is allocated 33MHz bandwidth. The bandwidth of the control channels is 1 MHz. The system uses two 25 kHz simplex channels to provide full duplex voice and control channels. It is desired that an equitable distribution of channels in the cells. Compute the number of channels available per cell if the system follows a cell structure determined by shift parameters:

i) $i = 2; j = 0$

ii) $i = 1; j = 2$

iii) In the sheet provided on page 5, draw the *cell cluster* that would be served by choosing the parameters in *ii*) above.

iv) Explain why the service provider **did not** choose a cluster of 5 cells for providing the service

(14 marks)

B2..*a*) Explain why free space propagation model cannot be directly used in evaluating power received by a mobile phone.

(4 marks)

b) Obtain the Friis transmission equation $\frac{P_r}{P_t} = G_t G_r \left[\frac{\lambda}{4\pi R}\right]^2$ in free space. All the symbols have their usual meanings

(5 marks)

c) In a communication link, the transmitter has a power output of 150 W. The transmitter and the receiver have parabolic antennas of diameter 2 m. The carrier frequency is 900 MHz. The gain of a parabolic antenna is given by $G = (4\pi A_e)/\lambda^2$, where A_e is the effective aperture. Note that for a parabolic antenna, the effective antenna area is roughly the geometric area of the surface. The transmitter is connected by a 20 m cable which has a loss of 3 dB/100 m specification. The receiver is situated 2 km away from the transmitter.

Assuming free space transmission between the two antennas

i) Calculate the power available at the receiver antenna

ii) If the receiver requires a minimum power of −110 dBm, find the required minimum transmitter power.

(11 marks)

B3. *a*) Explain briefly how Time Division Multiple Access operate

(3 marks)

b) Sketch a TDMA frame. Indicate and explain the essential components of a typical TDMA frame,

(4 marks)

c) What do the terms "*overheads*" and "*frame efficiency*" refer to in TDMA implementation.

(3 marks)

d) In the INTELSAT frame structure, the TDMA frame time is 2 ms. The system uses two reference stations, each using 576 reference bits. The traffic burst preamble has 560 bits and the number of bits in the guard bands is 128. If the bit rate is 120 Mbps, calculate the number of traffic terminal that can be supported to have an efficiency of 95%

(10 marks)

THE END