

UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAM 2005/2006

TITLE OF PAPER: TELECOMMUNICATIONS SYSTEMS
OPTICAL FIBRE AND MICROWAVE TRANSMISSION

COURSE NUMBER: ECO530

TIME ALLOWED: TWO HOURS

INSTRUCTIONS:

- 1) Answer any four questions out of six
 - 2) Each question carries 25 marks
 - 3) Marks for different sections are shown on the right hand margin.
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This paper has 7 pages including this page

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HAS BEEN GIVEN BY THE INVIGILATOR***

QUESTION 1

- a. Give the basic elements of a telecommunications network and their functions.
(6 marks)
- b. With the aid of a diagram, given that a call is placed between two towns, name and define the ten stages of a telephone call and where they take place.
(9 marks)
- c. Name three network topologies and explain the advantages of each.
(6 marks)
- d. Name and define three types of synchronization and discuss why synchronization is critical in a digital network.
(4 marks)

QUESTION 2

- a) Define PCM and using drawings, name and define the stages of PCM signal development

(15 marks)

- b) Given a 15 kHz analogue signal:

- a. What would be the sampling rate used in order to convert it into a PCM signal and why?

(2 marks)

- b. What would be the expected frame period, multiframe period and the transmission rate?

(6 marks)

- c. Explain how synchronization and signalling takes place in a PCM frame.

(2 marks)

QUESTION 3

- a) Give the basic diagram of and describe:
- a. the main functions of a digital concentrator of a switching system.
(5 marks)
 - b. In addition to the main functions of a concentrator, what are the three main additional functions and features required in a remote concentrator?
(5 marks)
- b) Briefly describe the structure of the stored program control(SPC)software and give the main requirements of the application software of switching systems.
(5 marks)
- c) Explain the following terms:
- i. Offered Traffic
(1 Mark)
 - ii. Carried traffic
(1 mark)
 - iii. Holding time
(1 mark)
 - iv. Busy hour
(1 mark)
 - v. Grade of service
(1 mark)
- d) A 60 extensions PABX is connected to the local exchange with 4 lines for out going traffic. Assuming 70% of the PABX traffic is local and each line generates 0.3 Erlangs, what is the probability of outgoing calls finding lines busy.
(5 marks)

QUESTION 4

- a. Give the standard definition of integrated services digital network (ISDN) and outline the main differences between ISDN and integrated digital network (IDN).
(5 marks)
- b. Give two main reasons why channel associated signalling not compatible with ISDN.
(2 marks)
- c. Give the structure of CCITT No. 7 signalling compatible with ISDN and explain the function at each level.
(3 marks)
- d. What is the main difference between basic rate ISDN (BRI) and primary rate ISDN (PRI)? Show how the bit rate of 192Kb/s is arrived at for a basic rate access ISDN by outlining what each component is used for.
(5 marks)
- e. With the aid of a diagram, describe the ISDN reference model as prescribed in ITU-T Recommendations I.411 and I.430 by providing the configuration of ISDN user-network.
(10 marks)

QUESTION 5

- a. If a transmitter has an output of 2 watts, a feeder loss of 3 dB and a 6-metre dish operating at 2 GHz, what will be the EIRP? (7 marks)
- b. A 20-km hop operating at 18GHz is to be implemented using a microwave system. Assuming transmitter power of 1 watt and total feeder loss of 6dB, the required minimum received signal level is -70dBW with a fade margin of 10dB. What will be the total antenna gain for the link? (8 marks)
- c. A 40-km link is installed with a total antenna gain of 60 dBi, operating at 7 GHz, with a transmitter of 1 watt and total feeder loss of 6 dB.
- i) What will be the incident received level? (8 marks)
- ii) What is the received signal level (RSL)? (2 marks)

QUESTION 6

- a. Explain the basic difference between the ITU specified cell phone network and GSM network. (5 marks)
- b. What is a cell phone? Explain step by step. (5 marks)
- c. When a cellular user crosses the boundary from one cell to another, the call is terminated. Explain why? (5 marks)
- d. The base station operating at 900 MHz, situated at 500 metre above sea level, transmits 10 watts with a 30 dB gain antenna and 3dB feeder loss. The average land usage is 40 % and the average ground height of the mobile is 200 metres above sea level. What will be the received signal level operating 1 km away from the base station, assuming 0 dB gain and 0 dB feeder loss? (10 marks)