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MOI UNIVERSITY

OFFICE OF THE CHIEF ACADEMIC OFFICER

UNIVERSITY EXAMINATIONS
2011/2012 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF
BACHELOR OF ENGINEERING
IN
ELECTRICAL & COMPUTER ENGINEERING

COURSE CODE: ECE 322

COURSE TITLE: INTRODUCTION TO TELECOMMUNICATION ENGINEERING

DATE: 25TH MAY, 2012 **TIME:** 9.00 A.M. – 12.00 NOON.

INSTRUCTION TO CANDIDATES

- THIS PAPER CONTAINS SEVEN (7) QUESTIONS.
- ATTEMPT ANY FIVE QUESTIONS FROM THIS PAPER.

THIS PAPER CONSISTS OF (4) PRINTED PAGES

PLEASE TURN OVER

ECE 322 :INTRODUCTION TO TELECOMMUNICATION ENGINEERING
(Second Semester, 2011/2012 Academic Year)

ATTEMT ANY FIVE QUESTIONS (All Questions Carry Equal Marks):

Question One

a) The term 'Telecommunication' emanates from two key words "Tele" and "Communication". Define the term based on these two key words. *(3 marks)*

b) Describe four major media used in telecommunication system and state which one is most preferred and why. *(5 marks)*

c) Outline the transmission impairments in Telecommunication systems. *(4 marks)*

d) Differentiate between full duplex and half duplex transmission. *(2 marks)*

Question Two

a) Define the term 'Signal' and differentiate between the following signals
   i. Discrete and digital signals,
   ii. Periodic and aperiodic signals,
   iii. Stationary and wide sense stationary signals. *(7 marks)*

b) Explain the following components of a sine wave using well labelled diagrams:
   i. Amplitude. *(2 marks)*
   ii. Frequency. *(2 marks)*
   ~~iii. Phase.~~ ~~*(2 marks)*~~

c) A signal has a bandwidth of 20Hz. The highest frequency is 60Hz. What is the lowest frequency? *(1 marks)*

Question Three

a) What is modulation? State the importance of this process in regards to telecommunication systems. *(3 marks)*

b) Differentiate between Analogue and Digital modulation schemes. Explain why digital modulation is becoming more popular compared to their analogue counterparts. *(5 marks)*

c) A telecommunication channel requires a bandwidth of 1MHz. The SNR for the channel is 63. What are the approximate bit rate and signal levels? *(6 marks)*

Question Four

a) Differentiate between:
   i. Suppressed and reduced sideband AM *(3 marks)*,
   ii. Modulation Index for AM and FM *(2 marks)*,
   iii. Audio and Minimum FSK *(3 marks)*,
   iv. Baud rate and bit rate *(2 marks)*.

b) Compare FSK Compare FSK and ASK in terms of noise susceptibility and bandwidth requirement. *(4 marks)*

Question five

a) State the metrics of Digital Modulation. *(3 marks)*
b) Explain why in a microwave link, several QAM-constellations are used (Hint: Microwave system uses 64-QAM, 128-QAM, and 256-QAM). *(3 marks)*

c) Given that the probability of bit error rate (BER) for Quadrature Phase-Shift Keying (QPSK) is:

$$P_b = Q\left(\sqrt{\frac{2E_b}{N_0}}\right)$$

where $Q(x) = \frac{1}{\sqrt{2\pi}} \int_x^{\infty} e^{-t^2/2}\, dt$, $x \geq 0$ = Gaussian Error Function,

E_b = Energy per bit,

$\frac{N_0}{2}$ = Noise power spectral density.

Show that the symbol error rate is given by:

$$P_s = 2Q\left(\sqrt{\frac{E_s}{N_0}}\right) - Q^2\left(\sqrt{\frac{E_s}{N_0}}\right)$$

where E_b = Energy per bit. *(5 marks)*

d) Define Pulse Code Modulation Schemes and give two examples. *(3 marks)*

Question Six

a) What is Multiplexing? In which layer of the OSI model does multiplexing take place? *(3 marks)*

b) What are channel access methods? Channel access scheme is based on the MAC-layer. In which layer of the OSI model and TCP/IP model is the MAC-layer a sublayer? *(4 marks)*

c) Explain why most of the existing telecommunication systems employ hybrid type of channel access methods. Give also an example of a hybrid system and state the channel access methods used. *(5marks)*

d) Time Division Multiplexing leads to two telecommunication hierarchy systems. Name them. *(2 marks)*

Question Seven

a) Explain the evolution of mobile telephony from the NMT to UMTS. *(4 marks)*

b) In wireless data communication, the most popular standard is the IEEE 802.11. List the members of the IEEE 802.11 family. *(4 marks)*

c) Differentiate between:
   i. GSM and GPRS
   ii. WiFi and WiMAX
   iii. Circuit switching and Packet switching *(6 marks)*

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DEPARTMENT OF ELECTRICAL & COMMUNICATION ENGINEERING

ECE 322 :INTRO. TO TELECOMMUNICATION ENG. CAT I TIME: 1 HOUR

Thursday, 26th April 2012 11.00am to 12.00noon

Instruction: Answer all questions

1.

a) Define term 'Telecommunication' and give examples of telecommunication systems. *(3 marks)*

b) Explain the significances of Telecommunication Systems. *(4 marks)*

c) Outline the transmission impairments in Telecommunication systems *(4 marks)*

d) Define the term 'Signal' and differentiate between the following signals
   i. Discrete and digital signals,
   ii. Periodic and aperiodic signals,
   iii. Stationary and wide sense stationary signals. *(7 marks)*

2.

a) What is modulation? Explain briefly the three elements of a sine wave that makes it suitable as a carrier wave. *(4 marks)*

b) Differentiate between:
   i. Suppressed and reduced sideband AM *(4 marks)*,
   ii. Modulation Index for AM and FM *(2 marks)*,
   iii. Audio and Minimum FSK *(4 marks)*,
   iv. Symbol error rate, P_s, for BPSK and QPSK *(4 marks)*.

c) Compare FSK and ASK in terms of noise susceptibility and bandwidth requirements. *(4 marks)*

d) A telecommunication channel requires a bandwidth of 1MHz. The SNR for the channel is 63. What are the approximate bit rate and signal levels? *(6 marks)*

3.

a) What is Multiplexing and how is it important in telecommunication systems? Which layer of the OSI model provides the multiplexing process? *(3 marks)*

b) The key principle of CDM is spread spectrum. Outline the spread spectrum features. *(3 marks)*