TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING

ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

UNIVERSITY EXAMINATION FOR:

DIPLOMA TELECOMMUNICATIONS

ETI 2309 : MOBILE COMMUNICATIONS .

END OF SEMESTER EXAMINATION

SERIES: DEC 2016

TIME:2 HRS

DATE:

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of FIVE questions. Attempt ANY THREE questions
Do not write on the question paper.

Question ONE

(a)   An urban area has a population of two million residents. Three competing trunked mobile networks (system A, B and C) provide cellular service in this area. System A has 394 cells with 19 channels each, system B has 98 cells with 57 channels each and system C has 49 cells, each with 100 channels. Find the number of users that can be supported at 2% blocking if each user averages two calls per hour at an arrange call duration of three minutes. Assuming that all three trunked systems are operated at maximum capacity, compute the percentage market penetration of each cellular provide. **(12 marks)**

(b)   A hexagonal cell within a four-cell system has a radius of 1.387km. A total of 60 channels are used within the entire system. If the load per user is 0.029 E_r langs, and $\lambda = 1\,Call/hour$, compute the following for a E_r lang C system that has a 5% probability of a delayed call.

   (i)   User per kilometer

   (ii)   Probability that a delayed call will have to wait for more than 10 seconds

   (iii)   Probability that a call will be delayed for more than 10 seconds

                                                                              (8 marks)

Question TWO

(a) (i) With the aid of a diagram describe the operation of a GMSK orthogonal coherent detector.

   (ii) (I) Determine I the 3-dB bandwidth for a Gausian low pass filter used to produce 0.25 Gmsk with a channel data rate of $R_b = 270$ Kbps.

      (II) The 90% power bandwidth in the RF channel.

(b) (i) Derive the expression for M-ary PSK signal.

   (ii) Derive the expression for power spectral density.

(10 marks)

Question THREE

With the aid of diagrams describe the operation of:

(a) Frequency hopped spread spectrum system
(b) Direct sequence spread spectrum

(20 marks)

Question FOUR

(a) Describe the following terms as used in mobile Gsm communications:

   (i) Base station

   (ii) Control channel

   (iii) Forward channel

   (iv) Reverse channel

   (v) Hand off

   (vi) Koaner

   (vii) Transceiver

   (viii) Mobile switch centre

(6 marks)

(b) Compare cdma one 15 – 95 and GSM, DSC 19—mobile communications systems.

(14 marks)

Question FIVE

(a)   Derive the expression for digital $A\omega$ signal and plot frequency spectrum for message signal   and corresponding $A\omega$ signal.   **(12 marks)**

(b)   A zero mean sinusoidal message is applied to a transmitter that radiates an $A\omega$ signal with   10kw powder:

    (i)   Compute the carrier power if the modulation index is 0.6.

    (ii)   Calculate: (I)   the percentage of the total power in the carrier.

                (II)   the power is each side band.

                                           (4 marks)

(c)   Using appropriate block diagram show how SSB is generated using:

    (i)   a sideband filter

    (ii)   a balanced modulator

                                           (4 marks)