Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
July/August, 2017

AUG 22 2017

Level : B.E.
Year : IV
Course : ETEG 432
Semester : II
Exam Roll No. :
Time : 30 mins.
F. M. : 20
Registration No. :
Date :

SECTION "A"
[20 Q. × 1=20 marks]

Encircle the most suitable answer to the following questions:

1) GSM uses binary βT= ___GMSK modulation.
a) 0.5 b) 0.3 c) 0.1 d) 0.8

2) The _____ is a database which contains information about identity of mobile equipment which prevents call from stolen or fraudulently altered phones.
a) HLR b) AuC c) EIR d) MSC

3) _____ is the linking point between cell phone and regular telephone.
a) Base Station b) Control Office c) Central Office d) MTSO

4) The typical output of a cellular phone is _____ W.
a) 5 b) 10 c) 1 d) 3

5) When a single cell is divided into smaller cells the process is called _____.
a) Cell Splitting b) Cell division c) Reuse d) Cell sharing

6) A cellular phone operates on _____.
a) half duplex b) full duplex c) simplex d) echoplex

7) Which algorithm is used for Ciphering key generation to produce 64-bit ciphering key (Kc)?
a) A3 b) A5 c) A8 d) both a and b

8) During Mobile Initialization which particular channel is used to synchronize with carrier frequency and phase?
a) BCCH b) SCH c) TCH d) FCCH

9) _____ MHz is the frequency separation between reverse and forward link.
a) 30 b) 45 c) 55 d) 40

10) A reverse link channel used by a subscriber unit to acknowledge a page from the PCH is _____.
a) AGCH b) RACH c) CCCH d) BCCH

11) What is an Erlang?
a) It is a unit of magnetic field intensity measured around a conductor.
b) It is the number of erroneous bits received per unit of time.
c) It is a unit of electrical energy radiated in space.
d) It is equal to the number of simultaneous calls originated during a specific hourly period.

12) The basic service unit of cellular telephony is called a _____.
a) location area
b) cell
c) PLMN service area
d) MSC/VLR service area

13) The PLMN service area is an area served by _____ network.
a) one
b) four
c) ten
d) various

14) Among the given values of Cluster Size, N, for any cellular system, the invalid value of N is
a) 12
b) 13
c) 14
d) 16

15) When one channel picks up the signal carried by another channel is called _____.
a) Adjacent Channel Interference
b) Co- channel interference
c) Echo
d) Cross link

16) IS-95 is based on _____.
a) FDMA
b) CDMA
c) DSSS
d) TDMA

17) In IS-95 the frequency reuse factor is normally _____.
a) 5
b) 1
c) 7
d) 3

18) Fading of the received radio signals in a mobile communication environment occurs because of _____ propagation.
a) Direct
b) Multipath
c) Bi Path
d) Single

19) The basic GSM is based on _____ traffic channels.
a) connection oriented
b) connection less
c) packet switching
d) circuit switching

20) _____ System are typically characterized by very small cells, especially in densely populated areas.
a) 2G
b) 3G
c) 2.5G
d) 3.5 G

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SECTION "B"
[5Q × 11 = 55 marks]

Attempt *ANY FIVE* questions. Assume any suitable data if necessary. Figures in margin indicate full marks for each questions.

1. a) Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $Q = \sqrt{3N}$, where $N = i^2 + ij + j^2$ [4]
   b) If 20 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25 KHz RF bandwidth, find [3]
      i. The number of duplex channels.
      ii. The total number of channels per cell site, if N = 4 cell reuse is used.
   c) What are the parameters to be taken into consideration by a designer to make a proper handoff in a wireless system? Elaborate your answer with critical reasoning. [4]

2. a) Prove that in the two-ray ground reflected model, $\Delta = d'' - d' \approx \frac{2h_t h_r}{d}$ [5]
   b) For given $\lambda = 1/3\,\text{m}$, $d_1 = 1km$, $d_2 = 1\text{km}$, identify the Fresnel zone within which the tip of the obstruction lies for h = 25 m. [3]
   c) Explain why wireless system is preferable over wired system. [3]

3. a) What are the factors influencing a small scale fading? [3]
   b) Derive an expression for Doppler shift? Compute the received carrier frequency if the mobile is moving directly toward the transmitter at an sped of 30 m/s, assuming the transmitter which radiates a sinusoidal carrier frequency of 1800 MHz [5]
   c) How can an ISI be mitigated? [3]

4. a) Calculate the capacity of a 3-sectored CDMA system with voice activity detection (VAD) implemented in the transmitter. [4]
   b) If GSM uses a frame structure where each frame consists of eight time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find (i) the time duration of a bit, (ii) the time duration of a sot, (iii) the time duration of a frame, and (iv) how long must a user occupying a single time slot wait between two successive transmissions. [4]
   c) Define diversity? Explain the operation of maximal ratio selection diversity. [3]

5. a) Explain the detailed operation in a GSM system when a MS is powered on. [5]
   b) Draw a flow diagram of authentication process in a GSM system. [4]
   c) Differential between 3G and 4G system. [2]

6. a) Consider a mobile system with carrier frequency 900 MHz and a base station installed in an urban area which has to maintain a signal to noise ratio of 12 dB for a proper voice communication. Design a downlink budget link for a base station transmitter power = 43 dBm, height of a base station = 120 m, height of mobile station = 2m, cable loss = 5 dB, Gt = 10 dBi, miscellaneous losses = 3 dB. Given

$$L_p(urban)(dB) = 69.55 + 26.16\log f_c - 13.82\log h_t - a +$$

$$(44.9 - 6.55\log h_t)\log d$$

$$a = (1.1\log f_c - 0.7)h_r - (1.56\log f_c - 0.8)(dB)$$

[5]

b) Write Short notes on (*ANY TWO*) [6]

i. MIMO

ii. OFDM

iii. SDMA