3E9501

Roll No. :_____

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M. Tech. (Sem. III) (Main/Back) Examination, February - 2012
Digital Communication
3MDC1 - Mobile Communication

Time : 3 Hours]

[Total Marks : 100
[Min. Passing Marks : 33

Attempt any five questions. Marks of questions are indicated against each question. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitably if any and specify the same.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. Nil 2. Nil

1 (a) Describe the methods to increase capacity of mobile network.
(b) Write the basic difference between the control channels and traffic channels.
(c) Define the handoff probability, cell blocking probability, interruption duration and handoff delay.

8+4+8=20

2 (a) Draw the flow chart for closed loop power control.
(b) Write down the expressions to calculate the traffic for the cases :
(i) Infinite sources lost call cleared
(ii) Infinite sources, lost call delayed
(iii) Finite sources, lost calls cleared
(iv) Finite sources lost call delayed
(c) What is the load that can be offered to a switch of capacity 1500 with a mean holding time of 1000 s if the fraction of delayed calls waiting longer than 1 minute is not to exceed 10%?

4+8+8=20

3 (a) Define the terms :
(i) Frequency spread
(ii) Doppler spread — 203 Rappaport
(iii) Time selective fading
(iv) Coherence time — 203 Rappaport

(b) What are the physical cause and concept for time delay spread.
(c) What are the basic mathematical models of delay profiles. 507 of Rappaport

8+6+6=20

4 (a) If there are 380 seizures (lines connected for services) and 10 blocked calls (lost calls) during the busy hour, what is the blocking probability.
(b) In a wireless network each subscriber generates two calls per hour on the average and a typical call holding time is 120 seconds. What is the traffic intensity ?
(c) The maximum calls per hour in a mobile cell equals 4000 and the average call holding time is 160 seconds. If the blocking probability is 2% find the offered load A. How many service channels are required to handle the load ?

6+6+8=20

5 (a) Consider a base station transmitting to a mobile station in free-span. The following parameters relates to this communication system :
- Distance between base station and mobile station : 8000 m
- Transmitter frequency : 1.5 GHz
- Base station transmitting power P_t = 10 W
- Total system losses : 8 dB
- Mobile receiver noise figure N_f = 5 dB
- Mobile receiver antenna temperature = 290 K
- mobile receiver bandwidth B_w = 1.25 MHz.
- Antenna gains are 8 dB and 0 dB for the base station and mobile station, respectively.
- Antenna height at the base station and mobile station are 30 m and 3m respectively.

Calculate the received signal power at the mobile receiver antenna and signal to noise ratio of the received signal.

(b) Consider a flat Rayleigh fading channel to determine the number of fades per second for p=1 and average fade duration, when the maximum Doppler frequency is 20 Hz. What is the maximum velocity of the mobile if the carrier frequency is 900 MHz.

12+8=20

(a) In the GSM 800 digital channelized cellular system, the one-way bandwidth of the system is 12.5 MHz. The RF channel spacing is 200 KHz.

Eight users share each RF channel and three channels per cell are used for control channels. Calculate the spectral efficiency of modulation (for a dense metropolitan area with small cells) using the following parameters.

- Area of a cell = 8 km^2
- Total coverage area = 4000 km^2
- Average number of calls per user during the busy hour = 1.2
- Average holding time of a call = 100 seconds
- Call blocking probability = 2%
- Frequency reuse factor = 4

(b) A hopping bandwidth, B_{ss} of 600 MHz and a frequency step size, Δf, of 400 Hz are used. What is the minimum number of PN chips that are required for each frequency word ?

12+8=20

(a) What are three channel types that are used in the UMTS ? Discuss the role of each channel type.

(b) What is the hopping rate of Bluetooth, and how many bits are transmitted in one slot ? If each frame of the HV3 voice packet in Bluetooth carries 80 bits of sample speech, what is the efficiency of the packet transmission ? How often do HV3 packets have to be sent to support 64 kbps voice in each direction ?

8+12=20