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06EC81

# Eighth Semester B.E. Degree Examination, May/June 2010
# Wireless Communication

Time: 3 hrs. Max. Marks:100

**Note:** ***Answer any FIVE full questions, selecting at least TWO questions from each part.***



## PART – A

1 a. Briefly explain the different generations of cellular systems. **(10 Marks)**

b. Explain the AMPS (advanced mobile phone system) network operations, for a mobile originated call. **(10 Marks)**

2 a. What is the function of the visitor location register? **(04 Marks)**

b. Explain the purpose of global title and global title translation for a cellular system. **(06 Marks)**

c. What are the functions of the mobile switching centre (MSC)? With a neat block diagram, explain the components of the MSC. **(10 Marks)**

3 a. Explain the differences between cell splitting and cell sectoring. **(06 Marks)**

b. Explain the concept of mobility management. With a figure, explain the three basic functions performed by the location management. **(10 Marks)**

c. Write a note on network security. **(04 Marks)**

4 a. Explain with a neat schematic, the GSM network interfaces and protocols. **(10 Marks)**

b. Briefly explain the GSM channel concept. **(10 Marks)**

## PART – B

5 a. Define MSRN. What is the purpose of mobile station roaming number? Also explain the GSM call setup using the MSRN. **(10 Marks)**

b. Explain the TDMA concept. How it is implemented in GSM? **(10 Marks)**

6 a. Explain with a neat diagram, the network nodes found in a CDMA 2000 wireless system. **(10 Marks)**

b. Explain with a neat block diagram, the generation of the CDMA paging channel signal. **(10 Marks)**

7 a. Define OFDM. Briefly explain this OFDM technique. **(06 Marks)**

b. Explain the basic operation and characteristics of spread spectrum modulation systems. **(10 Marks)**

c. Define ultra – wide band radio technology. **(04 Marks)**

8 a. Explain the details of Bluetooth protocol stack, with a figure. **(10 Marks)**

b. Describe the basic wireless MAN. **(04 Marks)**

c. Describe the basic difference between a wireless LAN and a wireless PAN. **(06 Marks)**

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2002 SCHEME

EC754

# Seventh Semester B.E. Degree Examination, Dec.08/Jan.09
## Wireless Communication

Time: 3 hrs. Max. Marks:100



**Note: 1.** ***Answer any FIVE full questions.***
**2.** ***Missing data be suitably assumed.***
**3.** ***Standard notations are used.***

1 a. Explain the growth of mobile radio systems around the world with 3 examples beginning with AMPS. Specify the future trends in cellular and personal communications. **(10 Marks)**

b. Using tabular column approach, explain how mobile to mobile call is established. **(10 Marks)**

2 a. Elaborate the following terms with related equations and diagrams:
i) Frequency reuse ii) Hand-off at a cell-boundary iii) Cell splitting **(12 Marks)**

b. A hexagonal cell with 4-cell system has a radius of 1.4 kms. A total of 80 channels are used in the entire system. If the load per user is 0.03 Erlangs and $\lambda$ = 1 call/Hr, compute the following for an Erlang 'C' system that has 5% probability of a delayed call for a traffic intensity of 10 Erlangs:
i) How many users per square km will this system support?
ii) What is the probability that a delayed call will have to wait for more than 12 secs?
iii) What is the probability that a call will be delayed for more than 12 secs? **(08 Marks)**

3 a. Explain the following with related equations: i) Elliptical polarized wave interms of depolarized field components and transformation matrix. ii) Frasnel zones iii) Scattering. **(10 Marks)**

b. Starting from the basic principles of 'Reflection', for 'Two-ray ground bounce model' prove that the received power at a distance d from the transmitter is given by, $P_r = P_t G_t G_r \frac{h_t^2 h_r^2}{d^4}$ **(10 Marks)**

4 a. What are the factors that influence small scale fading? Explain. **(08 Marks)**

b. Assume a discrete channel impulse response is used to model urban R.F. radio channels with excess delays of 100 µs and with micro-cellular excess delays of 5 µs. If the number of multi-path bins is fixed at 64, find: i) $\Delta\tau$ ii) Maximum RF BW. Which the 2 models can accurately represent. **(04 Marks)**

c. What is meant by spread spectrum sliding correlator channel sounding? Explain along with related diagrams. **(08 Marks)**

5 a. What is ISI in digital communication? How is it removed by using a 'Raised cosine filter'? Specify the transfer function of the filter and draw the impulse response. **(10 Marks)**

b. With related block diagram, explain BPSK receiver with carrier recovery circuit. **(06 Marks)**

c. What is meant by offset BPSK? Explain with time-offset waveforms of an OBPSK modulator. **(04 Marks)**

6 a. What is meant by the following: i) Vector quantisation? ii) Sub-band coding? iii) Adaptive transform coding? Explain with related equations/parameters. **(10 Marks)**

b. What is the necessity of choosing speech coding for mobile communication? Draw and explain a RELP encoder. **(10 Marks)**

7 a. What is concept of USDC codec? With related block diagram, explain a USDC speech encoder. **(08 Marks)**

b. What are the features of TDMA? Enumerate with a TDMA frame structure. **(07 Marks)**

c. If a GSM time slot consists of 6 trailing bits, 8.25 Gaurd bits, 28 training bits and 2 traffic bursts of 58 bits of data, find the frame efficiency. **(05 Marks)**

8 Write short notes on:
a. Repeaters for range extension.
b. Wideband PCS microcell model.
c. Packet radio using ALOHA protocol.
d. Microcell concept. **(20 Marks)**

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**2002 SCHEME** EC754

# Seventh Semester B.E. Degree Examination, June-July 2009
## Wireless Communication



Time: 3 hrs. Max. Marks:100

**Note: 1.** ***Answer any FIVE full questions.***
**2.** ***Missing data may be suitably assumed.***

1 a. Explain the following terms with respect to wireless communication systems:
   i) Mobile Switching Centre (MSC).
   ii) Base Station (BS).
   iii) Full Duplex System. **(06 Marks)**

   b. With a neat timing diagram, explain how a call to a mobile user initiated by a land-line subscriber is established. **(10 Marks)**

   c. Differentiate between paging system and cordless telephone system. **(04 Marks)**

2 a. Explain the concept of channel assignment strategies. **(04 Marks)**

   b. A particular FDD cellular system uses two 25 kHz simplex channels to provide full duplex voice and control channels. The total band width allocated for the system is 40 MHz. Compute the number of channels available per cell if the system uses: i) 3 – cell reuse ii) 4 – cell reuse iii) 12 – cell reuse. If 2 MHz of allocated spectrum is dedicated to control channel. Determine the distribution of voice and control channels in each case in each of the three systems. **(10 Marks)**

   c. In a radio cell layout, in addition to hexagonal topology, a square or an equilateral triangle can also be used.
      i) Given the same distance between the cell centre and its farthest perimeter points, compare the cell coverage among the three regular polygons i.e. Hegaxon, Square and Triangle.
      ii) What are the advantages of using the hexagonal cell shape over the square and triangle cell shapes? **(06 Marks)**

3 a. i) Explain the advantages and disadvantages of the two-ray ground reflection model in the analysis of path loss.
      ii) What insight does the two-ray model provide about large-scale path loss that was disregarded when cellular systems used very large cells? **(04 Marks)**

   b. A receiver is located 10 km from 50 W transmitters. The carrier frequency is 900 MHz, free space propagation is assumed, Gt = 1 and Gr = 2 find : i) Power at the receiver ii) The magnitude of the E-field at the receiver antenna iii) rms voltage applied to the receiver input assuming that the receiver antenna has a purely real impedance of 50 Ω and is matched to the receiver. **(07 Marks)**

   c. Explain the following terms with neat sketches and equations:
      i) Fresnel zones.
      ii) Scattering.
      iii) Knife-edge diffraction. **(09 Marks)**

4 a. Explain the Longely-Rice and Okumura out door propagation models. **(06 Marks)**

   b. Explain small-scale multipath measurements. **(09 Marks)**

   c. Consider a transmitter which radiates a sinusoidal carrier frequency of 1850 MHz. For a vehicle moving 60 mph, compute the received carrier frequency if the mobile is moving.
      i) Directly towards the transmitter
      ii) Directly away from the transmitter. **(05 Marks)**

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5 a. With the help of neat block diagram, explain the working of QPSK transmitter and receiver. (08 Marks)

b. What is the necessity of pulse shaping techniques? Explain the role of Gaussian pulse shaping filter in reducing ISI. Draw the impulse response of Gaussian shaping filter. (07 Marks)

c. If a mobile radio link operates with 30 dB SNR and uses a 200 kHz channel, find the theoretical maximum data capacity possible. How does your answer compare to what is offered by the GSM standard, which operates at a channel rate of 270.8333 kbps? (05 Marks)

6 a. Explain briefly the different quantization techniques. (08 Marks)

b. What are vocoders? Explain the different types of vocoders. (09 Marks)

c. For an 8-bit uniform quantizer that spans the range (-1v, 1v), determine the step size of the quantizer. Compute the SNR due to quantization if the signal is a sinusoid that spans the entire range of the quantizer. (03 Marks)

7 a. Explain the concept of CDMA – specify its features. (06 Marks)

b. Explain what is CSMA protocols? Briefly explain the variations of the CSMA strategy. (08 Marks)

c. 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) Time duration of a bit.
ii) Time duration of slot.
iii) Time duration of a frame. (06 Marks)

8 Write short notes on:

a. Trunking and Grade of service.
b. Factors influencing small-scale fading.
c. Packet radio.
d. Cell splitting. (20 Marks)

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# Seventh Semester B.E. Degree Examination, Dec. 07 / Jan. 08
## Wireless Communication

Time: 3 hrs. Max. Marks:100

**Note :** ***Answer any FIVE full questions.***

1 a. What are the different mobile radio transmission systems? Explain briefly. **(04 Marks)**

b. With the help of timing diagram explain how a call to a land line user initiated by a mobile subscriber is established. **(10 Marks)**

c. Bring out a comparison of common wireless communication systems with reference to mobile station and base station. **(06 Marks)**

2 a. Explain the concept of frequency re-use in cellular communication. **(04 Marks)**

b. If 20 MHz of total spectrum is allocated for a duplex wireless cellular system and each simplex channel has 25 kHz RF band width find

i) The number of duplex channels.

ii) The total number of channels per cell site; if N = 4 cell; reuse is used. **(06 Marks)**

c. Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $Q = \sqrt{3N}$. **(03 Marks)**

d. Given a cellular system that requires an S/I ratio of 18 dB. (Assume K = 4).

i) For a frequency factor of 7, calculate the worst-case signal-to-channel interference ratio.

ii) Is a frequency reuse factor of 7 acceptable in terms of Co-channel interference? If not what would be a better choice of frequency reuse factor? **(07 Marks)**

3 a. What are the basic propagation mechanisms in mobile communication systems? Explain in detail. **(06 Marks)**

b. If a transmitter produces 50 W of power, express the transmit power in units of i) dBm and ii) dBW. If 50 W is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna. What is Pr(10 kin)? Assume unity gain for the receiver antenna. **(07 Marks)**

c. Explain Longley-Rice model for out-door propagation. **(04 Marks)**

d. If $P_t = 10$, $G_t = 0$ dB and $f_c = 900$ MHz, find $P_r$ in watts at a free space distance of 1 km. **(03 Marks)**

4 a. Explain the factors influencing the small scale fading in wireless communication. **(06 Marks)**

b. Explain small scale multipath measurements. **(09 Marks)**

c. A vehicle receives a 900 MHz transmission while traveling at a constant velocity for 10s. The average fade duration for a signal level 10 dB below the rms level is 1 ms. How far does the vehicle travel during the 10s interval? How many fades the signal undergo at the rms threshold level during a 10s interval. Assume that the local mean remains constant during travel. **(05 Marks)**

5 a. With the help of neat block diagram explain the working of DPSK transmitter and receiver. **(08 Marks)**

b. Explain the need of pulse shaping techniques in mobile communication. What is the role of Gaussian pulse shaping filter in reducing ISI? Draw the impulse response of Gaussian shaping filter. **(07 Marks)**

c. Find the first zero-crossing RF bandwidth of a rectangular pulse which has $T_s = 41.06\mu s$. Compare this to the bandwidth of a raised cosine filter pulse with $T_s = 41.06\mu s$ and $\alpha = 0.35$. **(05 Marks)**

6 a. What are different characteristics of speech signal? Explain the importance of each of these. **(06 Marks)**

b. List four significant factors, which influence the choice of speech coders in mobile communication systems. Elaborate on the trade offs which are caused by each factor. **(08 Marks)**

c. Consider a sub-band speech coder that allocates 5 bits for the audio spectrum between 225 Hz and 500 Hz, 3 bits for 500 Hz to 1200 Hz, and 2 bits for frequencies between 1300 Hz and 3 kHz. Assume that the sub-band coder output is then applied to a rate $3/4$ convolution coder. Determine the data rate out of the channel coder. **(06 Marks)**

7 a. With the help of relevant diagram explain the concept of space division multiple access system (SDMA). **(07 Marks)**

b. Derive the equation for the capacity of cellular CDMA. Specify the relevant parameters, which assist in increasing capacity. **(07 Marks)**

c. Determine the number of analog channels per cell for the case of n = 3 propagation path loss, where the minimum acceptable $C/I = 14$ dB. What is the appropriate cluster size for the system? Assume the channel bandwidth is 30 kHz the total spectrum allocation is 20 MHz. **(06 Marks)**

8 Write short notes on:

a. Grade of service.

b. Channel planning for wireless systems.

c. Vocoders.

d. Packet radio. **(20 Marks)**

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EC754

**NEW SCHEME**

# Seventh Semester B.E. Degree Examination, Dec.06/Jan. 07
## Electronic & Communication Engineering
## Wireless Communication

Time: 3 hrs.] [Max. Marks:100

**Note:** ***Answer any FIVE questions.***

1 a. Compare the specific parameters of NAMPS, IS-95, GSM and iDen systems and elaborate how the evolution of PCS has taken place. **(08 Marks)**

b. Differentiate between a paging system and a cordless telephone system. **(04 Marks)**

c. Using a tabular column concept, explain how a mobile to mobile communication is established. **(08 Marks)**

2 a. With associated diagram and equations derive the equation of SIR if the cluster size is 7. **(06 Marks)**

b. Define the following with related equations/diagrams,
i) Blocked calls delayed ii) Range extension iii) Micro cell zone. **(06 Marks)**

c. A city has an area of 1300 sq. kms. It is covered by a cellular system of cluster size 7. Each cell has a radius of 4 kms. The city is allocated 40 MHz spectrum with a full duplex channel Band width of 60 KHz. Assume GOS of 2% for an 'Erlang B' system with an offered traffic for each user being 0.03E and traffic intensity per cell of 84E. Compute. i) Total no. of cells in the service area. ii) Total no. of channels/cells iii) Maximum Traffic carried by the system. iv) No. of mobiles per channel **(08 Marks)**

3 a. A mobile is located 5 kms from a Base station and uses a vertical $\lambda/4$ antenna with a gain of 2.55 dB to receive radio signals. The E-field at 1 km from the transmitter is $10^{-3}$ v/m. Carrier frequency used for the system is 900 MHz. Find i) the length and effective aperture of the receiving antenna. ii) the received power at the mobile using the 2-ray ground reflection model, assuming height of the transmitting antenna to be 50m and the height of the receiving antenna to be 1.5m. above the ground. **(07 Marks)**

b. Explain the following with related diagrams/equations.
i) Fresnel zones ii) Knife edge diffraction model iii) Scattering. **(09 Marks)**

c. What is 'log-normal shadowing'? Explain its effect over a large number of measurement locations which have the same T-R separation. **(04 Marks)**

4 a. With related diagrams explain 'Durkin's model' of path – loss simulator. **(06 Marks)**

b. For LOS and BOS environments, draw and explain 'Wide band PCS Micro cell' model. Specify the average path loss for both the environments. **(06 Marks)**

c. What are the types of 'Small scale fading'? Explain the fading effects due to 'time delay spread'. **(08 Marks)**

5 a. Specify the factors that influence; i) the choice of Digital Modulation ii) the use of raised cosine filter in mobile communication. **(06 Marks)**

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b. Draw and explain a $\pi/4$ QPSK Transmitter with related equations and constellation diagrams. **(08 Marks)**

c. Explain the following parameters;
   i) Performance of Frequency Hopping SS.
   ii) Performance of Digital Modulation in slow, flat fading channels. **(06 Marks)**

6 a. What is meant by sub-band coding? Draw and explain a sub band coder and decoder. **(08 Marks)**

b. Specify the LPC excitation methods. Further, with block diagram concept explain the 'CELP code Book search'. **(08 Marks)**

c. Explain in brief, the two methods of evaluation of speech coders. **(04 Marks)**

7 a. Explain the CDMA concept. Specify its features. **(06 Marks)**

b. What are the 'Packet Radio Protocols'? Explain Pure ALOHA and Slotted ALOHA with related equations and graphs. **(08 Marks)**

c. Derive the equation for the capacity of cellular CDMA. Specify the relevant parameters which assist in increasing the capacity. **(06 Marks)**

8 Write short-notes on :
   a. Channel Planning for wireless systems.
   b. Okumara model for signal prediction.
   c. Frequency domain channel sounding
   d. Direct sequence SS **(20 Marks)**

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**NEW SCHEME**

**EC754**

Reg. No.

# Seventh Semester B.E. Degree Examination, January/February 2006

## Common to EC/TC

## Wireless Communication

Time: 3 hrs.) (Max.Marks : 100

**Note:** *1. Answer any FIVE full questions.*
*2. All questions carry equal marks.*

1. (a) Explain the evolution of mobile radio communications. **(8 Marks)**

   (b) With a neat diagram explain paging systems. **(6 Marks)**

   (c) Make a critical comparison of the following mobile communication systems at the base station.

   i) TV remote control

   ii) Cordless phone systems

   iii) Cellular phone. **(6 Marks)**

2. (a) What are the different methods available for improving coverage and capacity of a cellular system? Explain any one method. **(7 Marks)**

   (b) What are the objectives of channel assignment strategies? Explain the dynamic channel assignment in detail. What is the advantage of this scheme? **(7 Marks)**

   (c) If a total of 33 MHz bandwidth is allocated to a particular FDD cellular telephone system which uses tow 25kHz simplex channels to provide full duplex voice and control channels, calculate the number of channels available/cell if a system uses

   i) 4-cell reuse

   ii) 7 - cell reuse

   iii) 12 - cell reuse. **(6 Marks)**

3. (a) What are the basic prorogation mechanisms in mobile communication systems? Explain any one in detail. **(5 Marks)**

   (b) For a point-to-point communication systems in the frequency range of 40 MHz to 100 GHz, which prorogation model is available to predict path loss? Explain in detail w.r.t operating modes, important modifications and short comings. **(7 Marks)**

   (c) Explain the scattering process in a mobile radio environment. **(5 Marks)**

   (d) For a receiver located 10 km from a 50 w transmitter carrier frequency is 900 MHz, free space propagation is assumed, if the transmitter antenna gain, $G_t = 1$, and the receiver antenna gain, $G_r = 2$ find the power at the receiver. **(3 Marks)**

4. (a) What is an impulse response model of a multipath channel? Derive an expression to show that the mobile radio channel can be modeled as a linear time varying channel. **(7 Marks)**

   (b) Explain the different factors influencing small scale fading. **(8 Marks)**

   (c) Consider a transmitter which radiates a simsoidal carrier frequency of 1850 MHz. For a vehicle moving 60 mph, compute the received carrier frequency if the mobile is moving directly towards the transmitter. **(5 Marks)**

Contd.... 2

5. (a) Explain the need of pulse shaping techniques in mobile communication. What is the role of Gaussian pulse shaping filter in reducing ISI? Draw the impulse response of Gaussian pulse shaping filter. **(6 Marks)**

   (b) What are linear modulation techniques? With the block diagram explain QPSK modulation and detection techniques. **(10 Marks)**

   (c) What is a combined linear and constant envelope modulation? Highlight its advantages and disadvantages. **(4 Marks)**

6. (a) What are different characteristics of speech signal? Explain the importance of each of these. **(8 Marks)**

   (b) With a block diagram explain adaptive differential pulse code modulation technique. **(8 Marks)**

   (c) For an adaptive PCM system for speech coding, the input speech signal is sampled at 8 kHz, each sample is represented by 8 bits. The quantizer step size is recomputed every 10 msec and is encoded for transmission using 5 bits. Compute the transmission bit rate of such a speech coder. **(4 Marks)**

7. (a) With a relevant diagram explain space division multiple access system. **(7 Marks)**

   (b) For a wireless communication system, explain the following :

   i) Frequency division duplexing(FDD)

   ii) Time division duplexing (TDD)

   iii) Narrow band systems (NB). **(9 Marks)**

   (c) If a US-AMPS cellular operator is allocated 12.5 MHz for each simplex band and if the total spectrum allocation is 12.5 MHz, guard band allocated is 10 kHz and the channel bandwidth is 30kHz, find the number of channels available in a FDMA system. **(4 Marks)**

8. Write short notes on any FOUR of the following :

   (a) Grade of service

   (b) Indoor propagation models

   (c) Doppler shift

   (d) Line coding

   (e) Vocoders. **(5×4=20 Marks)**

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