

**MOBILE COMMUNICATION AND NETWORKS
(ECE3101)**

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) The concept of MAHO is applicable in
(a) 1G analog cellular system (b) base station antennas
(c) 2G cellular system (d) none of these
- (ii) Determine no of cells in cluster when $i=2$ and $j=4$
(a) 7 (b) 14 (c) 28 (d) 35
- (iii) Mobility of users give rise to which of the following phenomenon in wireless communication
(a) Delay spread (b) Doppler spread
(c) Scattering of transmitted signals (d) None of these
- (iv) If the cell-site antenna height is doubled, there will be
(a) an increase in propagation path loss by 6 dB
(b) reduction in path loss by 6 dB
(c) reduction in path loss by 12 dB
(d) no change in path loss
- (v) CDMA radio takes advantage of a multipath delay greater than 1 μ s using
(a) QPSK modulator (b) FDD
(c) Rake receiver (d) None of the above
- (vi) The available forward and reverse frequency bands in GSM are divided into 200 kHz wide channels called as
(a) Time Slot
(b) Relative Radio Frequency Channel Numbers
(c) Absolute Radio Frequency Channel Numbers
(d) None of the above
- (vii) All decision-making processes for connection in UMTS are done at
(a) RNC (b) Node B (c) SGSN (d) GGSN

- (viii) What are the advantages of 4G-LTE network over 3G network
 - (a) More spectral efficiency
 - (b) Low power consumption
 - (c) Scalability and flexibility with other networks
 - (d) All above
- (ix) If the bandwidth of the transmitted signal is larger than the channel coherence bandwidth, then the signal could be severely influenced by
 - (a) frequency-selective fading
 - (b) fast fading
 - (c) slow fading
 - (d) none of these
- (x) To increase the total capacity of a cellular network, the primary objective is to
 - (a) Increase antenna height
 - (b) Increase number of cells in a cluster
 - (c) Reduce number of cells in a cluster
 - (d) Increase number of channels in a cell.

Fill in the blanks with the correct word

- (xi) Reduction in cluster size is limited by _____ interference.
- (xii) Shortest direct radio signal path between the transmitters to receiver is known as _____.
- (xiii) _____ is a phenomenon in wireless communication where a radio signal's strength and reliability change over time and distance.
- (xiv) When a roaming user enters an MSC(Mobile Switching Centre) area, the MSC informs the associated _____ about the UE(User Equipment)
- (xv) The chip rate of W-CDMA _____.

Group - B

2. (a) Why square and circular cell structure is not suitable for ideal cell geometry? Justify your answer with pictorial representation. [[CO1] (Analyse/IOCQ)].
 - (b) Explain the significance of cell splitting and cell sectoring for cellular network design. [[CO1] (Understand /LOCQ)]
 - (c) Consider that a geographical service area of a cellular system is 4200 km^2 . A total of 1001 radio channels are available for handling traffic. Suppose the area of a cell is 12 km^2 . (i) How many times would the cluster of size 7 have to be replicated to cover the entire service area? (ii) Calculate the number of channels per cell and the system capacity. [[CO1] (Apply/IOCQ)]

$$3 + 5 + (2 + 2) = 12$$
3. (a) Illustrate the handoff process with suitable diagram. [[CO1] (Understand /LOCQ)]
 - (b) Propose a technique to accommodate increasing number of subscribers adaptively for a cellular network. [[CO1] (Analyze/IOCQ)]

- (c) (c) A cellular system is installed with 100 cell-sites employing a 7-cell cluster and 500 full duplex channels. (i) How many numbers of channels per cell are available? (ii) Calculate the total number of channels available in the entire system. (iii) Repeat part (a) and (b) for Cell size = 12. [[CO1](Apply/IOCQ)]
4 + 4 + 4 = 12

Group - C

4. (a) Calculate the change in received signal strengths (in dB) in mobile radio propagation condition ($\gamma=4$) at two different points.
 (i) When the second distance is twice the distance of the first point.
 (ii) When the second distance is ten times the distance of the first point. [[CO6](Analyse/IOCQ)]
- (b) Explain briefly the radio propagation mechanism in wireless communication. [[CO1](Remember/LOCQ)]
- (c) Differentiate between the reflection and scattering mechanism of wireless propagation. [[CO1](Analyse/IOCQ)]
4 + 4 + 4 = 12
5. (a) Differentiate between flat fading and frequency selective fading. [[CO1](Analyse/IOCQ)]
 (b) Explain which type of fading occurs if
 (i) coherence-time, T_c is greater than symbol-duration rate T_s
 (ii) coherence-time, T_c is lesser than symbol-duration rate T_s . [[CO1](Remember/LOCQ)]
- (c) Consider that a mobile subscriber travelling at a uniform velocity of 96 kmph receive digital data from a wireless communication system operating at 900 MHz carrier frequency. What should be the symbol rate so as to receive distortionless communication? [[CO6](Apply/IOCQ)]
3 + 4 + 5 = 12

Group - D

6. (a) Critically compare FH-SS and DS-SS techniques in terms of multipath resilience, interference rejection, and bandwidth efficiency, and which technique is more suitable for CDMA evolution. [[CO3,CO6](Apply/IOCQ)]
 (b) Analyze the differences between forward and reverse channels in CDMA IS-95 systems with respect to power control mechanisms, synchronization requirements, and user capacity. [[CO3](Analyse/IOCQ)]
 (c) Why soft handoff is necessary in CDMA network? [[CO3](Apply/IOCQ)]
4 + 5 + 3 = 12
7. (a) Explain how the coordination of serving GPRS support node (SGSN) and gateway GPRS support node (GGSN) enables mobility management and packet data transfer. [[CO3, CO6] (Remember/LOCQ)]
 (b) Explain the significance of GPRS attachment and detachment in packet switched communication. [[CO3] (Apply/IOCQ)]
 (c) Justify the significance of PCU in GPRS architecture. [[CO3] (Analyse/IOCQ)]
6 + 3 + 3 = 12

Group - E

8. (a) Explain the significance of RNC and Node B in UMTS network. *[(CO3)(Understand/LOCQ)]*
- (b) Performance of the UMTS network enhanced after adopting modulation and coding. Justify this statement. *[(CO3)(Evaluate/HOCQ)]*
- (c) Why W-CDMA is the dominant transmission technology for 3G cellular systems? Explain. *[(CO3)(Analyze/IOCQ)]*
- 4 + 5 + 3 = 12**
9. (a) Explain the basic principle of orthogonal frequency division multiple Access (OFDMA). *[(CO4)(Analysis/IOCQ)]*
- (b) What are the advantages of using OFDMA in 4G networks? *[(CO4)(Remember/LOCQ)]*
- (c) Give examples of applications that benefit significantly from 4G speeds. *[(CO4)(Remember/LOCQ)]*
- 5 + 4 + 3 = 12**
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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	35.42	59.38	5.2