

**MOBILE COMPUTING  
(INFO 4132)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

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

**Group – A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Which one of the following statements is not true about millimetre waves?
    - (a) Millimetre waves have high atmospheric attenuation
    - (b) Millimetre waves ranges are limited
    - (c) Millimetre waves move in non-line-of-sight paths
    - (d) Millimetre waves move in line-of-sight paths.
  
  - (ii) Relaying and network coding improves the performance of a cellular network
    - (a) by extending the network coverage
    - (b) by increasing the system capacity
    - (c) by enhancing the wireless link reliability
    - (d) All of the above.
  
  - (iii) In 5G NR, NR stands for
    - (a) New Run      (b) Next Radio      (c) New Radio      (d) None of the above.
  
  - (iv) The basic toolbox of available RRM techniques are
    - (a) mode selection (MoS)      (b) resource allocation (ReA)
    - (c) power control (PC)      (d) all of the above.
  
  - (v) In MIMO, which factor has the greatest influence on data rates?
    - (a) The size of antenna      (b) The height of the antenna
    - (c) The number of transmit antennas      (d) The area of receive antennas.
  
  - (vi) New solutions for interference and radio resource management is needed in 5G because of
    - (a) massive deployment of small cells
    - (b) introduction of Nomadic Nodes and Moving Relay Nodes, which may refashion the network deployment in 5G
    - (c) both (a) & (b)
    - (d) none of the above.

- (vii) OFDM is a technique of
1. encoding digital data
  2. multiple carrier frequencies
  3. wide band digital communication
  4. 4G mobile communication
- (a) 1,2 and 3 are correct (b) 2 and 3 are correct  
(c) 1, 2 and 4 are correct (d) all the four correct.

- (viii) All users in CDMA system use \_\_\_\_\_ carrier frequency.
- (a) different (b) two (c) ten (d) same

- (ix) \_\_\_\_\_ Service provides both extreme high data-rate and low latency communications.
- (a) Extreme Mobile Broadband(xMBB)  
(b) Massive Machine-Type Communication (mMTC)  
(c) Ultra-reliable Machine-Type Communication (uMTC)  
(d) None of the above.

- (x) Peak data rate in GSM is \_\_\_\_\_
- (a) 9.6 Kbps (b) 1 Mbps (c) 100 Mbps (d) 42 Mbps.

### Group- B

2. (a) Differentiate between second generation and fourth generation cellular networks. [(CO1)(Analyze/IOCQ)]  
(b) Differentiate between Local area Network (LAN) and Metropolitan Area Network (MAN). [(CO1)(Analyze/IOCQ)]  
(c) Explain any four Key performance Indicators (KPI) in 5G technology. [(CO1)(Understand/LOCQ)]  
**4 + 4 + 4 = 12**
3. (a) Explain four enablers of 5G technology in detail. [(CO2)(Understand/LOCQ)]  
(b) Differentiate between Straight flow and Forward-backward flow. [(CO2)(Analyze/IOCQ)]  
(c) Describe RAN architecture briefly. [(CO2)(Understand/LOCQ)]  
**4 + 4 + 4 = 12**

### Group - C

4. (a) Define millimetre wave communication (mmW)? Examine the propagation challenges observed in millimetre wave communication. [(CO3)(Remember/LOCQ/Analyze/IOCQ)]  
(b) Identify the challenges in device technology for mmW. [(CO3)(Understand/LOCQ)]  
(c) Explain how the self-backhauling helps indeployment of 5G mmW networks. [(CO3) (Understand/IOCQ)]  
**(2 + 2) + 2 + 6 = 12**

5. (a) Identify requirements of multi-hop D2D communications for proximity and emergency services. [[CO3](Apply/IOCQ)]  
 (b) Illustrate the principles of radio resource management for multi-hop D2D. [[CO3](Analyze/IOCQ)]  
 (c) “Paradigm shift from human-type communications (HTC) toward machine-type communications (MTC) is mainly driven by the need to create Internet of Things (IoT)” – Assess the statement with reasons. [[CO3](Evaluate/HOCQ)]  
**4 + 4 + 4 = 12**

**Group - D**

6. (a) Compare between SU-MIMO and MU-MIMO. [[CO4](Analyze/IOCQ)]  
 (b) Differentiate between Frequency hop-code division multiple-access systems and Direct sequence-code division multiple-access systems. [[CO4](Analyze/IOCQ)]  
 (c) “Non-orthogonal schemes are efficient for multiple accesses in 5G” – Justify the statement. [[CO4](Evaluate/HOCQ)]  
**2 + 4 + 6 = 12**
7. (a) Describe the classification of CoMP techniques suggested by 3GPP. [[CO4](Understand/LOCQ)]  
 (b) “OFDM access scheme is more bandwidth efficient as compared to FDMA” – Justify the statement. [[CO4](Evaluate/HOCQ)]  
 (c) Compare and contrast between OFDMA and OFDM. [[CO4](Analyze/IOCQ)]  
**4 + 4 + 4 = 12**

**Group - E**

8. (a) Explain the role of relaying in wireless networks. Describe with diagram cooperative diversity in the context of relaying. [[CO5](Understand/LOCQ)]  
 (b) Discuss various network deployment types in 5G. [[CO6](Understand/LOCQ)]  
**(4 + 2) + 6 = 12**
9. (a) Discuss the aspects that motivate new solutions for interference and radio resource management in 5G. [[CO6](Understand /LOCQ)]  
 (b) Explain multiple access mechanism suitable for multiple TWR communication pairs aided by common relay. [[CO5](Understand/LOCQ)]  
**6 + 6 = 12**

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	52.1	33.3	14.6

**Course Outcome (CO):**

After the completion of the course students will be able to

INFO4132.1 Understand cellular network concept and can classify different generation of cellular networks.

INFO4132.2 Understand 5G system concept and 5G architecture.

INFO4132.3 Gather knowledge about 5G Machine-type communications (MTC), Device-to-device (D2D) communications and Millimeter wave communications.

INFO4132.4 Understand 5G radio-access technologies, Massive multiple-input multiple-output (MIMO) systems and coordinated multi-point transmission in 5G.

INFO4132.5 Understand 5G Relaying and wireless network coding.

INFO4132.6 Understand 5G Interference management, mobility management, and dynamic reconfiguration

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question