Chapter 4

Compare 3G and 4G wireless system with respect to
(i) Frequency Band used
(ii) Data rate
(iii) Access Technique
(iv) Switching used

Parameters	3G wireless system	4G wireless system
Frequency Band used	**16-25 GHz**	**2-8 GHz**
Data rate	**385 kbps-2Mbps**	**100 Mbps-1 Gbps**
Access Technique	**WCDMA/CDMA2000**	**MC-CDMA or OFDM**
Switching used	**Circuit/Packet**	**Packet**

State feature of 3G TD- SCDMA. (Any four) 4M
Ans:

(1) Bandwidth: 1.6MHZ
(2) Data Rate: Up to 384kbps of packet data rate,
(3) Multiple Access: Time division synchronous code division multiple access technology.
(4) Backward Compatibility: GSM
(5) Developed by: China academy at telecomm (CATT) and Siemens corporation jointly developed.
(6) uplink signals are synchronized at the base station receiver reduces the interference between users of the same timeslot using different codes by improving the orthogonality between the codes

State feature of 4G wireless Architecture. 4M
Ans:
Features of 4G:
1.Faster and more reliable data rates than 100 Mb/s
2. It has a Low cost in comparison to other generations (1G, 2G, 3G networks)
3. It supports Bluetooth, Wi-Fi, Wired and Wireless Ad-Hoc Networking
4. It supports for multimedia services like teleconferencing and wireless internet.
5. They have wide bandwidth.
6. 4G networks are completely packet-switched networks.
7. They have high internet speeds.
8. Provide global mobility and service portability

State any four features of UMTS. 4M
Ans: Features of UMTS:
1)Frequency spectrum: Uplink 1920-1980 MHz Downlink 2110-2170 MHz
2) Channel Bandwidth:5 MHz
3) chip rate:3.84 Mbps
4) Duplexing Technique: FDD and TDD modes

5) Modulation scheme: Direct sequence CDMA with QPSK
6) Frame length:10 ms frame with 15 time slots
7) Coding technique: Orthogonal variable spreading factor(OVSF)
8) Service type: Multi-rate and multi-service

State any four specifications of UMTS or (W-CDMA)

Ans: Specifications of UMTS are:

1. It is more robust for multipath delays.
2. It provides higher immunity towards frequency selective fading.
3. It has very high packet data rates of 2.048Mbps.
4. It has very high channel bandwidth of 5 MHz
5. It has backward compatibility with the GSM systems.
6. It has high frame structure of 16 slots per frame.
7. It gives signals of higher voice and data quality and also small bit-error rates.
8. It has a common world-wide spectrum band.
9. It can operate in multiple radio environments such as cellular, cordless, satellite, LAN etc.
10. It has a wide range of telecommunication services such as voice, data, multimedia, Internet etc.
11. It has global seamless connectivity (roaming).

List the features of IMT-2000(Any four) 4M
Ans:

- Common spectrum worldwide (1.8-2.2 GHz band)
- Multiple radio environments (cellular, cordless, satellite, LANs)
- Wide range of telecommunications services (voice, data, multimedia, internet)
- Flexible radio bearers for increased spectrum efficiency
- Data rates up to 2 Mb/s (phase 1)—for indoor environments
- Maximum use of IN capabilities (for service provision and transport)
- Global seamless roaming
- Enhanced security and performance
- Integration of satellite and terrestrial systems

State the Vision of IMT 2000 (any four points).

1.Common Spectrum worldwide(1.8-2.2 GHz band)
2.Multiple radio environments (cellular,cordless,satellite,LANs)
3.Wide range of telecommunication services(voice,data,multimedia,internet)
4.Flexible radio bearers for increased spectrum efficiency.
5.Data rate up to 2 Mbps(phase 1)-for indoor environments
6.Maximum use of IN capabilities (for service provision and transport)
7.Global seamless roaming
8.Enhanced security and performance
9.Integration of satellite and terrestrial systems

List the following parameters of 3G TD SCDMA System:
(i) Data rate
(ii) Bandwidth
(iii) Multiple access
(iv) Backward compatibility.

Ans:
(i) Data rate:-Packet data rates up to 384 Kbps
(ii) Bandwidth:-1.6 MHz
(iii) Multiple access:-Time Division Synchronous Code Division Multiple Access Technology
(iv) Backward compatibility:-GSM

State the features of UMTS and give UMTS air interface specification. 6M
Ans:
Features of UMTS:
1.UMTS (Universal Mobile Telecommunications Service) is a third generation (3G) broadband, packet-based transmission of text, digitized voice, video, and multimedia at data rates up to 2 megabits per second (Mbps).
2.Universal Mobile Telecommunications System (UMTS) is a air interface standard UMTS as a competitive open air-interface standard for 3G wireless telecommunications.
3. UMTS offers a consistent set of services to mobile computer and phone users, which is not depend on the location. UMTS is based on the Global System for Mobile (GSM) communication standard. Once UMTS is available, computer and phone users can be continuously connected to the Internet wherever they travel will have the same set of capabilities. Users will get access to internet via combination of terrestrial wireless and satellite transmissions.
4. A packet-switched connection that uses the Internet Protocol (IP) that provides a virtual connection is always available.
5. UMTS also makes it possible to provide new services like alternative billing methods or calling plans. For instance, users can choose to pay-per-bit, pay-per-session, flat rate, or asymmetric bandwidth options.
6. The higher bandwidth of UMTS also enables other new services like video conferencing.
7. UMTS may allow the Virtual Home Environment (VHE) to fully develop, where a roaming user can have the same services to either at home, in the office or in the field through a combination of transparent terrestrial and satellite connections.

UMTS air interface specification:

SR.No	Parameters	Specifications
1	Frequency spectrum	Uplink,1920MHz-1980MHz,
2	Channel bandwidth	5MHz
3	Chip rate	3.84 Mcps

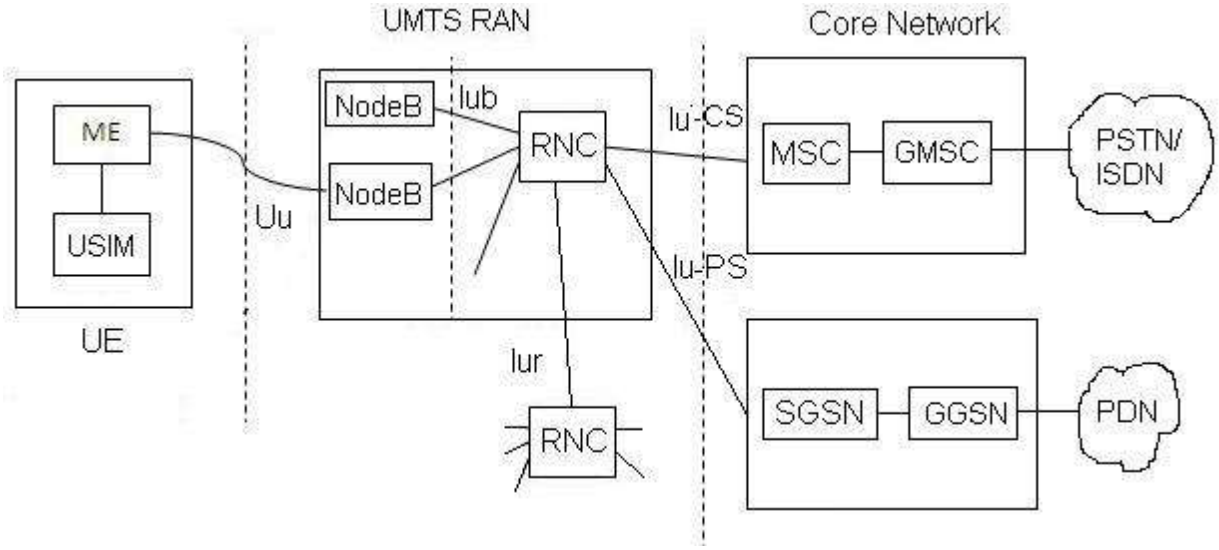
4	Duplexing technique	FDD and TDD modes
5	Modulation scheme	Direct sequence CDMA and QPSK
6	Frame length	10 ms frame with 15 time slots
7	Coding technique	Orthogonal Variable Spreading
8	Service type	Multi-rate and multi-service

State any four features of 4G CDMA 2000. 4M

Ans: 1) Code division multiple access 2000 is the natural evolution of IS-95 (cdmaOne).
2) It includes additional functionality that increases its spectral efficiency and data rate capability.
3) Code division multiple access is a mobile digital radio technology where channels are defined with codes (PN sequences).
4) CDMA permits many simultaneous transmitters on the same frequency channel.
5) Since more phones can be served by fewer cell sites, CD MA-based standards have a significant economic advantage over TDMA or FDMA-based standards.
The main CDMAz2000 standards are: CDMA2000 1xRTT,CDMA2000 1xEV and CDMAz2000 EV-DV.

Draw the architecture of UMTS the function of different blocks in UMTS. 4M

Ans :



User Equipment (UE):
The User Equipment or UE is the name given to what was previous termed the mobile, or cellphone. The new name was chosen because the considerably greater functionality that the UE could have. It could also be anything between a mobile phone used for talking to a data terminal attached to a computer with no voice capability.

- **Radio Network Subsystem (RNS):**

The RNS also known as the UMTS Radio Access Network, UTRAN, is the equivalent of the previous Base Station Subsystem or BSS in GSM. It provides and manages the air interface for the overall network.

- **Core Network:** The core network provides all the central processing and management for the system. It is the equivalent of the GSM Network Switching Subsystem or NSS.

The core network is then the overall entity that interfaces to external networks including the public phone network and other cellular telecommunications networks.

State the spectrum requirement of IMT 2000. 2M
Ans:
Common spectrum for IMT 2000 world-wide is from 1.8 GHz-2.2 GHz band
or
For Uplink: 1885-2025 MHz (Mobile satellite services)
Downlink: 2110-2200 MHz (Mobile satellite services)

List two features of 4G LTE. 2M
Ans
:
1. Peak data rates: downlink – 1Gbps; uplink -300Mbps
2. Spectrum efficiency: 3 times greater than LTE.
3. 10 times faster than the 3G network.
4. Peak spectrum efficiency:downlink -30bps / Hz; uplink – 15bps / Hz
5. 4G LTE is flexible and reliable.
6. Easy to standardize and it offers affordability