**RESEARCH ASSIGNMENT**

**Group 6**

1. **2G – Global System for Mobile Communication (GSM)**

* GSM Network Architecture: BSS, NSS, NMS, …
* Signaling Protocol Architecture
* Location Area Identity in GSM System/SIM concept/User Addressing/ IMEI/IMSI
* GSM Channel/Speech and Channel Coding
* Authentication and Security in GSM
* Frame Structure/Format/Timeslot and Burst
* GSM calling procedure/Hand-off procedure
* Intra-cell and Inter-cell handover/Intra and Inter BSC handover
* GSM service and feature

**Group 1**

1. **3G – Third Generation of Mobile Network (UMTS)**

* UMTS network architecture and protocol
* Network management system in 3G network
* Spreading and Scrambling
* Radio Air interface in 3G network: CDMA, WCDMA, TD-CDMA, CDMA2000
* Procedure in UMTS network: radio resource control, UTRAN signaling, call handing, security management
* Mobility management: Core Network mobility management, radio network mobility management
* Radio Network planning and optimization

**Group 3**

1. **4G – Long Term Evaluation (LTE) and LTE-A**

* Network Architecture and Interface
* Mobility Management Entity (MME)
* Air interface and radio network
* MIMO transmission
* Interconnection with UMTS and GSM/ Cell reselection between TLE and GSM/UMTS

**Group 3**

1. **5G – Fifth Generation of Mobile Network**

* 5G use cases and system concept; frequency band
* 5G mobile network services requirement trends
* 5G network challenges
* 5G network communication: *Massive MIMO Communications; Millimeter-Wave Mobile Communications; M2M and D2D communication in 5G*
* 5G and AI

**Group 4**

1. **Satellite Communications Network**

* Satellite Communications Networks and Applications: *use of satellite communication, frequency allocation for satellite services; Ground Segment and space segment for satellite communication; satellite communications network vision*
* Types of orbits for satellite communication: *GEO, MEO, LEO*
* Architecture of satellite networks: Fixed broadband network, Mobile satellite system
* Satellite network topology, types of links, connectivity

**Group 5**

1. **Wi-Fi, Bluetooth, ZigBee, and WiMAX**

* Wi-Fi: Architecture and Functions, IEEE 802.11, Basic Services, Media Access Control
* Bluetooth: Architecture and Functions, Frequency Band and RF channels, Applications
* ZigBee: General Architecture, IEEE 802.15.4, Media Access Control, Basic Services
* WiMAX: Architecture, IEEE 802.16, Media Access Control, Basic services