COMPUTER ENGINEERING DEPARTMENT

MCC Assignment 1

COURSE: **B.E.** YEAR: **2020-2021** SEMESTER: **VII**
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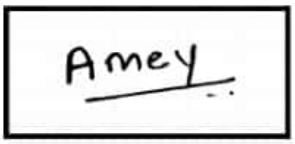
CLASS: **COMPS BE B** DATE OF SUBMISSION: **22-10-2021**

Sr. No.	Questions
1	Draw and explain the electromagnetic spectrum for communication.
2	Why is a mobile IP packet is required to be forwarded through a tunnel? Explain minimal techniques of encapsulation of Mobile IP.
3	Compare WCDMA and CDMA2000.



Signature of Student

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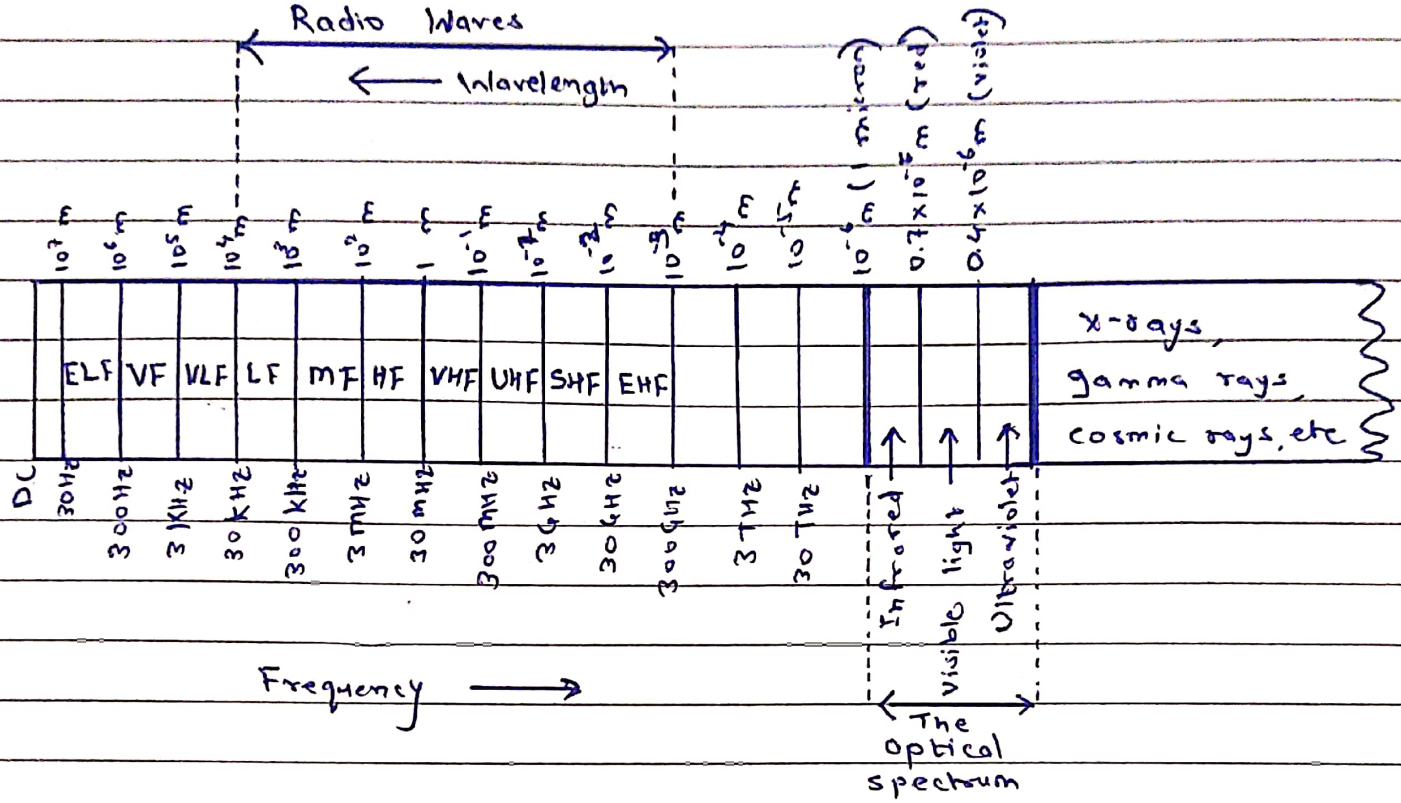
Q1. Draw and explain electromagnetic spectrum for communication

Ans:



- The transmission over the air (i.e. radio transmission) can take place using many different frequency bands. Each band has its own advantage as well as disadvantage.
- The above diagram shows the frequency spectrum used that can be used for data transmission. It starts from 30 Hz and goes upto 300 THz.
- Along with the frequencies show the wavelength of the signals calculated by the formula: $\lambda = c/f$ where c = speed of light in vaccum i.e. 3.8 * 108 m/s.

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Band	Range	Details / Application
Very low frequency	From 3KHz onwards	They are long waves, having large wavelength
Low Frequency (LF)	30 KHz to 300 KHz	Used by submarines due to their water penetrating ability and can also follow earth's surface.
Medium Frequency (MF)	300 KHz to 3 MHz	Used for radio broadcast using AM/SW/FM modulation techniques. Also used for aircraft navigation
High Frequency (HF)	3 MHz to 30 MHz	Used for radio broadcast using AM/SW/FM modulation techniques. Also used for aircraft navigation
Very High Frequency (VHF)	30 MHz to 300 MHz	TV broadcast range begins here; Used for TV broadcast, Land mobile
Ultra-High Frequency (UHF)	300 MHz to 3 GHz	WLANs, Analog-based mobile phones, cordless telephones, 3G cellular systems, e
Super High Frequency (SHF)	3 GHz to 30 GHz	Directed microwave links, radar, satellite
Extremely High Frequency (EHF)	30 GHz to 300 GHz	Very close to the infrared region; Also used for satellite, radar.
Infrared	3 THz to 30 THz	Used for directed links, e.g. to connect different buildings via laser links.

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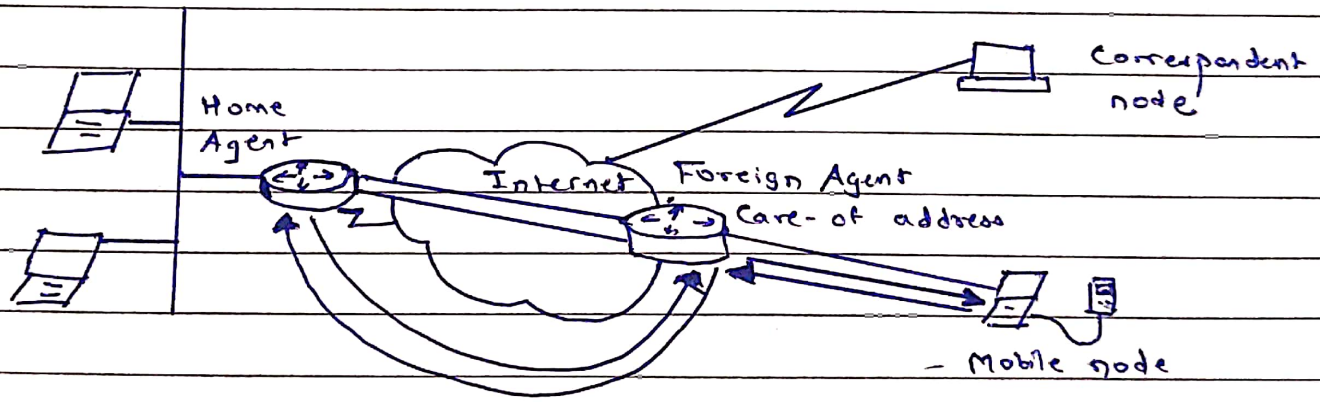
Q2. Why is mobile IP packet required to be forwarded through a tunnel. Explain minimal techniques of encapsulation of mobile IP packet.

Ans:

- The mobile node is a device such as a cell phone, personal digital assistant, or laptop whose software enables network roaming capabilities.
- The home agent is a router on the home network serving as the anchor point for communication with the mobile node.
- The foreign Agent is a router that may function as the point of attachment for the mobile node when it roams to a foreign network, delivering packets from the home agent to the mobile node.



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Why Tunnelling ?

- Consider a situation when a correspondent node (CN) wants to send an IP packet to a Mobile Node (MN). All the CN knows about this MN and its IP address.
- The CN is totally unaware of the MN's location. (which in fact a major requirement of Mobile IP) and so sends it as usual to MN's IP address.
- The internet routes this packet to the home router of the MN also called Home Agent (HA).
- The HA now knowing that the MN is not in its home network send encapsulates and tunnels it to the COA.
- The Care-of-address (COA) defines the current location of the MN from an IP point of view.
- Since internet routes are created based on the header contents of an IP packet, to route it from HA to COA, we need a new to create header for the packet to be transmitted.
- The new header on top of the original header is made. Now this will enable HA to set a new direct route (a tunnel) to the MN from the HA as it is roaming.
- Tunnelling : It is the process of creating a tunnel by the HA to the COA to route packets to the mobile node as it roams.
- It establishes a pipe wherein the data is inserted and moves in FIFO order.
- Encapsulation : Tunnelling has two primary functions : encapsulation of the data packet to reach the tunnel endpoint and decapsulation when the packet is delivered at the endpoint.

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Ver	IHL	DS (TOS)	Length	Outer header
IP identification		Flags	Fragment offset	
TTL	Min. encaps.	IP Checksum		
IP address of HA				
Care-of-address COA				
Protocol	S	Reserved	IP checksum	Inner header
IP address of MN				
Original Sender IP address (if S=1)				
TCP / UDP / .... payload				

- Minimal encapsulation is an optional encapsulation method for mobile IP.
- In methods like IP in IP encapsulation fields are redundant. So, here the number of fields is reduced with affecting the transmission.
- No field for fragmentation offset is present in inner header.
- minimal encapsulation does not work with already fragmented packets.

Ver:	IP version → (IPV4)
DS (TOS):	Copied from the inner header.
IHL:	Internet Header Length (32 bit word)
Length:	Length of complete encapsulated packet.
TTL	(Time To Live) must be high enough so that packet reaches the tunnel endpoint.

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Q3. Compare WCDMA and CDMA2000.

Ans!

- CDMA2000 is a 3G Technology evolved from IS-95 CDMA Technique.
- WCDMA is a 3G Technology evolved from Gsm technology.

Functions	CDMA2000	WCDMA
Core Network	ANSI - 41 MAP	Gsm MAP
Channel Bandwidth	1.25 MHz (1x), 3.75 MHz (3x)	5.0 MHz.
Channelization codes	4 - 128 (1x). 4 - 256 (3x)	4 - 256
Chip rate	1.2288 MCPs (1x) 3.6864 MCPs (3x)	4.096 MCPs (DOCOMO), 3.84 MCPs (UMTS)
Synchronized base station	Yes	No, but synchronized BS is optional.
Frame length	5 ms (signaling) 20, 40, 80 ms physical layer frames	10 ms for physical layer, 10, 20, 40, 80 ms for transport layer
Multi-carrier spreading option	Yes, but in CDMA2000 (1x) direct spread	No (Direct spread)
Modulation	QPSK (forward links) BPSK (Reverse link)	QPSK (both links)

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Modes of operation	FDD	FDD and TDD
Source identification code for sector	One PN code, 512 unique offsets are generated	512 unique scrambling codes, each identifying a sector
Channel Coding	Convolutional and Turbo code	Convolutional and Turbo code
Power Control	Both links (800 Hz)	Both links (1500 Hz)
Voice Coder	EVRC	AMR
Peak data rate	614 kbps	2 Mbps
Multimedia services	Yes	Yes