MOBILE AND WIRELESS COMMUNICATION

Course code	ESC-CSE-308G				
Category	Engineering Science Course				
Course title	Mobile and wireless communication				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- Understand the wireless/cellular radio concepts such as frequency reuse, handoff and interference between mobiles and base stations.
- Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by regulatory agencies.
- Understand the information theoretical aspects such as channel capacity, propagation effects, modeling the impact of signal bandwidth and motion in mobile systems.
- Describe the current and future Mobile Communication Systems, GSM, Satellite, Broadcasting, Bluetooth, Wireless LANs, Mobile Adhoc Networks.
- Describe the mobility support mechanism, WWW and WAPs.

UNIT 1

Introduction: Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system.

Wireless Transmission: Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum.

MAC Layer: Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA.

Broadcasting: Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

UNIT 2

GSM: Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services.

Wireless LAN: IEEE 802 11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

Bluetooth: User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management. Wimax

UNIT 3

Mobile Network Layer: Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6 , DHCP.

Mobile Adhoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics.

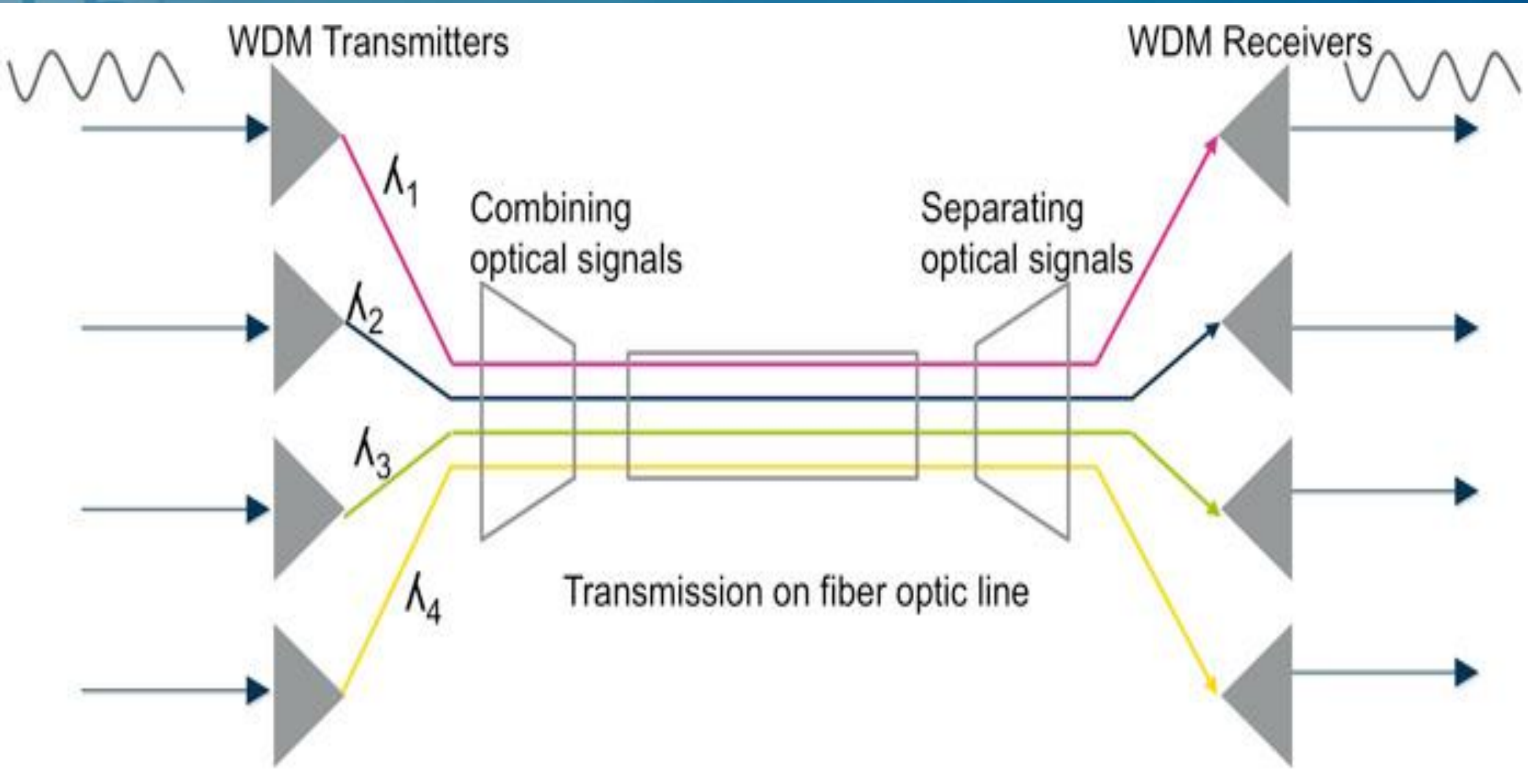
Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast-retransmission TCP, Transaction oriented TCP.

UNIT 4

Satellite Systems: History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System.

Support for Mobility: File System, WWW, HTML, System Architecture.

WAP: Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.


WDM Transmitters
WDM Receivers
λ1
λ2
λ3
λ4
Combining optical signals
Separating optical signals
Transmission on fiber optic line

Sr no.	FDM	TDM
1.	The signals which are to be multiplexed are added in the time domain . But they occupy different slots in the frequency domain .	The signals which are to be multiplexed can occupy the entire bandwidth in the time domain .
2.	FDM is usually preferred for the analog signals .	TDM is preferred for the digital signals .
3.	Synchronization is not required .	Synchronization is required .
4.	The FDM requires a complex circuitry at Tx and Rx .	TDM circuitry is not very complex .
5.	FDM suffers from the problem of crosstalk due to imperfect BPF .	In TDM the problem of crosstalk is not severe .
6.	Due to bandwidth fading in the Tx medium , all the FDM channels are affected .	Due to fading only a few TDM channels will be affected .
7.	Due to slow narrowband fading taking place in the transmission channel may be affected in FDM .	Due to slow narrowband fading all the TDM channels may get wiped out .

Comparison SDMA/TDMA/FDMA/CDMA

Approach	SDMA	TDMA	FDMA	CDMA
Idea	segment space into cells/sectors	segment sending time into disjoint time-slots, demand driven or fixed patterns	segment the frequency band into disjoint sub-bands	spread the spectrum using orthogonal codes
Terminals	only one terminal can be active in one cell/one sector	all terminals are active for short periods of time on the same frequency	every terminal has its own frequency, uninterrupted	all terminals can be active at the same place at the same moment, uninterrupted
Signal separation	cell structure, directed antennas	synchronization in the time domain	filtering in the frequency domain	code plus special receivers
Advantages	very simple, increases capacity per km²	established, fully digital, flexible	simple, established, robust	flexible, less frequency planning needed, soft handover
Dis-advantages	inflexible, antennas typically fixed	guard space needed (multipath propagation), synchronization difficult	inflexible, frequencies are a scarce resource	complex receivers, needs more complicated power control for senders
Comment	only in combination with TDMA, FDMA or CDMA useful	standard in fixed networks, together with FDMA/SDMA used in many mobile networks	typically combined with TDMA (frequency hopping patterns) and SDMA (frequency reuse)	still faces some problems, higher complexity, lowered expectations; will be integrated with TDMA/FDMA

Differences between Multiple access & multiplexing

MULTIPLE ACCESS	MULTIPLEXING
remote sharing of a communication channel such as a satellite or radio channel by users in highly dispersed locations	sharing of a channel such as a telephone channel by users confined to a local site.
a technique whereby many subscribers or local stations can share the use of a communication channel at the same time	A technique where many inputs are combined and a single output is transmitted over a single transmission medium
user requirements can change dynamically with time	user requirements are ordinarily fixed.
Example: FDMA, CDMA, TDMA, SDMA	Eg: 2:1 MUX, 4:1 MUX

Differences between Pure ALOHA and slotted ALOHA

Pure ALOHA	Slotted ALOHA
Any Station can transmit data at any time.	Any station can transmit the data only at the beginning of any time slot.
Vulnerability time = 2 x Transmission time.	Vulnerability time = Transmission time.
The probability of successful transmission in Pure ALOHA is $G \times e^{-2G}$	The probability of successful transmission in Slotted ALOHA is $G \times e^{-G}$
The max probability of successful transmission in pure aloha occurs at G=½ and the value is $½ \times e^{-1} = 18.39\%$	The max probability of successful transmission in slotted aloha occurs at G=1, the value is $1 \times e^{-1} = 36.79\%$
Time is continuous and not synchronised.	Time is discrete and Synchronised.

Wi-Fi vs Wi-Max

Wi-fi	Wi-Max
Wi-Fi stands for Wireless Fidelity	stands for Worldwide Interoperability for Microwave Access
Wi-Fi was officially launched in the year 1997	WiMAX came to the picture in the year 2004.
Wi-Fi has been defined under IEEE 802.11x standards where x is various Wi-Fi versions.	WiMAX is standardized under 802.16y family of wireless networking where y refers to various WiMAX versions.
Wi-Fi has several versions of it such as 802.11b, 802.11g, 802.11n.	WiMAX has a number of different versions too:802.16a, 802.16d and 802.16e
Wi-Fi has been defined under ISM bands where user has to pay no extra charging for utilizing those bands.	WiMAX protocols might work in the ISM bands or they might use a licensed frequency version for which the user probably would be charged.
100metres	80-90kilometers

Feature	WiMAX (802.16a)	Wi-Fi (802.11b)	Wi-Fi (802.11a/g)
Primary Application	Broadband Wireless Access	Wireless LAN	Wireless LAN
Frequency Band	Licensed/Unlicensed 2 G to 11 GHz	2.4 GHz ISM	2.4 GHz ISM (g) 5 GHz U-NII (a)
Channel Bandwidth	Adjustable 1.25 M to 20 MHz	25 MHz	20 MHz
Half/Full Duplex	Full	Half	Half
Radio Technology	OFDM (256-channels)	Direct Sequence Spread Spectrum	OFDM (64-channels)
Bandwidth Efficiency	<=5 bps/Hz	<=0.44 bps/Hz	<=2.7 bps/Hz
Modulation	BPSK, QPSK, 16-, 64-, 256-QAM	QPSK	BPSK, QPSK, 16-, 64-QAM
FEC	Convolutional Code Reed-Solomon	None	Convolutional Code
Encryption	Mandatory- 3DES Optional-AES	Optional- RC4 (AES in 802.11i)	Optional- RC4 (AES in 802.11i)
Mobility	Mobile WiMAX (802.16e)	In development	In development
Mesh	Yes	Vendor Proprietary	Vendor Proprietary
Access Protocol	Request/Grant	CSMA/CA	CSMA/CA

THANKS