Department of Electrical Engineering
Assignment
Date: 20/04/2020

Course Details

Course Title:	Moible And BroadBand And Network	**Module:**	3rd
Instructor:	Pir Meher Ali Shah	**Total Marks:**	30

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Q1.(a)	In how many types, an optical access network can be classified, explain each of them.	Marks 6
(b)	What are the advantages of Satellite Communication over terrestrial Communication?	Marks 4
Q2.(a)	Write are the types of WiFi Technologies, Discuss each type	Marks 4
(b)	Explain in detail about Wireless Body Area Network along with its type.	Marks 6
Q3.(a)	Write a comparative detail about the evolution of mobile technology from 1st Generation to 5th Generation.	Marks 6
(b)	What is DSL? Explain its architecture along with its types.	Marks 4

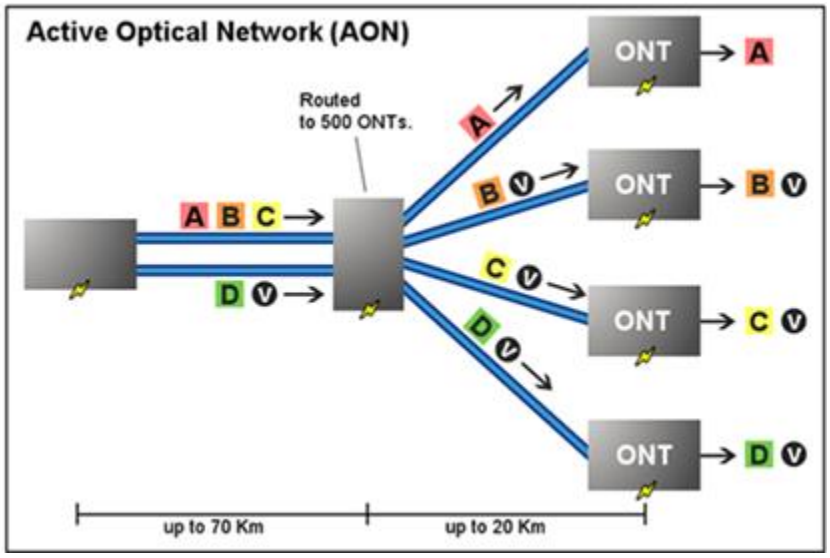
Q1 (a) In how many types, an optical access network can be classified, explain each of them.

The deployment of FTTH (Fiber To The Home) access networks has come a long way before subscribers use optical fibers instead of copper lines to achieve broadband Internet access. FTTH is a form of fiber-optic communication delivery that reaches one living or working space. The fiber extends from the central office to the subscriber's living or working space. There are two common systems available in FTTH networks: AON (active optical network) and PON (passive optical network).

Types of Networks

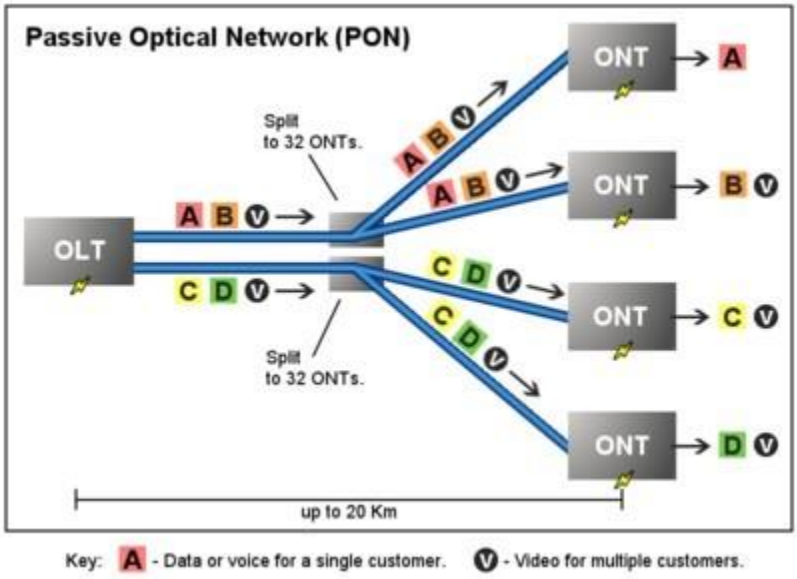
Active Optical Network

The AON arrangement is a point-to-point structure (PTP), meaning that each user has his own dedicated fiber optical line terminated on an optical concentrator. In an active optical system, environmentally electrical switching equipment are deployed, such as a router or a switch aggregator, to manage signal distribution and route data to proper places. The following figure show an AON system.



Passive Optical Network

Passive optical network, just as its name shows, it only uses fiber and passive components like optical splitters rather than active components like amplifiers, repeaters, or shaping circuits. Its arrangement is a point to multi-point (PMP) network. That is to say a passive optical network shares fiber optic strands for portions of the network. In passive optical system, a single fiber from a central office optical line terminal (OLT) is connected to optical network terminals (ONTs) or optical network units (ONUs) at customer premises. The image below is a PON system.



An OLT terminates the optical signals and distributes IT and Internet services to as many as 16 to 128 customers per fiber line. An optical splitter, also called PON splitter, is either fitted in or outside the subscriber's premise to divide a single optical signal into multiple equal but lower-power signals and distribute the signals to users. An optical network unit (ONU) terminates the PON at the customer's home. The ONU usually communicates with an optical network terminal (ONT), which may be a separate box that connects the PON to TV sets, telephones, computers, or a wireless router. ONU and ONT are basically the same device.

AON vs. PON

Each system has its own virtual points and shortcomings. As for AON subscribers, the bandwidth in each port is dedicated to each individual without sharing of it. Thus, higher bandwidth per port is possible through AON

compared with PON. In addition, because of its dedication to specific individual, it is easier to detect fiber faults or problems in AON. However, an AON system requires active equipment to manage signal transmission, which means power supply and potentially higher costs.

On one hand, a PON system is free from active parts or electronics, so it is less possible that passive parts go wrong in their normal operation, giving rise to a lower cost relative to maintenance of PON system. Besides, PON is efficient since each fiber optic strand can serve up to many users. On the other hand, because the bandwidth in PON is not dedicated to individuals, it is more difficult to figure out failures when disturbances of fibers occur. What's more, the share of fiber optic strands for portions of the network needs PON subscribers to be geographically closer to the central source of the data, likely that subscribers enjoy a slowdown data transmission with a distance limitation up to 20 km.

Q1 (b) What are the advantages of Satellite Communication over terrestrial Communication?

The advantages of satellite communication over terrestrial communication are as follows:

✓ Satellite are mainly wide area broadcast media as transmitter antenna may be designed to provide signals to service areas as small as a city or as large as a country.

✓ Terrestrial communication is point-to-point whereas Satellites communication is point to multipoint approach.

✓ Relatively fast installation. Once satellite is in position, earth station can be installed and communication can be established in days or hours. But terrestrial circuits require time consuming installations.

✓ The satellite costs are independent of distance whereas the terrestrial network costs are proportional to distance.

✓ The satellite itself is a single repeater. For terrestrial links antennas are located at a specific height to overcome obstacles and also repeaters are to be used in between the links to compensate for path losses.

✓ Satellite systems can provide coverage to remote places where terrestrial system fails. For communication between remote areas (hilly terrains, island etc.) and the main land satellite communication is the

only cost effective option
✓ Mobile communication is easy to achieve using satellite communication because of its broader coverage area and its flexibility in connecting mobile vehicles.
✓ Satellites have average low operating cost. Manufacturing of satellite is expensive but after that it would operate typically for years.
✓ As compared to optical fiber cable where the signal quality changes with the distance travelled by signal through the cable, satellite communication has an advantage that signal quality is independent of distance as long as the two stations fall within the same geographic coverage areas.
✓ Wide area of application such as whether forecasting, search, navigation, military.

Q2 (a) Write are the types of Wi-Fi Technologies, Discuss each type?

Types of WI-FI Technologies:

Currently they are four major types of WIFI technologies.
- Wi-Fi-802.11a
- Wi-Fi-802.11b
- Wi-Fi-802.11g
- Wi-Fi-802.11n

802.11a is the one of a series of wireless technology. That defines the format and structure of the radio signals sent out by WI-FI networking routers and antennas.

Wi-Fi-802.11b:
802.11b is the one of a series of wireless technology. 802. 11b support bandwidth 11mbps. Signal in unregulated frequency spectrum around 2.4 GHz. This is a low frequency compared with Wi-Fi-802.11a means it is working reasonable distance. It is interference with micro owns cordless

phones and other appliance. It is low-cost; signal range is good using home appliance.

Wi-Fi-802.11g:

In 2002 and 2003, This Technology supporting a newer slandered products. It is best technology of 802.11a and 802.11b. The 802.11 b support bandwidth up to 54mbps and it use a 2.4 GHz frequency for greater range. This cost is more than 802.11b. It is fast accessing and maximum speed.

Wi-Fi-802.11n:

The 802.11n is the newest WIFI technology. It was designed to improve on 802.11g .The amount of bandwidth supported by utilizing multiple wireless signals and antennas instead of one. It supports 100 mbps bandwidth and increased signal intensity also made.

Q2 (b) Explain in detail about Wireless Body Area Network along with its type?

Wireless Body Area Network

In today's world, wireless communication has a major application in sharing of information anywhere and at any time. We can use wireless networks in the form of WLAN or Wi-Fi in various fields such as education, healthcare and industrial sector. As the technology is growing, the demand of users as well as the demand of ubiquitous networking is increasing. WBAN (Wireless Body Area Network) allows the user to move another without having the restriction of a cable for sharing information.

The term 'Wireless Body Area Network' was coined in 2001 by Van Dam. It basically is a network containing sensor nodes which are attached to the human body, used to measure the bio signals (heart rate, blood pressure, brain signals etc.) of humans. It has majority of applications in medical sector. The communication in body sensor networks is of 2 types:

- **In-body communication**
- **On-body communication**

In-body communication is the communication between sensor nodes which are implanted inside human body. The **MICS** (*Medical Implant Communication*

System) communication can be used only for in-body communication. Onbody communication occurs between wearable devices which consist of sensor nodes. The **ISM** (*Industrial Scientific and Medical*) band and **UWB** (*Ultra-wide band*) communication can be used only for on-body communication.

WBAN requirements:

- Low power consumption
- Interoperability
- Self-healing
- Security
- Low latency

Q3 (a) Write a comparative detail about the evolution of mobile technology from 1st Generation to 5th Generation.

FIRST GENERATION (1G)

1G technology replaced 0G technology, which featured mobile radio telephones and such technologies as Mobile Telephone System (MTS), Advanced Mobile Telephone System (AMTS), Improved Mobile Telephone Service (IMTS), and Push to Talk (PTT).

1. Developed in 1980s and completed in early 1990's
2. 1G generation of analog cell phones speed up to 2.4kbps
3. Advance mobile phone system (AMPS) was first launched by the US and is a 1G mobile system

Second Generation Technology (2G to 2.7G)

2G is the Second-Generation wireless cellphones, based on digital technologies in the early 1990's. In 1991 2G was launched in Finland. 2G provided services such as text message, picture messages and MMS. 2G has greater security for both sender and receiver. All text messages are digitally encrypted, which allows for the transfer of data in such a way that only intended receiver can receive and read it. GSM uses TDMA to multiplex upto

8 calls per channel in the 900 and 1800 MHZ bands. GSM can not only deliver voice but also circuit switched data at sped up to 14.4kbps.

3G

3G is the third generation of mobile phone standards and technology. It is based on the International Telecommunication Union (ITU) who formulated a plan to implement a global frequency band in the 2000 MHZ range, which supports a single, ubiquitous wireless communication standard for all countries
throughout the world. This paln was called International Mobile Telephone 2000 (IMT-2000), Standard. 3G has the following enhancements over 2.5G and previous networks:

- Enhanced audio and video streaming.
- Several Times higher data speed.
- Video-conferencing support.
- Web and WAP browsing at higher speeds.
- IPTV (TV through the Internet) support.

3.5 G—HSDPA (High-Speed Downlink Packet Access)

High-Speed Downlink Packet Access (HSDPA) is a mobile telephony protocol which provides a smooth evolutionary path for UMTS-based 3G networks allowing for higher data transfer speeds. HSDPA is a packet-based data service in W-CDMA downlink with data transmission up to 8–10 Mbit/s (and 20
Mbit/s for MIMO systems) over a 5MHz bandwidth in WCDMA downlink.

3.75G—HSUPA (High-Speed Uplink Packet Access)

HSUPA will enhance advanced person-to-person data applications with higher and symmetric data rates, like mobile e-mail and real-time person-to person gaming. Traditional business applications along with many consumer applications will benefit from enhanced uplink speed. HSUPA will initially boost
the UMTS / WCDMA uplink up to 1.4Mbps and in later releases up to 5.8Mbps.

4G

4G is the fourth generation of broadband cellular network technology, succeeding 3G. A 4G system must provide capabilities defined by ITU in IMT Advanced. Potential and current applications include amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing, and 3D television. 4G is a concept of inter-operability between different sorts of networks, which is all about high speed data transfer such as 0–100MBPS of either the server or the data receiver set is moving at a speed of 60 Kmph. If the server and the receiver are stationary, the data transfer would be a minimum of 1GBPS.

5G

5G network technology will open a new era in mobile communication technology. The 5G mobile phones will have access to different wireless technologies at the same time and the terminal should be able to combine different flows from different technologies. 5G allows up to 900,000 more devices to be connected per square kilometer than 4G, which supports the connection of at most 100,000 devices per square kilometer. The 5G network will be 100 times more energy efficient than 4G. So even as the number of wireless devices increases, the energy required to power them will decline

Q3 (b) what is DSL? Explain its architecture along with its types.

DSL stands for Digital Subscriber Line. Users get a high speed bandwidth connection from a phone wall jack on an existing telephone network. DSL works within the frequencies that the telephone doesn’t so you can use the Internet while making phone calls. Consider DSL Internet the big brother to dial-up. Many local phone services provide DSL offering High Speed Internet access delivered through existing telephone networks. Telephone wires carry hundreds of thousands of frequencies. Only a few thousand are for telephone communications so the telephone and DSL modem can work at the same time.

There are two main types of DSL technology.

Symmetrical DSL– Symmetrical connections offer equal bandwidth for upload and download speeds.
Asymmetrical DSL– This is the most popular type of DSL connection. Most people download more information than they are uploading. Because of this, an asymmetrical connection has more downstream bandwidth and less upstream bandwidth.

RADSL - (Rate Adaptive Digital Subscriber Line)

- Most robust business DSL available today;
- Developed to overcome line impediments;
- Automatically adjusts for environmental conditions; - Because RADSL is a type of SDSL, it supports symmetric (equal downstream and upstream) data transmissions up to 768K.

ADSL - Asymmetrical Digital Subscriber Line
ADSL supports a range of asymmetric (higher downstream than upstream) data speeds that can reach up to 7Mbps downstream and 1.5Mbps upstream. ADSL can deliver simultaneous high-speed data and telephone service over the same line.

ADSL Lite (or G.lite)
This is a lower speed version of ADSL and provides downstream speeds of up to 1Mbps and upstream speeds of 512 kbps, at a distance of 18,000 feet from the service provider's premises. It is intended to simplify DSL installation at the user's end.

R-ADSL - Rate-Adaptive Digital Subscriber Line
The R-ADSL provides the same transmission rates as ADSL, but an R-ADSL modem can dynamically adjust the speed of the connection depending on the length and quality of the line.

HDSL - Hight Bit-Rate Digital Subscriber Line

The HDSL provides a symmetric connection, that is, upstream speeds and downstream speeds are the same, and range from 1.544Mbps to 2.048Mbps at a distance of 12,000–15,000 feet. Symmetric connections are more useful in applications like videoconferencing, where data sent upstream is as heavy as data sent downstream. HDSL-II, which will provide the same transmission rates but over a single copper-pair wire, is also round the block.

IDSL - ISDN Digital Subscriber Line

The ISDN Digital Subscriber Line provides up to 144 kbps transmission speeds at a distance of 18,000 feet (can be extended with a repeater), and uses the same techniques to transfer data as ISDN lines. The advantage is that, unlike ISDN, this is an ‘always on’ connection.

SDSL - Symmetric Digital Subscriber Line

SDSL supports symmetric (equal downstream and upstream) data transmissions up to 1.54Mbps.

VDSL - Very High Bit-rate Digital Subscriber Line

VDSL is the fastest of all xDSL flavors and provides transmission rates of 13–52Mbps downstream and 1.5–2.3Mbps upstream over a single copper-pair wire, at a distance of 1,000–4,500 feet from the service provider’s premises.

VDSL2 - Very High Bit-rate Digital Subscriber Line 2

VDSL2 is faster than VDSL and provides transmission rates up to 100Mbps at longer distances.