Kafrelsheikh University - Faculty of Engineering			
Course	Digital Communications	Date	27/5/2017
Time	3 Hours	Mark	70
Students	3rd year Computer and systems		

Answer all the following questions:

Clarify your answer with the suitable diagrams.

Q.1 Compare between twisted pair, Coaxial cable and optical fiber in terms of the advantages and disadvantages. (7 Marks)

ANS:

	Optical Fiber	Coaxial Cable	Twisted Pair
Bandwidth	Very High	Medium	Low
Interference	Immune	Not Immune	Very weak against Interference
Cost	Very High	Medium	Very low
Distance	In the range of hundreds to thousands of KM	In the range of tens of KM	Less than 1 KM
Installation Difficulty	Very hard	Easy	Very Easy

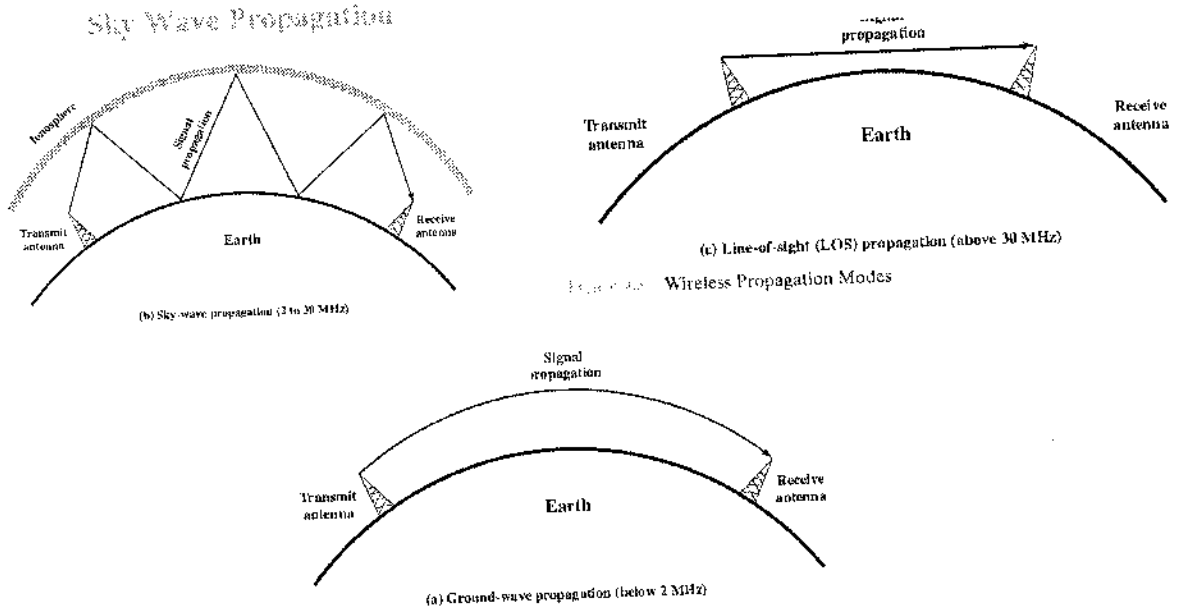
Q.2 Explain the types of propagation of Wireless signals w.r.t the bandwidth. (7 Marks)

ANS: A signal radiated from an antenna travels along one of three routes: ground wave, sky wave, or line of sight (LOS).

Ground wave propagation more or less follows the contour of the earth and can propagate considerable distances, well over the visual horizon. This effect is found in frequencies up to about 2 MHz.

With sky wave propagation, a signal from an earth-based antenna is reflected from the ionized layer of the upper atmosphere (ionosphere) back down to earth. Although it appears the wave is reflected from the ionosphere as if the ionosphere were a hard reflecting surface, the effect is in fact caused by refraction.

Above 30 MHz, neither ground wave nor sky wave propagation modes operate, and communication must be by line of sight (Figure 4.8c). For satellite communication, a signal above 30 MHz is not reflected by the ionosphere and therefore a signal can be transmitted between an earth station and a satellite overhead that is not beyond the horizon.



Q.3 Draw and Explain the transmitter and receiver circuits in optical fiber systems in the case of: **(7 Marks)**

a) Analogue Signals **b) Digital Signals**

Figure 3 - Methods of Modulating LEDs or Laser Diodes

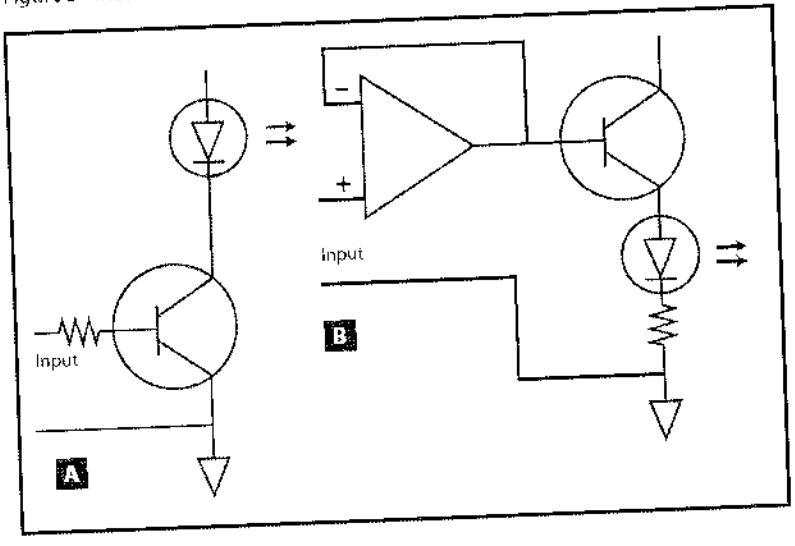
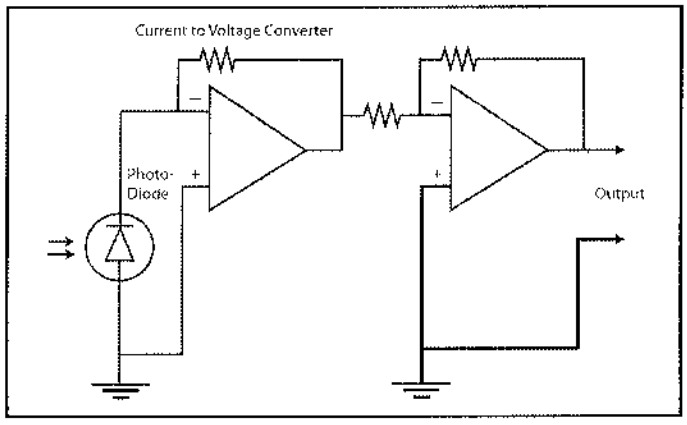


Figure A is the transmitter of Digital Signal. a transistor is used to switch the LED or LD on and off in step with an input digital signal. This signal can be converted from almost any digital format by the appropriate circuitry, into the correct base drive for the transistor.

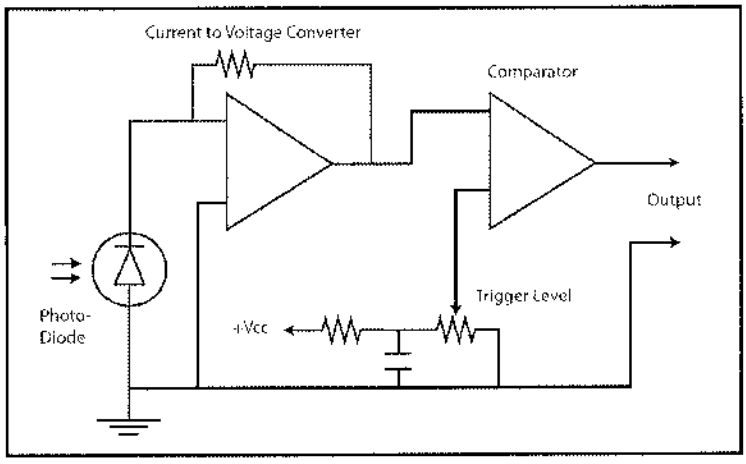
Figure B is the transmitter of Analogue Signal. The inverting input is used to supply the modulating drive to the LED or LD while the non-inverting input supplies a DC bias reference.

Figure 10 · Basic Analog Fiber Optic Receiver



The first stage is an operational amplifier connected as a current-to-voltage converter. This stage takes the tiny current from the photodiode and converts it into a voltage, usually in the millivolt range. The next stage is a simple operational voltage amplifier. Here the signal is raised to the desired output level. Figure 11 is a functional diagram of a simple digital optical receiver. As in the case of the analog receiver, the first stage is a current-to-voltage converter. The output of this stage, however, is fed to a voltage comparator, which produces a clean, fast rise-time digital output signal. The trigger level adjustment, when present, is used to "touch up" the point on the analog signal where the comparator switches. This allows the symmetry of the recovered digital signal to be trimmed as accurately as desired.

Figure 11 · Basic Digital Fiber Optic Receiver



Q.4 Explain the three KEPLER's laws that control the orbit of Satellites around the earth.
(7 Marks)

Kepler's first law states that the satellite follows an elliptical path in its orbit around the Earth.

The satellite does not necessarily have uniform velocity around its orbit. Kepler's second law states that the line joining the satellite with the centre of the Earth sweeps out equal areas in equal times. Kepler's third law states that the cube of the mean distance of the satellite from the Earth is proportional to the square of its period.

Q.5 Compare Between The GEO, MEO and LEO orbits of satellites. (7 Marks)

Geostationary or geosynchronous earth orbit (GEO)

GEO satellites are synchronous with respect to earth. Looking from a fixed point from Earth, these satellites appear to be stationary. These satellites are placed in the space in such a way that only three satellites are sufficient to provide connection throughout the surface of the Earth (that is; their footprint is covering almost 1/3rd of the Earth). The orbit of these satellites is circular. There are three conditions which lead to geostationary satellites. Lifetime expectancy of these satellites is 15 years.

1) The satellite should be placed 37,786 kms (approximated to 36,000 kms) above the surface of the earth.

2) These satellites must travel in the rotational speed of earth, and in the direction of motion of earth, that is eastward.

3) The inclination of satellite with respect to earth must be 00.

These satellites are used for TV and radio broadcast, weather forecast and also, these satellites are operating as backbones for the telephone networks.

Low Earth Orbit (LEO) satellites:

These satellites are placed 500-1500 kms above the surface of the earth. As LEOs circulate on a lower orbit, hence they exhibit a much shorter period that is 95 to 120 minutes. LEO systems try to ensure a high elevation for every spot on earth to provide a high quality communication link. Each LEO satellite will only be visible from the earth for around ten minutes.

These satellites are mainly used in remote sensing and providing mobile communication services (due to lower latency).

Medium Earth Orbit (MEO) satellites:

MEOs can be positioned somewhere between LEOs and GEOs, both in terms of their orbit and due to their advantages and disadvantages. Using orbits around 10,000 km, the system only requires a dozen satellites which is more than a GEO system, but much less than a LEO system. These satellites move more slowly relative to the earth's rotation allowing a simpler

system design (satellite periods are about six hours). Depending on the inclination, a MEO can cover larger populations, so requiring fewer handovers.

Q.6 Find the JD from reference time Jan 0.5 1900 to UT 13 hours of 18th December 2016.

(C1= 30.6001, C2= 1720994.5, JDref = 2145020, JC = 36525) (7 Marks)

•Solution: y = 2016 mon = 12 dy = 18 hours = 13 minutes = 0 seconds = 0

•d = dy + hours/24 = 18 + 13/24 = 18.5417

•A = floor (y/100) = 2016/100 = 20

•B = 2 –A + floor (A/4) = 2 – 20 + 5 = -13

•C = floor (365.25 x y) = 736344

•D = floor (30.6001 x (mon + 1)) = 397.8013

•JD = B + C + D + d + 1720994.5

•Thus, Julian Day = 2457741.843

•JDref = 2145020 JC = 36525

•Thus T = (JD – JDref)/ JC = (2457741.843– 2415020) / 36525 T = 1.169660314852841 (time has no dimensions)

Q.7 What are the Basic Security Strategies to protect a Wi-Fi Network? (7 Marks)

1. Block your Service Set Identifier (SSID) from being broadcast, wireless beacon so PCs can easily find the access point.
2. Change the default network name in the access point.
3. Change the default access point password.
4. Center the access point in the middle of the building/house.

Q.8 What are the differences, advantages and disadvantages between Re-active and Pro-active routing protocols in Mobile ad-hoc networks? (7 Marks)

Re-active: Does not take initiative for finding routes

•Establishes routes "on demand" by flooding a query

Pros and cons:

•Does not use bandwidth except when needed (when finding a route)

•Much network overhead in the flooding process when querying for routes

•Initial delay in traffic.

Pro-active: •Routes are set up based on continuous control traffic

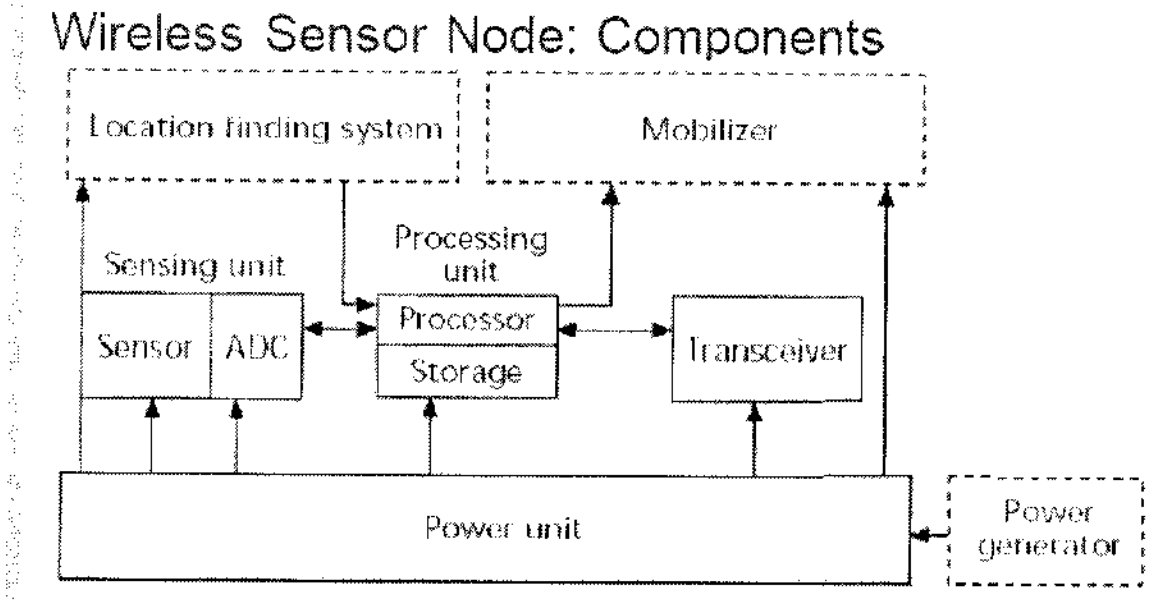
•All routes are maintained all the time

Pros and cons:

•Constant overhead created by control traffic

•Routes are always available

Q.9 Draw the components of a wireless sensor network node. (7 Marks)



Q.10 Locate the error In the following (15,11) Multi-Parity Check Code, where the parity bits are in BOLD: (7 Marks)

101010011001011

Solution: P1P2P3P4=1111=15.

The bit no 15 is in error.

The correct data is: 101010011001010

Good Luck and Best Wishes *Dr. Ibrahim Elashry*