Name:……

Reg.No:…….

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING)

DEGREE EXAMINATION- MODEL QUESTION PAPER 2

EN14 107-BASICS OF ELECTRICAL, ELECTRONICS AND COMMUNICATION

ENGINEERING (2014 admissions)

Section 2 (Basics of Electronics and Communication Engineering)

Part A

Answer any 4 questions.

1. What is ADC and DAC?

2. Reduce the expression and realize using gates.

F (A,B,C,D) = AB + ABC + AC+ACD

3. Compare AM and FM.

4. Write about applications of SATELLITE communication system.

5.Describe about universal gates. (4X5=20 Marks)

Part B

6. What are cascaded amplifiers? How gains are calculated? Explain briefly.

OR

7. a)Compare advantages and disadvantages of TTL and CMOS. (9)

b) What is amplifier gain? Describe about voltage Gain, Current Gain,Power Gain (6)

8. Describe about principle of light transmission through fibre? (15)

OR

9. a) Describe about Principle of Radar with diagram. (9)

b) What are the applications of radar? (6)

Answer key:

1. An Analog-Digital Converter (ADC) is a widely used electronic component that converts an analog electric signal (usually a voltage) into a digital representation. The ADCs are at the front-end of any digital circuit that needs to process signals coming from the exterior world. Its schematic symbol is:

The output of a microphone, the voltage at a photodiode or the signal of an accelerometer are examples of analog values that need to be converted so that a microprocessor can work with them.

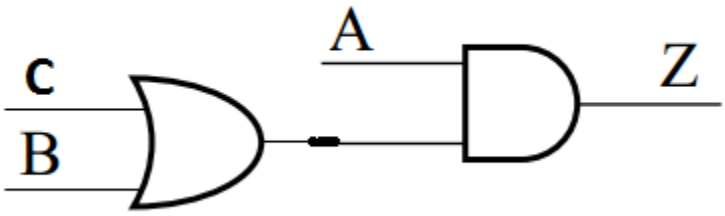
Digital to analog converter is used to convert digital quantity into analog quantity. DAC converter produces an output current of voltage proportional to digital quantity (binary word) applied to its input. Today microcomputers are widely used for industrial control. The output of the microcomputer is a digital quantity. In many applications the digital output of the microcomputer has to be converted into analog quantity which is used for the control of relay, small motor, actuator e.t.c. In communication system digital transmission is faster and convenient but the digital signals have to be converted back to analog signals at the receiving terminal. DAC converters are also used as a part of the circuitry of several ADC converters.

2. F (A,B,C,D) = AB + ABC + AC+ACD'

=AB(1+C)+AC(1+D')

=AB+AC

=A(B+C)= NEED OF ONE AND GATE AND OR GATE.



3. Comparison between AM and FM

Amplitude Modulation

- Less bandwidth. Hence, low fidelity of modulating signal.
- Amplitude of carrier signal is changing. Hence, poor noise immunity.
- Transmitting efficiency is less, because transmission power is wasted in sidebands.
- Stereophonic transmission is not possible.
- But AM signal travels as space waves.
- Hence, area of transmission and reception is large (it can cover complete earth globe).
- Simple instruments and circuits are required.
- It occupies less space of frequency spectrum, due to less bandwidth.

Frequency Modulation

- Larger bandwidth. Hence, good fidelity of modulating signal.
- Frequency of carrier signal is changing. Hence, better noise immunity.
- Transmitting efficiency is large, because transmission power is completely useful.
- Stereophonic transmission is possible.
- FM signal travels in light of sight distance, i.e. it is known as sky waves.
- Hence, area of transmission and reception is less (thus, its transmission is limited up to horizon of transmitting tower only).
- More costly and complicated circuit.
- It unnecessarily occupies extra space of frequency spectrum, due to large bandwidth.

4.

Advances in satellite technology have given rise to a healthy satellite services sector that provides various services to broadcasters, Internet service providers (ISPs), governments, the military, and other sectors. There are three types of communication services that satellites provide: telecommunications, broadcasting, and data communications. Telecommunication services

include telephone calls and services provided to telephone companies, as well as wireless, mobile, and cellular network providers.

Broadcasting services include radio and television delivered directly to the consumer and mobile broadcasting services. DTH, or satellite television, services (such as the DirecTV and DISH Network services in the United States) are received directly by households. Cable and network programming is delivered to local stations and affiliates largely via satellite. Satellites also play an important role in delivering programming to cell phones and other mobile devices, such as personal digital assistants and laptops.

Data communications involve the transfer of data from one point to another. Corporations and organizations that require financial and other information to be exchanged between their various locations use satellites to facilitate the transfer of data through the use of very small-aperture terminal (VSAT) networks. With the growth of the Internet, a significant amount of Internet traffic goes through satellites, making ISPs one of the largest customers for satellite services.

Satellite communications technology is often used during natural disasters and emergencies when land-based communication services are down. Mobile satellite equipment can be deployed to disaster areas to provide emergency communication services.

5.

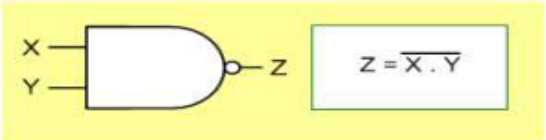
NAND Gate:

The **NAND** gate represents the complement of the AND operation. Its name is an abbreviation of **NOT AND**.

The graphic symbol for the NAND gate consists of an AND symbol with a bubble on the output, denoting that a complement operation is performed on the output of the AND gate.

The truth table and the graphic symbol of NAND gate is shown in the figure.

X	Y	NAND
0	0	1
0	1	1
1	0	1
1	1	0



The truth table clearly shows that the NAND operation is the complement of the AND.

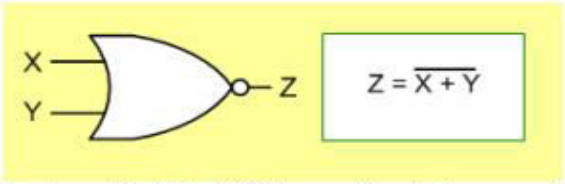
NOR Gate:

The **NOR** gate represents the complement of the OR operation. Its name is an abbreviation of **NOT OR**.

The graphic symbol for the NOR gate consists of an OR symbol with a bubble on the output, denoting that a complement operation is performed on the output of the OR gate.

The truth table and the graphic symbol of NOR gate is shown in the figure.

X	Y	NOR
0	0	1
0	1	0
1	0	0
1	1	0



The truth table clearly shows that the NOR operation is the complement of the OR.

Universal Gates:

A universal gate is a gate which can implement any Boolean function without need to use any other gate type.

6.

1. Cascade Amplifier:

To increases the voltage gain of the amplifier, multiple amplifier are connects in cascade. The output of one amplifier is the input to another stage. In this way the overall voltage gain can be increased, when number of amplifier stages are used in succession it is called a multistage amplifier or cascade amplifier. The load on the first amplifier is the input resistance of the second amplifier. The various stages need not have the same voltage and current gain. In practice, the earlier stages are often voltage amplifiers and the last one or two stages are current amplifiers. The voltage amplifier stages assure that the current stages have the proper input swing. The amount of gain in a stage is determined by the load on the amplifier stage, which is governed by the input resistance to the next stage. Therefore, in designing or analyzing multistage amplifier, we start at the output and proceed toward the input.

A n-stage amplifier can be represented by the block diagram as shown in **fig.1**

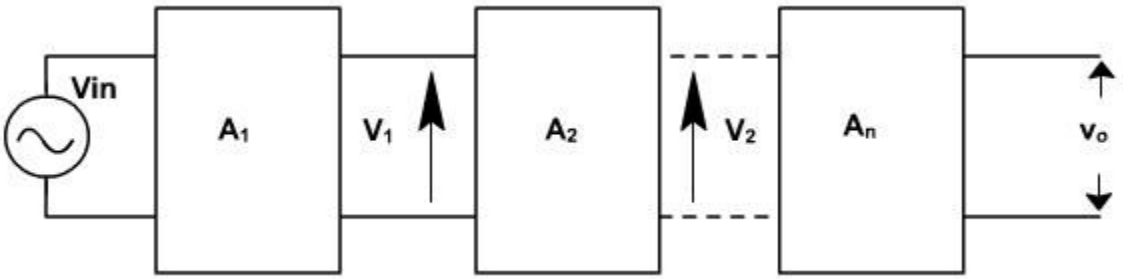


Fig.1

In **fig. 1**, the overall voltage gain is the product of the voltage gain of each stage. That is, the overall voltage gain is ABC.

To represent the gain of the cascade amplifier, the voltage gains are represents in dB. The two power levels of input and output of an amplifier are compared on a logarithmic scale rather than linear scale. The number of bels by which the output power P_2 exceeds the input power P_1 is defined as

$$\text{No of bels} = \log_{10}\left(\frac{P_2}{P_1}\right)$$

$$\text{or No of dB} = 10 * \text{No. of bels}$$

$$= 10\log_{10}\left(\frac{P_2}{P_1}\right)$$

Since,

$$P_1 = \frac{v_1^2}{R_{in}} \;\&\; P_2 = \frac{v_2^2}{R_0}$$

where R_{in} is the input resistance of the amplifier and R_0 is the load resistance

$$dB = 10\log_{10}\left(\frac{v_2^2/R_0}{v_1^2/R_{in}}\right)$$

In case R_{in} and R_0 are equal, then power gain is given by

$$dB = 10\log_{10}\left(\frac{v_2}{v_1}\right)^2 = 20\log_{10}\left(-\frac{v_2}{v_1}\right)$$

$$\therefore A_{dB} = A_{dB1} + A_{dB2} + \ldots..$$

Because of dB scale the gain can be directly added when a number of stages are cascaded.

7.a)

CMOS - Advantages
Operates on 3-18V and on d.c
They have a low current drain
They have low power consumption.
They have a high FAN OUT
CMOS has very good noise immunity.

CMOS - Disadvantages
Slow switching speed
CMOS devices can easily be destroyed by static electricity

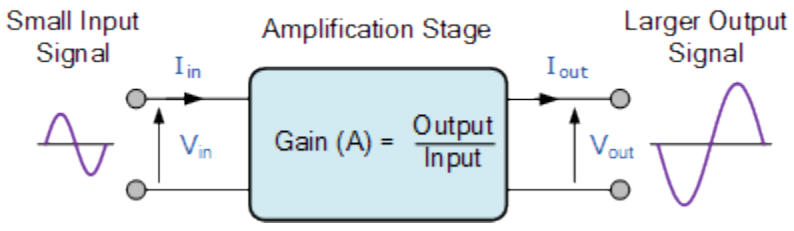
TTL - Advantages
Fast switching speed
No damage is done to TTL devices if inputs are left unconnected

TTL - Disadvantages.
Requires a stabilised voltage supply in the range +5V + or - 0.25V
Low fan out
Higher power consumption than CMOS devices.
High current drain

b) Amplifier Gain

The introduction to the amplifier gain can be said to be the relationship that exists between the signal measured at the output with the signal measured at the input. There are three different kinds of amplifier gain which can be measured and these are: *Voltage Gain* (Av), *Current Gain* (Ai) and *Power Gain* (Ap) depending upon the quantity being measured with examples of these different types of gains are given below.

<u>Amplifier Gain of the Input Signal</u>



<u>Voltage Amplifier Gain</u>

$$Voltage\,Gain\,(A_v) = \frac{Output\ Voltage}{Input\ Voltage} = \frac{Vout}{Vin}$$

Current Amplifier Gain

$$Current\,Gain\,(A_i) = \frac{Output\ Current}{Input\ Current} = \frac{Iout}{Iin}$$

Power Amplifier Gain

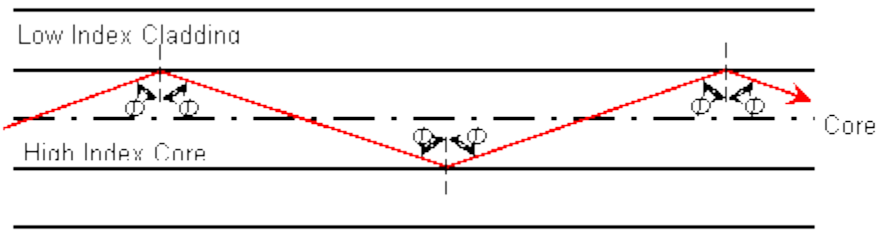
$$Power\,Gain\,(A_p) = A_v\ x\ A_i$$

8 .

Principle of ray propagation :

The ray propagation through fibre is based on simple property of light ray, **Total Internal Reflection**. As we all know that when light ray is passing from denser (refractive index is higher) dielectric medium to a rarer (refractive index is lower) dielectric medium then from the point of incidence at the interface it bends away from the normal. When the incidence angle is sufficiently high such that the angle of refraction is 90º then it is called critical angle. Now if light ray falls at the interface of the two mediums at an angle greater than the critical angle then the light ray gets reflected back to the originating medium with high efficiency (around 99.9%) i.e. total internal reflection occurs. With the help of innumerable total internal reflections light waves are propagated along the fiber with low loss as shown in figure2. In this context, two parameters are very crucial namely **Acceptance Angle** and **Numerical Aperture**.

Figure 2.



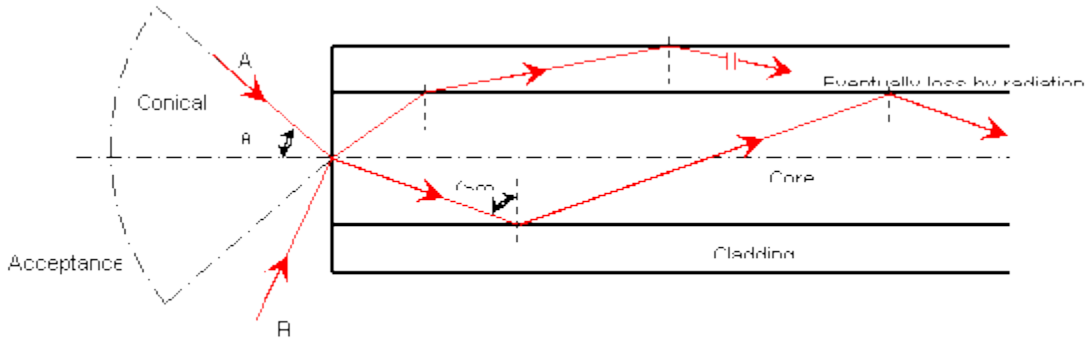
Acceptance angle is the maximum angle at which light may enter the fiber in order to be propagated and is denoted by θa in figure3. The relationship between the acceptance angle and the refractive

indices of the three media involved-core, cladding and air, leads to the definition of Numerical Aperture which is given by –

$NA = (n1^2-n2^2)^{1/2} = n0 \sin \theta a$ where n0 is the refractive index of air.

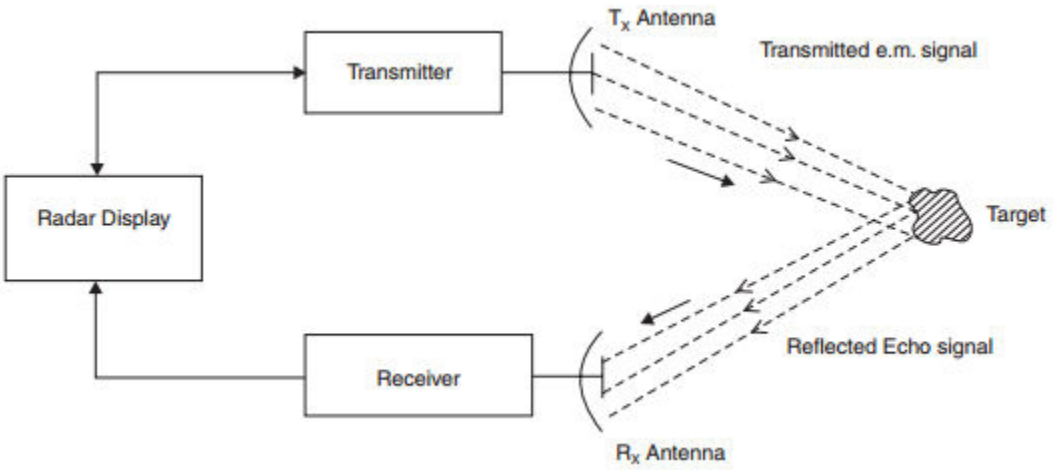
The light ray shown in figure3 is known as a meridional ray as it passes through the axis of the fiber. However, another category of ray exists which is transmitted without passing through the fiber axis and follows a helical path through the fiber.

Figure 3.



9.

Basic Radar block diagram



- **Transmitter**
  The radar transmitter produces the short duration high-power rf pulses of energy that are into space by the antenna.

- **Duplexer**
  The duplexer alternately switches the antenna between the transmitter and receiver so that only one antenna need be used. This switching is necessary because the high-power pulses of the transmitter would destroy the receiver if energy were allowed to enter the receiver.
- **Receiver**
  The receivers amplify and demodulate the received RF-signals. The receiver provides video signals on the output.
- **Radar Antenna**
  The Antenna transfers the transmitter energy to signals in space with the required distribution and efficiency. This process is applied in an identical way on reception.
- **Indicator**
  The indicator should present to the observer a continuous, easily understandable, graphic picture of the relative position of radar targets.

Applications

1. Air Traffic Control (ATC)

2. Air Navigation

3. Ship Safety

4. Space: Radars are used for rendezvous and dockign and was used for landing on the moon. The large ground based radars are used for detection and tracking of satellites. The satellite-borne radars used for remote sensing (SAR, Synthetic Aperture Radar).

5. Remote Sensing

6. Law Enforcement: The radar speed meter, familiar to many, is used by police for enforcing speed limits.

7. Military: Radar is an important part of air-defence systems as well as the operation of offensive missiles and other weapons.