PERFORMANCE EVALUATION AND ANALYSIS OF PASSIVE OPTICAL NETWORK WITH OPTIMUM PARAMETER`S

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Abstract: This paper shows Optical networks, optical amplifiers play a most pivotal property is that it directly converts the optical energy without converting it into electrical energy. This paper proposes a novel designing, analysis, and evaluation of an optical network. This paper also explains why EDFA optical amplifier is much better as a comparison to the other optical amplifier (network). The optical amplifier is the most pivotal property is that it directly converts the optical energy without converting electrical energy. This paper tells the optimum parameters utilization for the conversion of amplifying the optical signal without any distortion. In this paper design and implement the cascaded stages of the optical amplifier (network) without any loss of the signals in the different stages of the amplifier. It’s also explaining the future prospective of the EDFA optical amplifier. In the Erbium-doped fiber amplifier (EDFA) optical amplifier (network) explores how optical network increases the efficiency of the signal. This optical network shows that the wavelength and noise gain response in the stages of the optical network and it will explore the different parameters of the optical network. It will explain the understanding of the EDFA optical network and explore the next generations of the network`s and its characteristics.

Keywords: EDFA, WDM, PUMP POWER PON,APON,EPON, ETC.

INTRODUCTION: In the past decade a phenomenal growth of telecommunication networks has been observed, where most part determined by regularly growing client requests for new applications and in addition nonstop progressions in the technologies concerned. The rise of Wavelength Division Multiplexing (WDM) modernization has given a pragmatic answer to meet this challenge. In addition, with Passive Optical Network–Wavelength Division Multiplexing (PON-WDM) innovation, various optical signals can be transmitted concurrently and autonomously utilizing non-covering bearer wavelengths using a single fiber, each at couple of Gigabits per second (Gbps), which fundamentally raises the utilizable Bandwidth (BW) of an optical fiber [1]. In the Passive Optical Network (PON) is a Point-To-point and Point –to-Multipoint (P2MP) framework where, splitters are utilized to empower a solitary fiber appropriate for several premises, usually 16-128. A PON is the form of access network with the components of an Optical Line Terminal (OLT) in the main Central Office (CO) with various Optical Network Units (ONUs) as a user or many others server points likes to close to end clients. It lessens the number of fibers and CO hardware required when equated with Point-to-Point (P2P) designs. In its most common shape, an optical system will contain both dynamic and inactive optical devices. Dynamic segments can be situated at the CO, inside end focuses at the client's premises, and in the repeaters, switches, and different devices situated in the transmission route between CO and the client [2]. A large number of these gadgets are equipped for being reconfigured by either a neighbourhood or a remote control gadget. These are utilized for capacities, for example, mixture of light starting with one fiber then onto the next, diverting the light signal to another transmission path, part the signal into at least two branches, enhancing the optical power, and giving out data contained in the signal.

Now the recent development of the web controlling and access administrations, for example, the Internet Protocol (IP) video transmission and Voice over IP (VoIP) is increasing the interest for long distance broadband access. Instead the vast majority of the bandwidth administrations around the world are conveyed with the copper based systems, optical network innovation has been industrially accessible for quite a while and is being implemented in substantial amount in few nations [3]. With excessive BW contributions of optical systems in Wide Area Network (WAN), confined access is required for connecting Local Area Network (LAN) and the service network. This reflectively affects the plan of cutting edge optical system for the next generation structures and innovations. There are key arrangements of fiber based methodology elected to convey in systems. One is Active Optical Network (AON) and another is PON. The previous relies upon active components and in PON no active components are used. [4].

OPTICAL NETWORK: Optical systems are high-limit media transmission systems dependent on optical advancements and parts that give steering and rebuilding at the bandwidth range just as bandwidth based methods [5]. In this utilizes optical cables for information transmits. To enhance with the throughput of the system and to limit transmission delay, the system framework must both lessen the occasions a message is prepared by the central hubs and must streamline the handling at every hub. The unpredictable idea of large portion of the current systems doesn't really permit this. Subsequently unpredictable routing tables are frequently used to settle on directing choices requiring complicated and tedious handling. In optical networks, clients are requesting more services and alternatives are conveying more and diverse sorts of information traffic. It gives the required BW and adaptability to empower start to finish wavelength administrations. Fiber offers a huge BW than regular copper links. A solitary optical cable has a potential BW in the order of 50THz. Moreover, it has minimal effort, amazingly very low bit error rate (normally 10^{-12}, contrasted with 10^{-6} in copper links). Subsequently, most favoured mechanism in the information transmits within the lower bit rate in excess of couple of many Mb/s every moment more than any separation within one km. In the additionally favoured methods for acknowledging short distance (a couple of meters to several meters), rapid (Gbps or more) interconnection inside extensive frameworks. In the previous couple of decades, optical fibers have been generally established in a wide range of media transmission systems. Optical fibers are utilized in two ages of optical systems. In the original, it was basically utilized for transmission and just to give broadcasting ability, since it gives low Bit Error Rate (BRR) and higher limits than copper links. All the exchanging and other sharp system capacities were dealt with the use of electronics components. Subsequently, the BW was restricted by the hardware at the fiber endpoints. Right now, transmission rates are confined to 10 Gbps (OC-192) in monetarily accessible frameworks. The main Advantage in the fibres' is to huge BW is additionally taken by a strategy called Dense Wavelength Division Multiplexing (DWDM), where the optical BW is alienated into add up to many channels on various wavelengths and each channel works at electronic rate. These wavelengths do not overlap with one another as long as the channel space is sufficiently substantial. Other than the huge BW, WDM systems can likewise give information straightforwardness in which the system may acknowledge information at any speed and according to any standard frames. Information lucidity might be acknowledged through all-optical (single-bounce) transmission and exchanging of signals. In an all-optical system, information is exchanged from source to goal in optical shape without experiencing any optical to electrical change [6, 7].

EDFA Design:

The key element of EDFA optical amplifier (network) innovation is the Erbium Doped cable/fiber (EDF), is an ordinary optical fiber doped with erbium. Essentially, EDFA dependents on the length of the optical fiber (EDF) , a pump laser, and a WDM combiner. The WDM combiner is for joining the sign and siphon wavelength, with the goal that they can engender at the same time through the EDF. EDFA can be planned that siphon vitality spreads a similar way as the sign (forward siphoning), the other way to the sign (in reverse siphoning), or both sides simultaneously. The pump vitality may either by 980nm pump laser or 1480nm pump laser, or a mix of both. The most widely recognized arrangement is the forward siphoning design utilizing 980nm siphon vitality. Since this setup exploits the 980nm semiconductor siphon laser diodes, which highlight compelling cost, dependability and low power utilization.

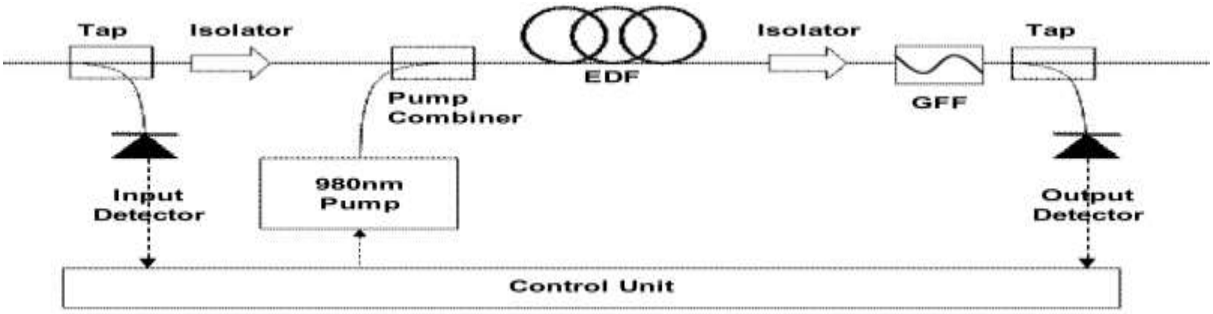

Figure 1.1 Basics of EDFA (Optical network)

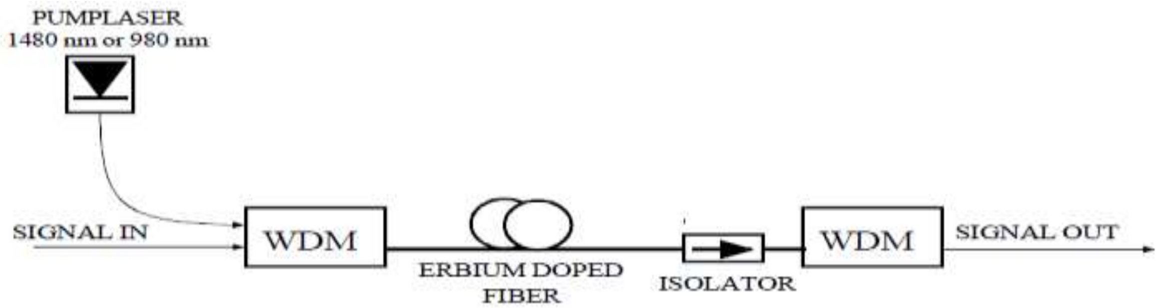

Figure 1.2 Erbium Doped Fiber Optical Amplifier

Optical Network Design:

in this network optical amplifier (network) shows the simulation results with the gain and wavelengths, with noise and wavelength.

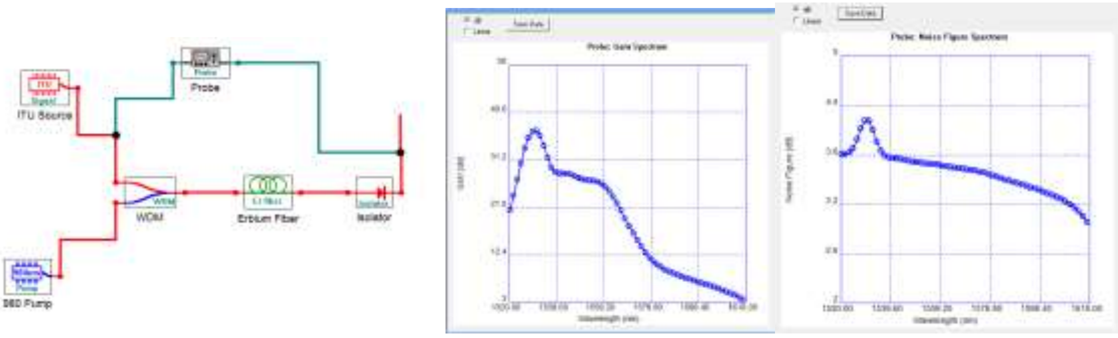

Figure:1 First Stage of optical network design. Fig:1(a) Gain Versus Wavelength Fig:1(b) Noise Versus Wavelength

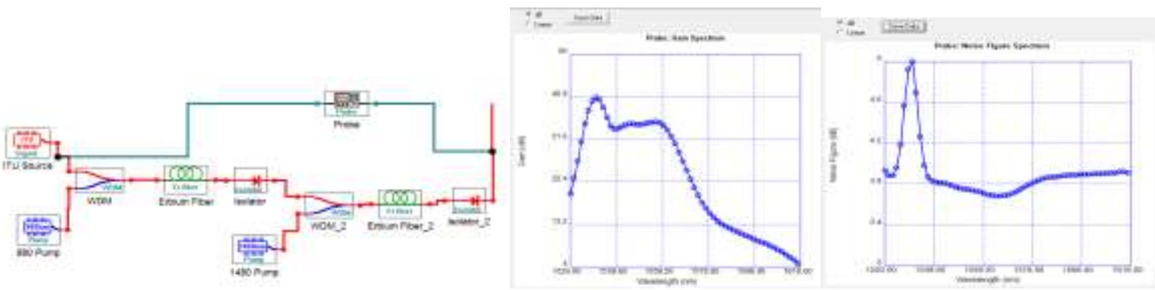

Fig:2 Second Stage of Optical Network Design Fig:2(a) Gain Versus Wavelength Fig:2(b) Noise Versus Wavelength

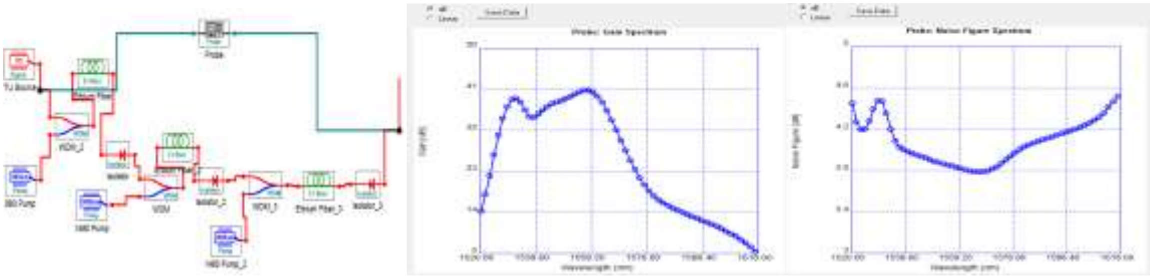

Fig:3 Third Stage of Optical Network Design Fig:3(a) Gain Versus Wavelength Fig:3(b) Noise Versus Wavelength

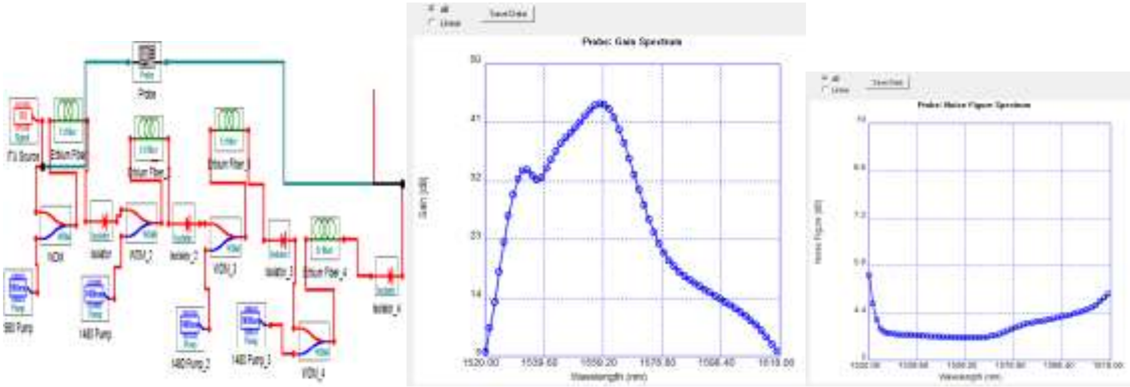

Fig:4 Forth Stage of Optical Network DesignFig:4(a) Gain Versus Wavelength Fig:4(b) Noise Versus Wavelength.

Results and discussion:

After the simulation results of the entire optical network shown in the figures (1-4). In these results shown that the gain and noise both changed when the wavelength has been changed. When first part or the phase of the EDFA network shows that standard gain minimum and the gain flatness shown after the signal passes from the half distance of the wavelength and suddenly decay after certain period it will be constant as shown in the figure 1.1(b and c). When second stage of the EDFA optical amplifier (network) is designed the maximum gain increases and the wavelength also increases as shown in the figure2.1 (b, c). After the final phase in the optical amplifier (network) shows simulation results shows that the previous results are not good but fourth stage results after simulation is much better as compares to the others as shown in figures 4.1(b,c). The parameters as shown in the table 1.1 check the simulation results and see the difference between all the stages.

Table 1.1

Sr.. No.	Optimum Parameter	Optical network (First Stage) results in dB.	Optical network (Second Stage) results in dB.	Optical network (Third Stage) results in dB.	Optical network (Fourth Stage) results in dB.
1	Standard gain	27.801	32.485	34.531	35.929
2	Maximum gain	36.967	40.368	40.670	43.891
3	Minimum gain	3.487	4.670	5.389	5.710
4	Gain flatness (p-p)	33.480	35.991	35.281	38.181
5	Gain Flatness (rms)	10.586	11.750	11.973	12.092
6	Gain tilt	17.816	15.066	8.814	0.125

This optical network design shows that the optimum parameters of the optical amplifier (network).

In this paper explore the different changes of the gain and noise when the wave length of different stages of EDFA amplifier. In this ranges of the wavelengths used in between the 1550 nm -1620 nm. The software used for the designing of the optical network is GM and FOSP for the designing of optical amplifier optical network into the maximum range of the gain increases and gain decreases with wavelength goes to zero in the maximum reach of wavelength in the case of noise also it is also increases slowly to the peak and after that it will slowly decay at last it reach the zero at the maximum value of the wavelength.

The Optimum Parameter of the optical network:

Table 1.2 shows that the optimum parameters after the results or the simulation results of the optical amplifier (network).

Optimum parameter`s optical network

Sl. No.	Optimum Parameter`s	Range in (First Stage)%	Range in (Second Stage)%	Range in (Third Stage)%	Range in (Forth Stage)%
1	Power conversion efficiency	29.944	39.361	40.541	41.213
2	Quantum conversion efficiency	47.113	48.295	47.014	46.656

Conclusion:

In this paper demonstrates the distinctive optical parameters in the various phases of the optic al organize. In this system each stage gives the better outcome for the past stage yet in this system can likewise be adjusted with the diverse optical improvement strategies with the assistance of wavelength division multiplexing methods like OFDM, TWDM, PON, and so forth for the progression of the optical system it tends to be shown with versatile information rates for changing connection misfortune spending plan, utilizing propelled balance arrangement, for example, OFDM. In this paper shows that the wavelength and gain changes during the transmission but still it can be improved also. But in this paper the gain and noise changes with respect to the wavelength after certain level it will be constant and does not changes in the further increases the gain. So this paper can also improve in the furtherr stages of the optical amplifier (network) but in this paper shows the maximum utilization of the amplifier with the improved parameters.

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