EC0305 - OF3

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1) $(p, k) = (2, 3)$

Number of nodes: $N = k p^k$
$= 3 \times 2^3$
$= 24$

Number of wavelength
$N_\lambda = pN = k p^{k+1}$
$= 3 \times 2^{3+1}$
$= 48$

c) 24 and 48

2) c] Non-linear elastic scattering process
b] Non-linear variations of the refractive index in silica fiber

3) D] Point to Point Links

4) B] the traffic flowing along a certain path can be switched automatically to an alternate or standby path following failure or degradation of the link segment

5) D] 48

6) A] Effective Area D) Effective Length

7) A] True

8) Doped multi-band

9) $g = \dfrac{g_0}{1 + N_{ph}/N_{phsat}}$ $N_{ph} = \dfrac{1}{T a v_g \tau_r}$ | $g_0 = T a \tau_r \left(\dfrac{I}{qa} - \dfrac{n_{th}}{\tau_r}\right)$

10) Stark Splitting: The process of amplication at star coupler to ensure power / signal strength

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11) 1480 nm - Higher energy level of metastable band
1530 nm - Lower/normal energy level of metastable band
1600 nm - Energy level near to ground state

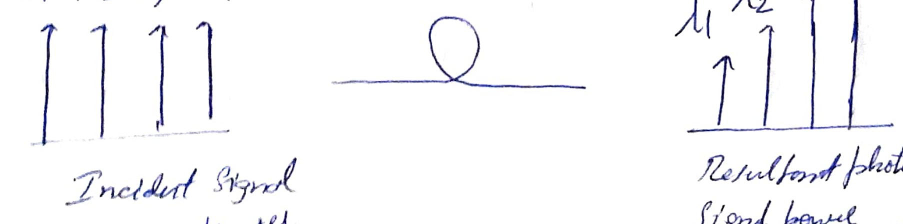
12) Configurations of EDFA:

1) Co directional EDFA
2) Counter directional EDFA
3) Dual directional EDFA

13) population inversion

14) <u>Stimulated Raman Scattering</u>:

The scattering results due to interaction of optical signals with molecular and atomic components of fiber. The incidenting photon on fiber molecule is called Stroke photon which has energy of $h\nu_1$, after interaction decreases to ($h\nu_2$) lossing its energy. This results in loss of signal power. The wavelength of incidenting photon is called pump wave length. The resultant photon has similar signal power of conjugate sub-channel of similar wavelength which depletes its signal power. The absorption of energy by fiber material will result in change of refractive index. The resultant photon wavelength is longer from incident photon $\lambda_4 > \lambda_3 > \lambda_2 > \lambda_1$



...nm - Higher energy level of metastable band

1530 nm - ,

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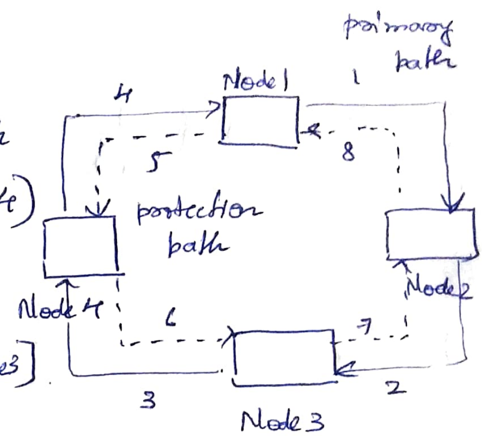
15) Working of UPSR and BLSR

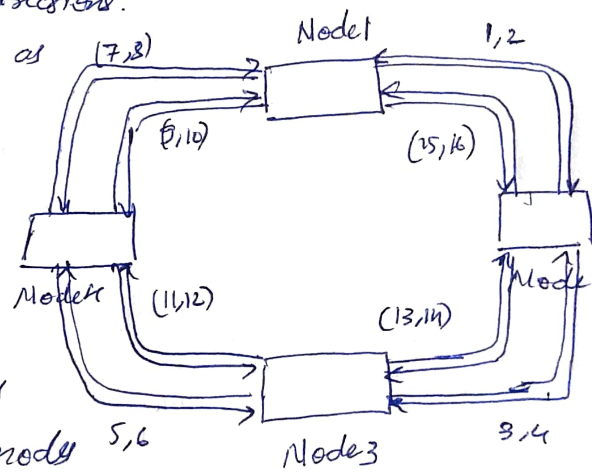
Unidirectional Path Switching Ring (UPSR):

⇒ It consists of two fibers namely primary path and protection path
The signals propagate in primary path only in one direction (Node1 - Node2 - 3 - 4)
The signal will take loop in order to reach all nodes. Upon failure it takes protection path [Node (1-3): Node1 - 5 - 6 - Node3].



Bidirectional Line Switching Ring (BLSR)

The signal can travelle in both directions.
It comes with better transmission as more bandwidth due to more cable availabilty. The node can have simultaneous transfer of signal.
Upon failure the signal changes path from primary to protection which facilitates transfers
If the connection between two nodes fail, it'll take loop around path to reach destination



16) Amplifier gain: The gain in SOA is given by

$$G = \frac{P_{s\,out}}{P_{s\,in}} \qquad G = \exp[\Gamma(g_a - \alpha)\tau]$$
$$= \exp[g(z)\, t]$$

$$g(z) = \frac{g_0(z)}{1 + \frac{P_0(z)}{P_{amp,sat}}}$$

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1480 nm - Higher energy level of metastab

1530 nm - Lower/normal energy level of m

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The gain per incremental length: $dP = g(z) P_s(z)\, dz$

$$g_z\, dz = \left(\frac{1}{P(z)} + \frac{1}{P_{ampsat}}\right) dP$$ int of eff length

$$\int_0^L g_0\, dz = \int_{P_1}^{P_2} \left(\frac{1}{P(z)} + \frac{1}{P_{ampsat}}\right) dP \Rightarrow \boxed{G = 1 + \frac{P_{ampsat}}{P_{sin}} \ln\left(\frac{G_0}{G}\right)}$$

17) Power Conversion Efficiency (PCE) and Gain in EDFA

The output power must be less than the input power along with response from pump wavelength to conserve the power.

$$P_{out} < P_{sin} + \frac{\lambda_p}{\lambda_s} P_{pin}$$

The Power conversion stan is measured by difference in signal power with pump input power. Here $(P_{pin} \gg P_{sin})$

$$PCE = \frac{P_{sout} - P_{sin}}{P_{pin}} \approx \frac{P_{sout}}{P_{pin}} < \left(\frac{\lambda_p}{\lambda_s}\right)$$

The Quantum conversion Efficiency $\left(QCE = \frac{\lambda_s}{\lambda_p} PCE\right)$

The gain is given as ration of output wrt input signal power

$$\boxed{G = \frac{P_{sout}}{P_{sin}} \approx \left(1 + \frac{\lambda_p}{\lambda_s} \frac{P_{pin}}{P_{sin}}\right)}$$

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