Page :
Date : / /

interms of frequency. A key reason for selecting a fixed frequency spacing, rather than a constant wavelength spacing, is that when locking a laser to a particular operating mode it is the frequency of the laser that is fixed. The ITU-T Recommendation G.692 specif selecting the channels from a grid of frequencies referrenced to 193.100 THz (1552.524nm) and spacing them 100 GHz (0.8nm) and ~~15002 GHz (1.6nm)~~ apart. Suggested alternative spacings include 50GHz (0.4nm) and 200 GHz (1.6nm).

The literature often uses the term dense WDM (DWDM), in contrast to conventional or regular WDM. This term does not denote a precise operating region or implementation condition, but instead, is a historically derive

Page :
Date : / /

designation. In general, it refers to the spacings denoted by ITU-T G.692. The original use of WDM was to upgrade the capacity of installed point-to-point transmission links. Typically, this way achieved by adding wavelengths that were separated by several tens, or even hundreds, of nanometers, in order not to impose strict requirements on the different laser sources and the receiving optical wavelength splitters. In the late 1980s, with the advent of tunable lasers that have extremely narrow linewidths, one then could have very closely spaced signal bands. This is the basis of dense WDM.

A key feature of WDM is that the discrete wavelengths form an orthogonal set of carriers that can be separated, routed, and switched without interferring with each other. This holds as long as the optical intensity is kept sufficiently low to prevent non-linear effects. Such as Stimulated Brillious scattering and four-tetd wave mixing processes, from degrading the link performance.

The implementation of WDM networks requires a variety of and/or active devices to combine, distribute, isolate, and amplify optical power at different wavelengths. the passive devices require no external control of their operation. So they are somewhat limited in their application in WDM networks. These components are mainly used to split and combine or tap off optical signals. The performance of active devices can be controlled electronically, thereby providing a large degree of network flexibility. Active WDM components include tunable optical filters, tunable optical sources and optical amplifiers.

F2. The use of such components in a typical WDM link containing various types of optical amplifiers. At the transmitting end, there are several independently modulated light sources, each emitting signals at a unique wavelength. Here, a multiplexer is needed to combine these optical outputs into a serial spectrum of closely spaced wavelength signals and couples them onto a single fiber. At the receiving end, a demultiplexer is required to separate the optical signals into appropriate detection channels for signal processing. At the transmitting end, the basic design challenge

Page :
Date : / /

is to have the multiplexer provide a low-loss path force from each optical source to the multiplexer output. Since the optical signals that are combined generally do not emit any significant amount of optical power outside of the designated channel spectral.

Fiber Grating Filters:-

A grating is an important element in WDM systems for combining and separating individual wavelengths. Basically, a grating is a periodic structure or perturbation in a material. This variation in the material has the property of reflecting or transmitting light in a certain direction depending on the wavelength. Thus, grating can be categorized as either transmitting or

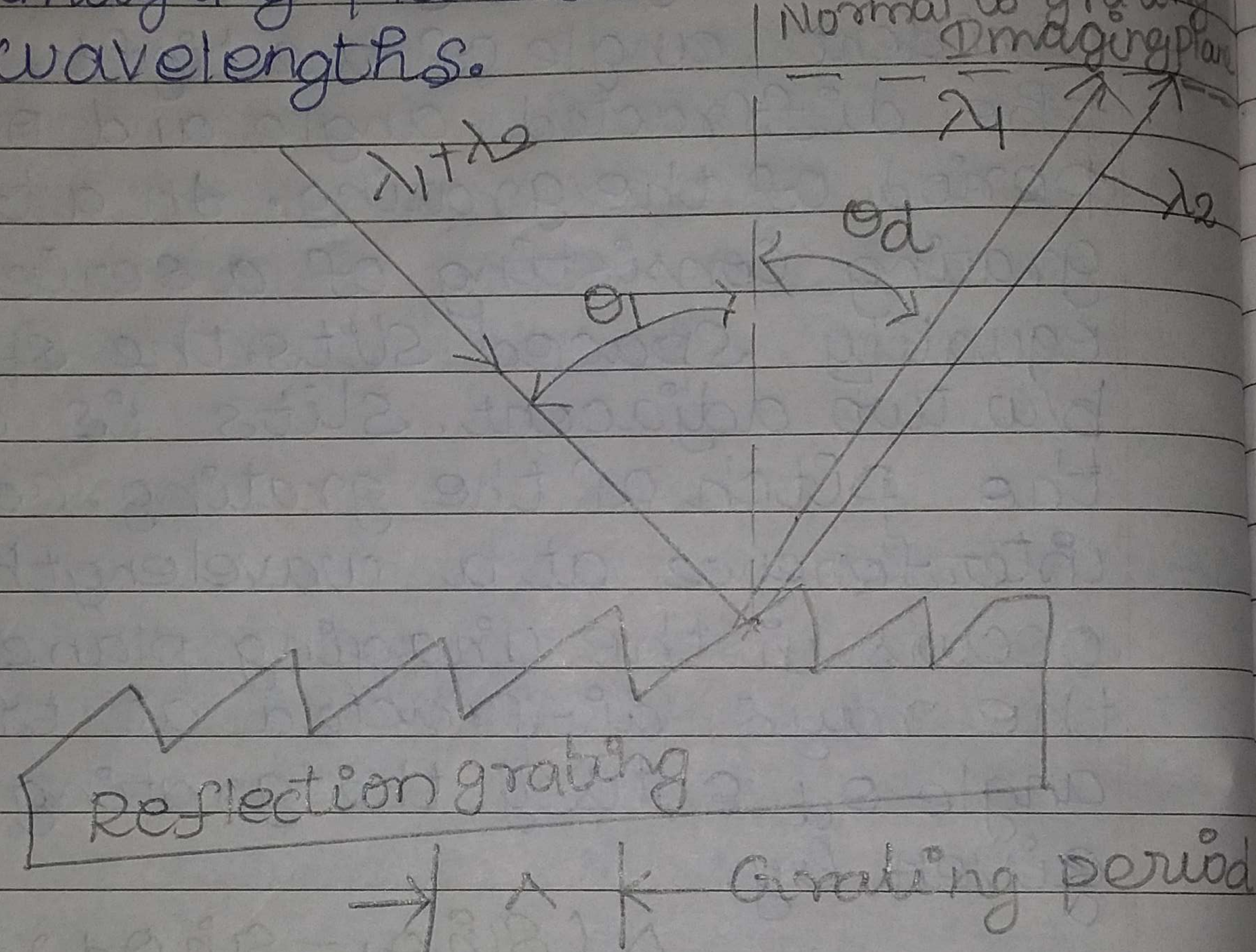
Page :
Date : / /

reflecting gratings.

Various parameters for a reflection grating. Here, θ_i is the incident angle of the light, θ_d is the diffracted angle, and Λ is the period of the grating. In a transmission grating consisting of a series of equality spaced slits, the spacing b/w two adjacent slits is called the pitch of the grating. Constructive interference at a wavelength λ occurs in the imaging plane when the rays diffracted at the angle θ_d satisfy the grating eqn given by,

$$\Lambda(\sin\theta_i - \sin\theta_d) = m\lambda \quad \text{---(1)}$$

Here m is called the order of the grating. In general, only the first-order diffraction condition m = 1 is considering. A grating can separate individual wavelengths since the grating equation is satisfied at different point in the imaging plane for different wavelengths.

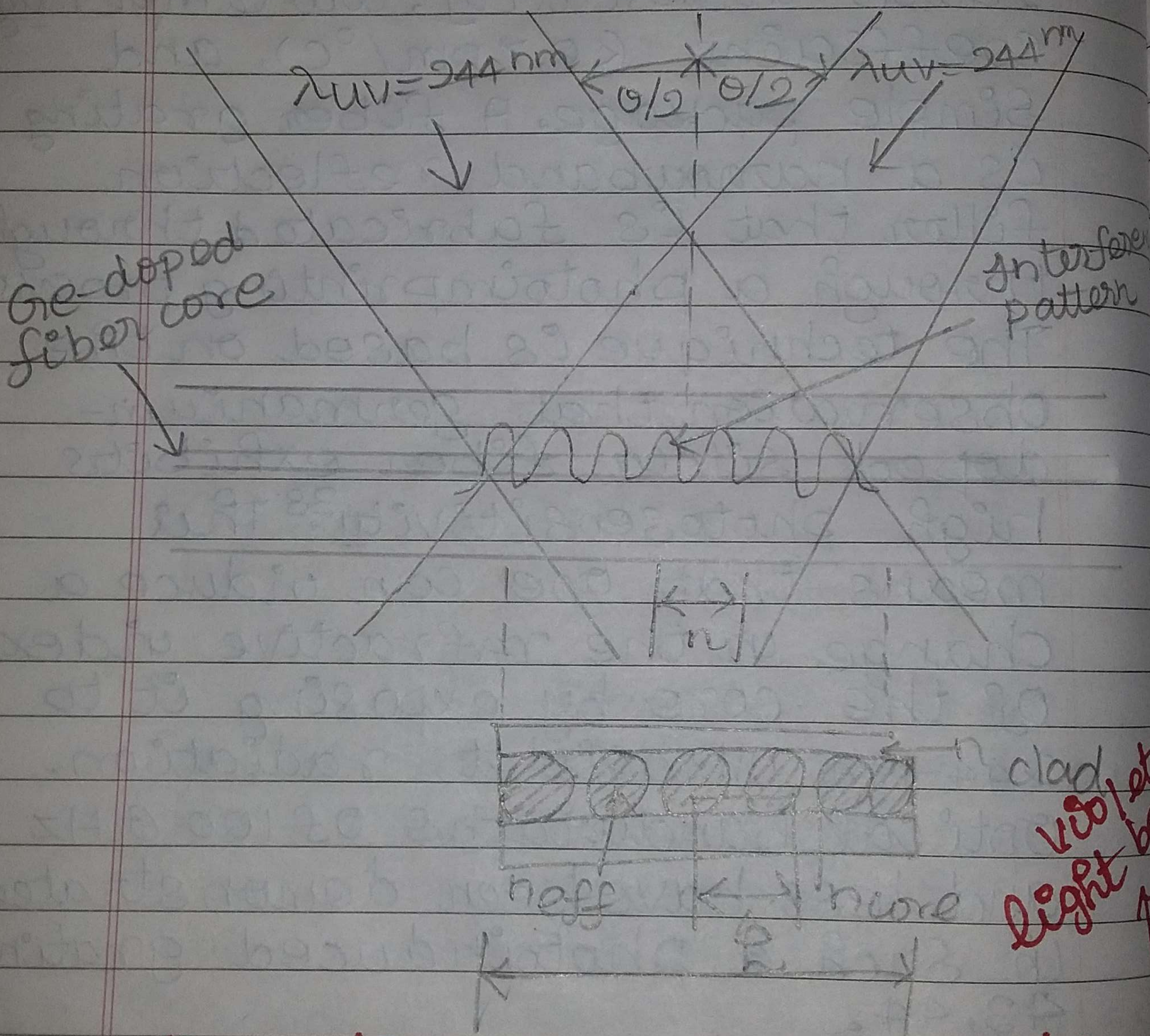


A Bragg grating constructed within an optical fiber constitutes a high performance device for accessing individual wavelengths in the closely spaced spectrum of dense WDM

Systems.[38-42] Since this is an all-fiber device, its main advantage are low cost, low loss, ease of coupling with other fibers polarization intensitivity, low temperature coefficient (<0.7 pm/°C), and simple package. A fiber grating is a narrowband reflection filter that is fabricated through through a photoimprinting process. The technique is based on the observation that germanium-doped silica fiber exhibits high photosensitivity.[38] This means that one can induce a change in the refractive index of the core by exposing it to 244-nm ultraviolet radiation. optical bandwidths of 100 GHz and less have been demonstrated in such a photoinduced gratings 43, 44.

Page :
Date : / /

(Several methods can be used to create a fiber-phase-grating demonstrates the so-called external-writing technique.



Formation of a Bragg grating in a filter core two interacting ultra

Page :
Date : / /

The grating fabrication is accomplishead by means of two ultraviolet beams transversely irradiating the fiber to produce an interference pattern in the core. Here, the regions of high intensity refractive index of the photosensitive core, whereas it remains unaffected in the zero-intensity region. A permanent reflective Bragg grating is thus written into the core. When a multi-wavelength signal encounters the grating, those wavelengths that are phase-matched to the Bragg reflection condition are not transmitted.

Using the standard grating equ(1), with λ being the wavelength of the ultraviolet light λ_{uv}, the period Λ of the interference pattern can be calculated from

Page :
Date : / /

the angle θ b/w the two interfering beams of free-space wavelength λ_{UV}, Fig (2) that θ is measured outside of the fiber.

The imprinted grating can be represented as a uniform sinusoidal modulation of the refractive index along the core.

$$n(z) = n_{core} + \delta n\left[1 + \cos\left(\frac{2\pi z}{\Lambda}\right)\right] \quad ---(2)$$

where n_{core} is the unexposed core refractive index and δn is the photoinduced change in the index.

The maximum reflectivity R of the grating occurs when the Bragg condition holds, that is, at a reflection wavelength λ_{Bragg} where.

$$\lambda_{Bragg} = 2\Lambda n_{eff} \quad ---(3)$$

and n_{eff} is the mode effective index of the core.

At this wavelength, the peak reflectivity R_{max} for the grating of length L and coupling coefficient κ is given by,

$$R_{max} = \tanh^2(\kappa L) \quad ---(4)$$

The full bandwidth $\Delta\lambda$ over which the maximum reflectivity holds is[42]

$$\Delta\lambda = \frac{\lambda^2_{Bragg}}{\pi n_{eff} L}\left[(\kappa L)^2 + \pi^2\right]^{1/2} \quad ---(5)$$

An approximation for the full-width half-maximum (FWHM) bandwidth is,

$$\Delta\lambda_{FWHM} \approx \lambda_{Bragg}\, s\left[\left(\frac{\delta n}{2n_{core}}\right)^2 + \left(\frac{\Lambda}{L}\right)^2\right]^{1/2} \quad ---(6)$$

Where $s \approx 1$ for strong gratings with near 100 percent reflectivity, and $s \approx 0.5$ for weak gratings.

For a uniform sinusoidal modulation of the index throughout the core, the coupling