**UNIT-IV**

**FIBER OPTIC RECEIVER AND MEASUREMENTS**

**Session input 1**

**SubTopic:Recap:Optical sources and Receivers.**

**Suggested Activity: Cross word puzzles**

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## Across

1. both carrier& optical confinementcan be obtained using this structure
2. LED 's aare best choice for
3. an indirect bandgap material
4. the plane of the emmiting region is oriented perpendicular to the fiber axis

## Down

1. timedelay between the application of current pulse & the onset of optical emmision
2. optical power radiated into a unit solid angle /unit area

**SubTopic::Fundamental Receiver operation**

**Suggested Activity: Slide Representation**

 After remembering and defining the basic optical receivers in optical system, it would be appropriate to let the learners to identify the fundamental operation of receiver.The students are explained with the power point presentation of receiver operation.The purpose of each block is explained in detail.

**SubTopic::** **Signal transmission through digital link**

**Suggested Activity: Slide Representation**

After defining the basic receiver operation, it would be appropriate to let the learners to identify the changes in the signal during each stage.This changes are explained with a slide representation.The changes in the signal shapes are shown clearly.

**SubTopic: Conclusion**

**Suggested Activity: Summarize**

 Theoperation are summarized and explained once again and conclude the section.

<http://www.powershow.com/view/9b0c2-OGFjY/Optical_Receivers_Theory_and_Operation_powerpoint_ppt_presentation>

http://pongsak.ee.engr.tu.ac.th/le426/doc/OptCommC7.pdf

**Session Input-2**

**SubTopic:Recap:Fundamental Receiver operation.**

**Suggested Activity: Tit for Tat**

The students are formed into two groups (One team is full of girls and another team is full of boys) and a team leader is represented by each item and the questions are asked from each team alternatively. The marks were entered in the black board for each team.Upto 3 questions were asked by each team. The questions asked were as follows

* What is meant by AGC circuit?
* What is the use of photo detector?.
* What are the basic operation occur in receiver circuit?

**SubTopic: Pre amplifiers.**

**Suggested Activity: Slide Representation**

 After remembering and defining the basic operations of receivers in optical system, it would be appropriate to let the learners to identify the necessity of preamplifiers and types of pre-amplifiers. The types are displayed in slides. They are Low impedance, High Impedance, Transimpedance.Each types are explained with their own advantage and disadvantages..

**SubTopic: High impedance FET amplifiers.**

**Suggested Activity: Chalk and Talk**

After defining the pre amplifiers,the FET amplifiers are used for High impedance is explained

**Sub Topic: Conclusion and Summary**

**Suggested Activity: Recall by questions.**

 Thestudents are asked with questions like

* What are the advantages of Transimpedance Amplifier?.
* Compare Low impedance and High Impedance.?

<http://www.imagineeringezine.com/ttaoc/r-circuits.html>

<http://pongsak.ee.engr.tu.ac.th/le426/doc/OptCommC7.pdf>

**Session Input-3**

**SubTopic:Recap:Pre Amplifier.**

**Suggested Activity: Recall by questions**

The students are asked questions randomly. The questions asked were as follows

* What is the necessity of pre-amplifiers.?
* What are the types of Pr-amplifiers.?
* What are the advantages of transimpedance amplifier?.

**SubTopic: Error Sources.**

**Suggested Activity: Slide Representation**

 After remembering and defining the basic operations of receivers in optical system and pre amplifiers, it would be appropriate to let the learners to the error sources in the receiver.The errors from internal and external were explained.They are displayed in slides.

**SubTopic: Basic receiver configuration.**

**Suggested Activity: Slide Representation**

The basic receiver configuration is explained and the expression for mean output from the detector is derived.

**Sub Topic: Conclusion**

**Suggested Activity: Recall by questions.**

 Thestudents are asked with questions like

* What are the errors occur in amplifier?.
* What are the additional noises induced in APD photodetector than PIN photodiode?
* <http://users.ece.gatech.edu/~barry/pubs/journal/coherent.pdf>
* <http://www.powershow.com/view/9b0c2-OGFjY/Optical_Receivers_Theory_and_Operation_powerpoint_ppt_presentation>

**Session input -4**

**SubTopic:Recap:Error sources.**

**Suggested Activity: Tit for Tat**

The students are formed into two groups (One team is full of girls and another team is full of boys) and a team leader is represented by each item and the questions are asked from each team alternatively. The marks were entered in the black board for each team.Upto 5 questions were asked by each team. The questions asked were as follows

* What are the various sources of error.?
* What is meant by thermal noise?
* What is the noise introduced from the photo detector?.

**SubTopic: Probability of Error.**

**Suggested Activity: Chalk and Talk**

 After remembering and defining the basic receiver configuration and the error sources ,the performance of the receiver is explained with probability of error and quantum limit.The probability of error measurement is explained with variance and mean of error.

**SubTopic: Quantum Limit.**

**Suggested Activity: Chalk and Talk**

 The receiver performance in terms of quantum limit is explained

**Sub Topic: Conclusion and Summary**

**Suggested Activity: Problem Solving.**

 Theproblems were given from probability of error and quantum limit.The BER,Minimum optical power needed for specific bit error rate are calculated.

<http://users.ece.gatech.edu/~barry/pubs/journal/coherent.pdf>

<http://www.powershow.com/view/9b0c2-OGFjY/Optical_Receivers_Theory_and_Operation_powerpoint_ppt_presentation>

**Session input - 5**

**SubTopic:Recap:Receiver Performance.**

**Suggested Activity: Questioning**

The students are asked questions randomly.Upto 5 questions were asked to them. The questions asked were as follows

* What are the methods used to analyse receiver performance?
* What is meant by quantum limit?

**SubTopic: Attenuation measurement in fibers.**

**Suggested Activity: Brain storming**

 The attenuation measurement is explained with the formula used for attenuation.Two techniques were explained with neat block diagram.

**SubTopic: Absorption loss measurement.**

**Suggested Activity: Slide representation**

 The absorption loss measurement method is explained with thermocouple technique.with neat block diagram.

**Sub Topic: Scattering loss measurement**

**Suggested Activity: Slide representation.**

 The Scattering loss measurement method is explained with slides with neat block diagram

<http://books.google.co.in/books/about/Fiber_Optic_Measurement_Techniques.html?id=4Ga2ioaf48cC&redir_esc=y>

**Session input – 6**

**SubTopic:Recap: Attenuation and loss measurement.**

**Suggested Activity: Questioning**

The students are asked questions randomly.Upto 5 questions were asked to them. The questions asked were as follows

* What is the use of mode scrambler?
* Give the formula used for attenuation measurement in cutback technique.

**SubTopic: Intermodal Dispersion measurement in fibers.**

**Suggested Activity: Chalk and Talk**

 The intermodal dispersion is measured from the phase difference of the two signals with the CRO is explained. With measurement block diagram..

**SubTopic: Intramodal Dispersion measurement in fibers..**

**Suggested Activity: Slide representation**

 The intramodal dispersion measurement from the pulse width changes is explained with neat block diagram.

**Sub Topic: Dispersion in Frequency domain**

**Suggested Activity: Slide representation.**

 The Dispersion measurement for intramodal and intermodal dispersion in frequency domain is measured using spectrum analyzer in stead of CRO is explained with slides with neat block diagram

<http://arxiv.org/ftp/arxiv/papers/1207/1207.4663.pdf>

<http://www.scribd.com/doc/53036897/Fiber-Measurements>

**Session input - 7**

**SubTopic:Recap: Dispersion measurement.**

**Suggested Activity: Questioning**

The students are asked questions randomly.Upto 5 questions were asked to them. The questions asked were as follows

* What is the measurement needed in CRO for intermodal dispersion?
* What is the measurement needed in CRO for intramodal dispersion ?

**SubTopic: Refractive index profile measurement.**

**Suggested Activity: Chalk and Talk**

 The essential of refractive index measurement is explained.Then interferometric method of measurent is explained with fringes pattern

**SubTopic: Near field scanning method**

**Suggested Activity: Slide representation**

 The measurement of refractive index using near field scanning method is explained.

**Sub Topic: Refracted near field method**

**Suggested Activity: Slide representation.**

 The measurement of refractive index using refracted near field method is explained.

**Sub Topic:Conclusion**

**Suggested Activity: Summarize.**

 The methods discussed are explained with concepts

<http://www.scribd.com/doc/53036897/Fiber-Measurements>

**Session input - 8**

**SubTopic:Recap: Refractive profile measurement**

**Suggested Activity: Questioning**

The students are asked questions randomly.Upto 5 questions were asked to them. The questions asked were as follows

* What is the necessity for refractive index profile measurement?
* What are the methods available for refractive profile measurement ?

**SubTopic: Cutoff wavelength measurement.**

**Suggested Activity: Chalk and Talk**

 The essential of cutoff wavelength measurement is discussed.The bend attenuation method is used is explained.For this it is bend for 60 mm and then bend for 140 mm.The power measured for each time is found.From that graph cutoff wavelength is measured.

**SubTopic: Spot size method**

**Suggested Activity: chalk and Talk**

 For cutoff wavelength the power from single mode and multi mode is measured.the graph is plotted with this information.

**Sub Topic: Power step method**

**Suggested Activity: Chalk and talk.**

For cutoff wavelength the power step method used to plot a graph.From this information **cutoff wavelength is measured.**

**Sub Topic:Conclusion**

**Suggested Activity: Summarize.**

 The various methods for cutoff wavelength is summarized with concepts

<http://www.scribd.com/doc/53036897/Fiber-Measurements>

**Session input – 9**

**SubTopic:Recap:Cut off wavelegth measurement**

**Suggested Activity: Questioning**

The students are asked questions randomly.Upto 5 questions were asked to them. The questions asked were as follows

* How the two different powers are measured in bend attenuation method for cut off wavelength?
* What is measured for power step method?

**SubTopic: Numerical aperture measurement**

**Suggested Activity: Chalk and Talk**

 The essential of numerical aperture measurement is discussed.The method is used is explained in detail with neat block diagram

**SubTopic: Fiber diameter measurement**

**Suggested Activity: Slide presentation**

 The fiber diameter for multimode fiber is explained.From the shadow of pulse ,the diameter is measured.

**Sub Topic: Mode field diameter measurement**

**Suggested Activity: slide representation.**

For single mode fiber instead of fiber dia,mode field diameter is measured.**.**

**Sub Topic:Conclusion**

**Suggested Activity: Recall by questions.**

 The questions are asked to the students to summarize the Diameter measurement.The questions asked were

 What is meant by mode field diameter?

 What is the necessity of measuring NA?

<http://www.scribd.com/doc/53036897/Fiber-Measurements>

