Optical Fibers

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> Optical Fibers ELC4032 (Elective 3)

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Optical Fiber Communication System



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Optical Fibers

Advantages of Optical Communications

- Low transmission loss.
- Wide bandwidth.
- Small size and weight.



- Immunity to interference (EMI & EMP).
- Electrical insulation (No arcing, sparking, ground loops, hazards).
- Signal security (banking, computer networks, military systems).
- Abundant raw material.

Course Outline

- Optical versus radio frequency communications.
- Optical fibers.
- Ray representation in optical fibers.
- Modal analysis in step-index optical fibers.
- Signal attenuation and distortion.
- Optical properties of semiconductors Emitters: laser diodes & light emitting diodes.
- Photo detectors: PIN & avalanche photo diode (APD).

Course Learning Outcomes

- Clearly <u>describe</u> the concepts of optical communications in comparison to traditional electrical systems.
- <u>Derive</u> and <u>analyze</u> the physics of light confinement in multimode fibers using geometrical optics approximations.
- <u>Derive, analyze and interpret</u> the physical meaning of the dispersion formulae in single and multimode fibers using electromagnetic model.
- Identify, tabulate and analyze the sources of signal distortion and attenuation in optical fibers.

Course Learning Outcomes

- <u>Comprehend</u> the fundamentals of <u>semiconductor optical</u> sources (Light-emitting and laser diodes) used in communication systems and be <u>capable</u> of <u>characterizing</u> there parameters and drive circuits.
- <u>Comprehend</u> the fundamentals of <u>semiconductor optical</u> detectors (PIN and Avalanche photodiodes) used in communication systems and be <u>capable</u> of <u>characterizing</u> there parameters.
- <u>Conduct</u> research and <u>prepare</u> presentation on selected topics related to optical communications.