

# Fiber Optics and Laser Instrumentation

**ICPE-351**

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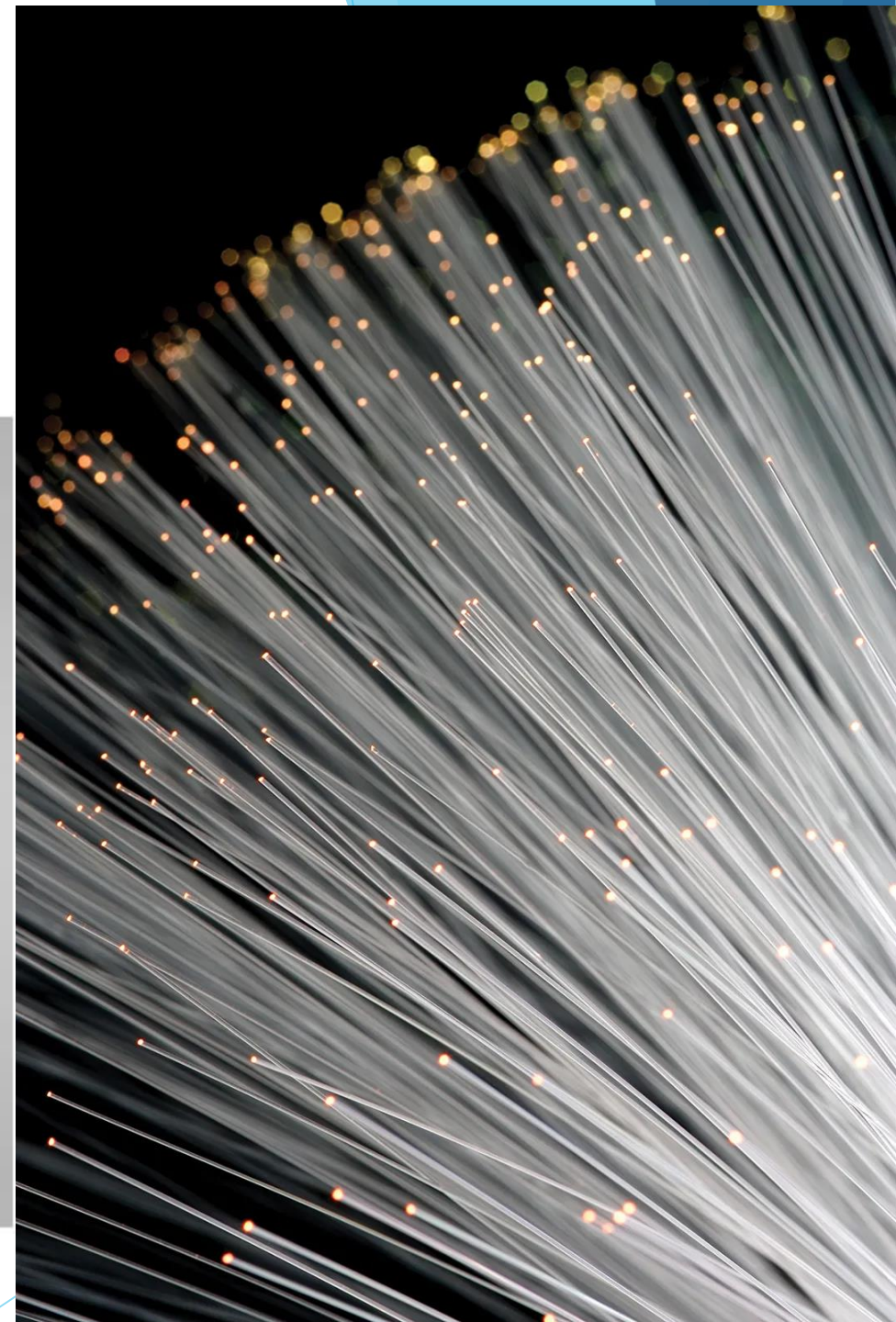
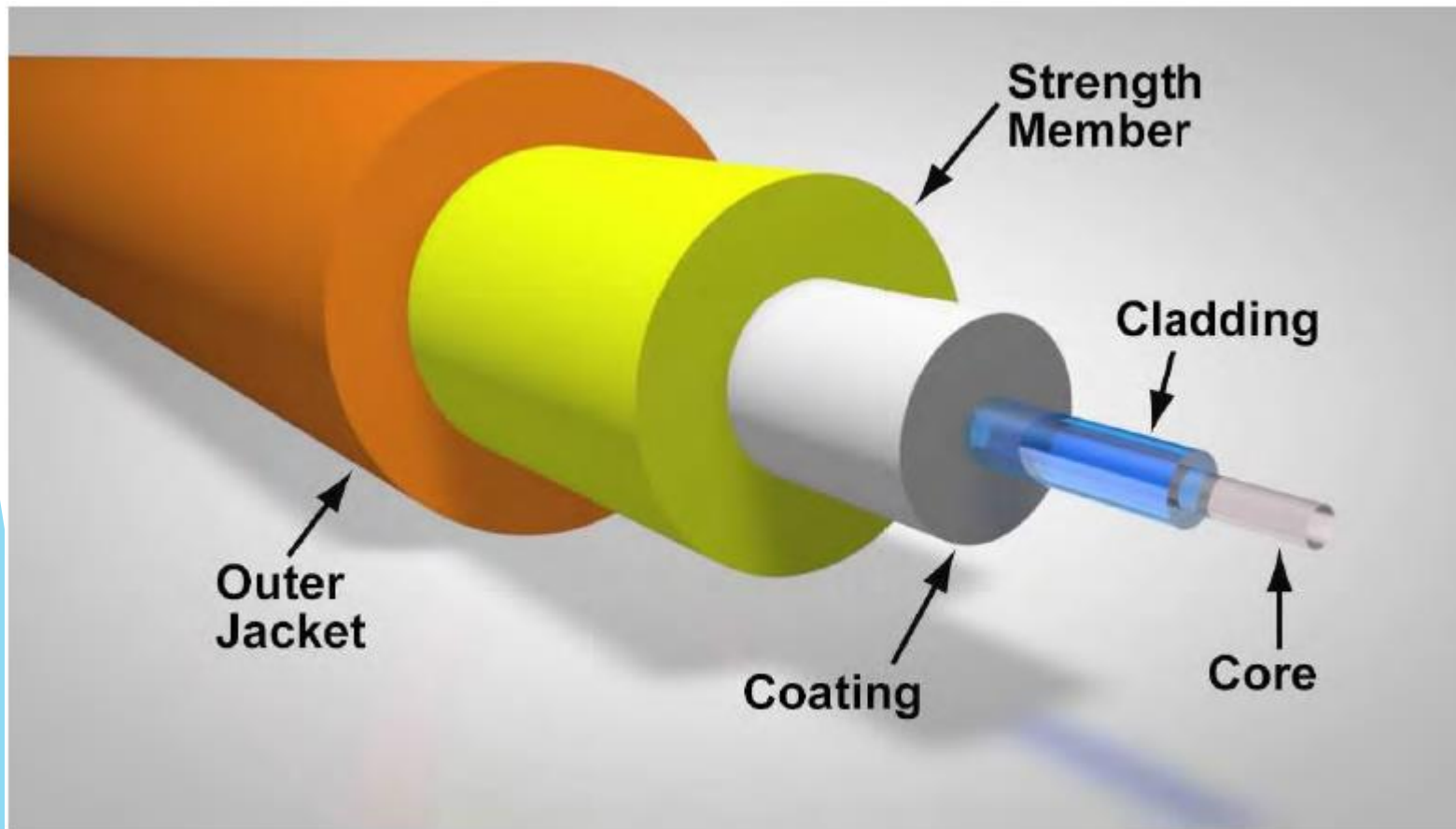
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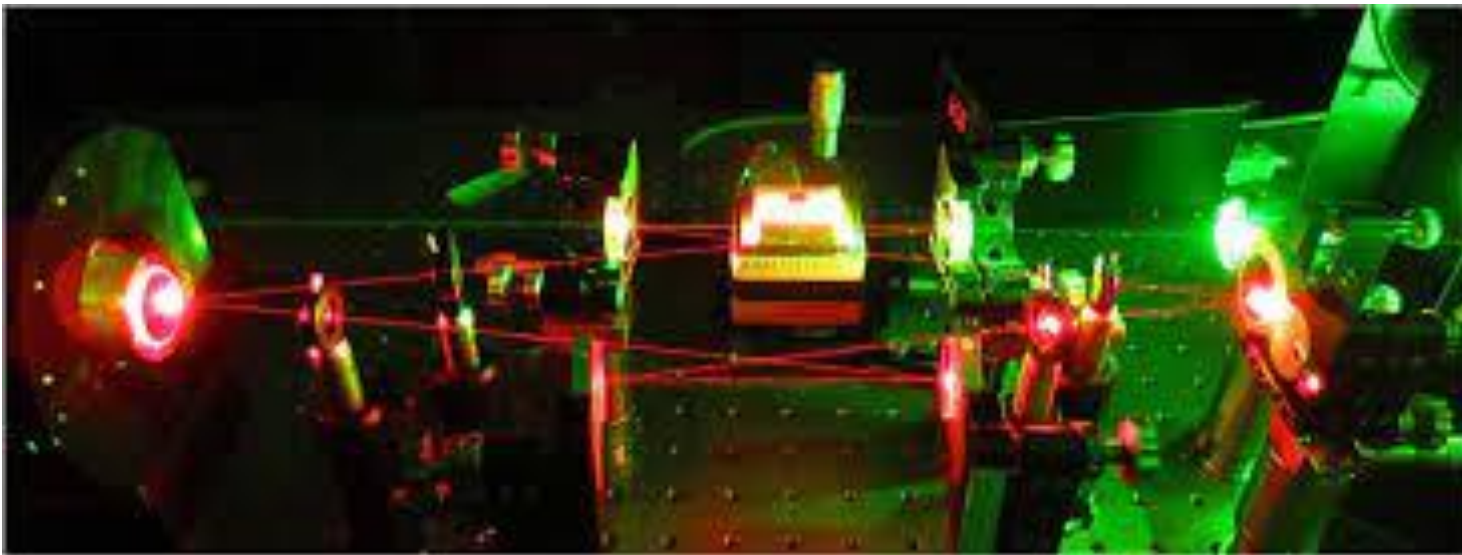
# Introduction

- ▶ **What ?**
- ▶ **Why?**

# Optical fiber



# LASER







**~3000BC**

Earliest known making of glass in the Bronze Ages



**~27BC**

Romans draw glass into fibre

**1840**

Jacques Babinet guides light in water and bent glass rods

**1888**

Bent glass rods used to illuminate body cavities for medical purposes

**1920**

Microscope illumination achieved using bent glass rods

**1931**

Mass production of glass fibres conceived



**1951**

First discussions of using transparent cladding on glass or plastic fibres

**1959**

American Optical draws fibres so fine they can only transmit a single mode of light

**1960**

First lasers demonstrated

**1980**

Fibre system carries video signal for Lake Placid Winter Olympics

**1981**

Canada trials fibre optics to homes in Manitoba

**1982**

MCI prepares to lay single-mode fibre from Washington to New York

**1984**

First fibre optic submarine cable laid to Isle of Wight

**1998**

Large effective area fibres are introduced

**2000**

Sumitomo Z-PLUS Fiber, was introduced with lower attenuation of 0.168 dB/km

**2002**

Z+ Ultra low loss Pure Silica Core Fibre with much lower attenuation demonstrated

**2009**

Bend insensitive (G.657) fibre introduced

3000BC 25BC 0 1000 1800 1900 1925 1950 1960 1980 1990 2000 Today



**1970**

Corning develop single-mode fibre with losses of 17dB per kilometre

**1986**

English Channel fibre optic service commences

**1996**

One trillion bits per second transmitted over single mode fibre



**1977**

Bell Labs extrapolates 100-year lifetime for diode lasers

**1988**

TAT-8 becomes operational as first transatlantic fibre optic cable

**1997**

FLAG: Fibre optic Link Around the Globe (28,000km)

# About course

## Course Outcome:

After completion of this course, the students would be able to:

1. Study about the transmission characteristics of light and principles of TRI in optical Fibers.
2. Know about the fundamentals of laser system, its mode of operation and their classifications.
3. Understand the principles of Holography, its application in NDT and the use of laser in biomedical application

# Syllabus

- ▶ **Optical Fibres and Their Properties:** Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics - Absorption losses - Scattering losses - Dispersion - Connectors and splicers - Fibre termination - Optical sources - Optical detectors. (10)
- ▶ **Industrial Application of Optical Fibres:** Fibre optic sensors - Fibre optic instrumentation system - Different types of modulators - Interferometric method of measurement of length - Moire fringes - Measurement of pressure, temperature, current, voltage, liquid level and strain. (9)
- ▶ **Laser Fundamentals:** Fundamental characteristics of lasers - Three level and four level lasers - Properties of laser - Laser modes - Resonator configuration - Q-switching and mode locking - Cavity damping - Types of lasers - Gas lasers, solid lasers, liquid lasers, semiconductor lasers. (6)
- ▶ **Industrial Application of Lasers:** Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect - Material processing - Laser heating, welding, melting and trimming of material - Removal and vaporization. (7)
- ▶ **Hologram and Medical Applications:** Holography - Basic principle - Methods - Holographic interferometry and application, Holography for non-destructive testing - Holographic components - Medical applications of lasers, laser and tissue interactive - Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology. (8)

# Books

- ▶ Recommended Books:
- ▶ 1. Senior JM, “Optical Fibre Communication - Principles and Practice,” Prentice Hall
- ▶ 2. Wilson J and Hawkes JFB, “Introduction to Opto Electronics,” Prentice Hall
- ▶ Reference Books:
- ▶ 3. Keiser G, “Optical Fibre Communication,” McGraw-Hill
- ▶ 4. Arumugam M, “Optical Fibre Communication and Sensors,” Anuradha Agencies
- ▶ 5. Read JF, “Industrial Applications of Lasers,” Academic Press
- ▶ 6. Monte R, “Laser Applications,” McGraw-Hill



# Assessments

➤ **Quiz- 3-4**

➤ **Assignments-2**