MICRO-PROJECT REPORT

OF

Prepare report on use of fiber optic system in medical industry.

In Partial fulfillment of Diploma in Electronics and Telecommunication Engineering

(Fifth Semester)

In the subject of

Optical Communication (EC5462)

By

Renuka Chikate	18EC010
Ballal Dhekankar	19EC017
Mukta Manoj Pathak	19EC041
Mansi Patil	19EC042
Parth Patil	19EC043
Parul Pritamwani	19EC045
Vinit Yawale	19EC059

Submitted To

Government Polytechnic, Amravati

(An Autonomous Institute of Govt. of Maharashtra)

Under the guidance of

Dr. Vikas Phate

Lecturer in Electronics

Department of Electronics and Telecommunication Engineering
Government Polytechnic Amravati,
(2021-2022)

Declaration

We, the undersigned hereby declare that the micro project report entitled "**Prepare report on use of fiber optic system in medical industry.**" contents are the outcome of our own literature survey. We further declare that contents of this report are properly cited and well acknowledged. This present report is not submitted to any other examination of this or any other institute.

Place: Amravati

Date: 21.12.2021

(Signatures)

Sr. No.	Name of team member	ID. Code	Signature
1.	Renuka Chikate	18EC010	_____
2.	Ballal Dhekankar	19EC017	_____
3.	Mukta Manoj Pathak	19EC041	_____
4.	Mansi Patil	19EC042	_____
5.	Parth Patil	19EC043	_____
6.	Parul Pritamwani	19EC045	_____
7.	Vinit Yawale	19EC059	_____

Government Polytechnic, Amravati.

(An Autonomous Institute of Govt. of Maharashtra)

Department of Electronics and Telecommunication

Certificate

This is to certify that Renuka Chikate, Ballal Dhekankar, Mukta Pathak, Mansi Patil, Parth Patil, Parul Pritamwani, Vinit Yawale Identity Code. 18EC010, 19EC017, 19EC041, 19EC042, 19EC043, 19EC045, 19EC059 of Fifth Semester Diploma in Electronics and Telecommunication Engineering has satisfactorily completed the micro project entitled "**Prepare report on use of fiber optic system in medical industry.**" in Optical Communication - EC5462 for the academic year 2021-22 as prescribed in curriculum.

Place: Amravati — Lecturer in Electronics

Date: 21/12/2021 — Dr. Vikas Phate

Department of Electronics and Telecommunication Engineering

Government Polytechnic Amravati,

(2021-2022)

Annexure-I

PART A- Plan (About 1-2 pages)

Title of Micro-Project: Prepare report on use of fiber optic system in medical industry.

1.0 Brief Introduction

This microproject briefly covers the concept of Fiber Optics. Fiber optics display a variety of characteristics that make them useful in the medical field. They are insensitive to electromagnetic disturbances and are commonly small in size. Additionally, their ability to withstand high temperatures, strong electromagnetic fields like MRIs, and ionizing radiation make fiber optics the perfect medical tool. Lastly, optical fibers are nontoxic, chemically inert, and intrinsically safe and thus, are an ideal material to use in and near the human body.

2.0 Aims of the Micro-Project

This Micro-Project aims

- Presenting a report on Fiber Optics application in medical industry.
- Understanding about how useful fiber optics technology is in medical purpose.

3.0 Course Outcomes Integrated

1. Use relevant optical fiber and sensors for the given applications.

4.0 Actual Procedure Followed:

1. Discuss about the topic in group.
2. Searched the information about applications of fiber optics in different fields.
3. Collected the information of use of fiber optic in medical field.
4. Collected all the relevant images.
5. Prepared the report.

5.0 Learning outcome of this Micro-Project:

1. Applications of fiber optics in medical field
2. Use of fiber optic sensors.

6.0 Assessment by Faculty as per Rubrics

Process Assessment (03)	Product Assessment (02)	Total Marks (05)	Signature of Faculty

Annexure-II

PART B- Plan (About 1-2 pages)
Format for Micro-Project Proposal

Title of Micro Project: Prepare report on use of fiber optic system in medical industry.

1.0 Detail Information:

- ✓ **Introduction:-**

When most people think of fiber optics, they think of cable TV and high-speed internet. However, fiber optics have also been prevalent in the medical community for a number of years. Today, the world's healthcare providers strive to find advanced biomedical instrumentation to provide more efficient patient diagnosis, monitoring and treatment.

Fiber optics display a variety of characteristics that make them useful in the medical field. They are insensitive to electromagnetic disturbances and are commonly small in size. Additionally, their ability to withstand high temperatures, strong electromagnetic fields like MRIs, and ionizing radiation make fiber optics the perfect medical tool. Lastly, optical fibers are nontoxic, chemically inert, and intrinsically safe and thus, are an ideal material to use in and near the human body. These unique properties allow for the development of complex biomedical instrumentation, which corresponds to an increased ability to perform surgical procedures and diagnostic examinations. Overall, this important technology continues to open doors in areas including neurology, gastroenterology, cardiology, and many more. As the global community continues to grow and live longer, advanced biomedical equipment becomes increasingly crucial.

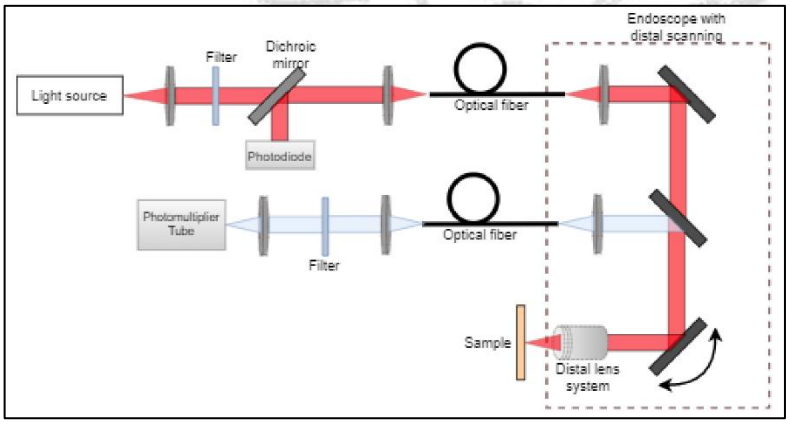
The physical characteristics of fiber, such as its flexibility and light weight, make it ideal for many different medical applications. However, minimally invasive surgery is one of the main driving factors behind the success of fiber optics. The rise in incidences of diseases like kidney stones, cancer, cardiovascular diseases and arthritis globally has resulted in a larger population seeking minimally invasive procedures. Whereas traditional surgery exposes tissues and organs through large incisions, minimally invasive surgery allows for less pain during operations, faster recovery time and lower risk of infection for the patient.

Thus, the main applications for fiber optics in the medical field are in small, compact instruments that assist physicians in performing surgeries or diagnosing patients. These tools continue to develop in both the hospital setting and in emerging research studies.

Applications of optical fiber in medical field

✓ **Endoscopy**

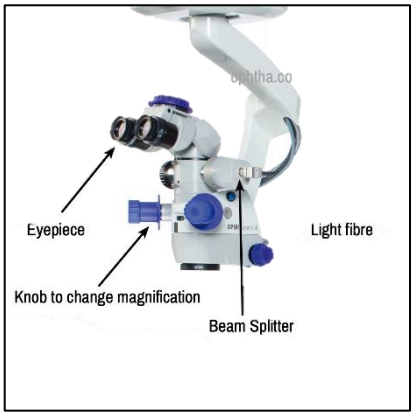
- What is endoscopy?
  Endoscopy is a nonsurgical procedure used to examine a person's digestive tract. Using an endoscope, a flexible tube with a light and camera attached to it, your doctor can view pictures of your digestive tract on a color TV monitor.



- Endoscopes use optical fibers to produce an image of inside the body. A doctor can insert a bundle of optical fibers into the body. This allows the doctor to see an image of the inside of the body clearly, and help them diagnose diseases like cancer, or see what they are doing during keyhole surgery.

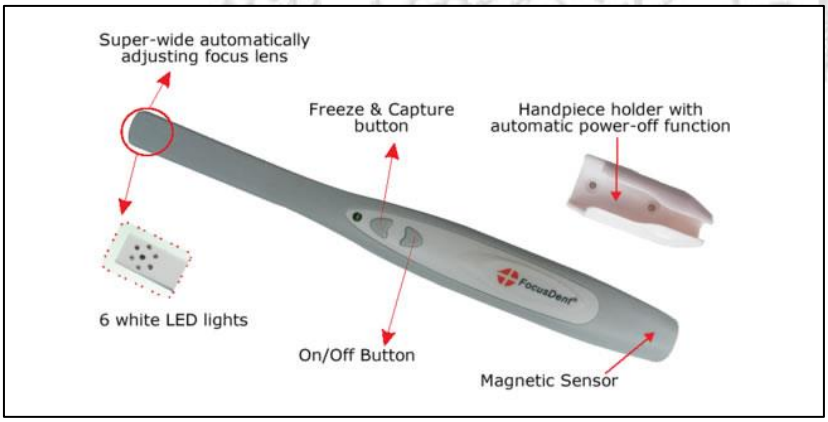
✓ **Surgical Microscope**

- An operating or surgical microscope is an optical instrument that provides the surgeon with a stereoscopic, high quality magnified and illuminated image of the small structures in the surgical area.
- The system directs light through the objective lens, which then passes into an optical fiber bundle that gets positioned over the sample. This system uses a coherent—or image guide—fiber bundle, in which the packed set of fibers is arranged the same way on both ends. This creates a small, flexible conduit that transmits a pixelated image of the sample.



✓ **Dentistry- Intra-Oral Dental Cameras**

- An intraoral camera is a tool your dentist uses to examine your mouth in as detailed a way as possible.
- As it is nearly impossible to see inside your own mouth, intra-oral cameras provide a previously unseen view. As the camera moves around your mouth, it sends video images to a computing unit where the images are enlarged and transmitted to a television screen.



✓ **Touch less Brain and Spine Surgery**

- It is the medical specialty concerned with the diagnosis and treatment of patients with injury to, or diseases/disorders of the brain, spinal cord and spinal column, and peripheral nerves within all parts of the body.
- Optical fibers are preferred fore brain and spine surgeries as they immune to electromagnetic interference (EMI), chemically inert, nontoxic, and intrinsically safe. Their use will not cause interference with the conventional electronics found in medical theaters.

✓ **Fiber Optic Probe Colorimeter**

- Fiber Optic Probe Colorimeters are the simplest and most convenient colorimeters one will ever use.
- Fiber optic probes are the ideal solution for analyzing large or awkwardly shaped samples, monitoring real-time kinetic reactions, sampling in vivo, and any other application where it is difficult to bring the sample to the spectrometer.

✓ **Optical Techniques for Brain Imaging**

- Optical imaging allows the living brain to be closely observed, and many functional interactions and changes to be investigated over many length scales. The effects of pathologies and treatments can also be readily investigated using fairly basic optical imaging tools.
- Fiber-optic methods allow us to image or manipulate neural activity in vivo. Combination of fiber optics technology with other techniques enhanced the availability. The methods are useful for dissecting complex neural circuits.
- Five Major Techniques used
  I. Functional magnetic resonance imaging (fMRI)
  II. Computerized tomography (CT)
  III. Positron emission tomography (PET)
  IV. Electroencephalography (EEG) and magnetoencephalography (MEG)
  V. Functional near-infrared spectroscopy (fNIRS)

Here, we have mentions information about few of the applications of optical fibers in medical field. There are innumerous applications of fiber optics cable and those are mainly more advantageous in medical fields due to the special advantages of optical fiber over other cables and techniques.

2.0 Aim of Micro project:-

This Micro-Project aims at:-

1. Presenting a report on Fiber Optics application in medical industry.
2. Understanding about how useful fiber optics technology is in medical purpose.

4.0 Conclusion:-

The integration of optical fibers into the medical community has enabled safer procedures, more efficient surgeries, faster recovery time, and better diagnostic examinations. The ideal characteristics of optical fibers, such as their amenability to sterilization and small dimension size, provide many opportunities for the development of medical instrumentation.

However, designing biomedical instrumentation continues to pose challenges. Medical devices must typically be reliable, highly stable, safe, and biocompatible among many other components. Although these requirements have created obstacles within the research community, the demand for sophisticated biomedical instrumentation continues to persist.

3.0 Action Plan

S.N.	Details of activity	Planned start date	Planned Finish date	ID. Code of Team Members
1.	Collected the information about use of fiber optics in surgeries.	2.12.2021	19.12.2021	18EC010
2.	Searched about why fiber optics are used in medical industries	2.12.2021	18.12.2021	19EC017
3.	Searched the applications and prepared the report file	2.12.2021	20.12.2021	19EC041
4.	Collected the images	2.12.2021	20.12.2021	19EC042
5.	Prepared the report file	2.12.2021	16.12.2021	19EC043
6.	Searched required Images.	2.12.2021	19.12.2021	19EC045
7.	Collected the information about applications	2.12.2021	18.12.2021	19EC059

5.0 Resources Required (major resources such as raw material, some machining facility, software etc)

S.N.	Name of Resource/material	Specifications	Qty	Remarks
1	Medical Applications of Optical Fibers	By J.K.CHHABRA Ex Scientist CSIO, Chandigarh	---	
2	https://www.sciencedirect.com	website	---	
3	https://www.mdpi.com	website	---	

4.0 Names of Team Members with Identity Code:

Sr. No.	Name	ID code
1.	**Renuka Chikate**	**18EC010**
2.	**Ballal Dhekankar**	**19EC017**
3.	**Mukta Pathak**	**19EC041**
4.	**Mansi Patil**	**19EC042**
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