Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electrical and Electronics Engineering

BEE022 Fiber Optics And Laser Instrumentation
Eighth Semester, (Even Semester)

Course (catalog) description

To contribute to the knowledge of Fiber optics and Laser Instrumentation and its Industrial and Medical Application.

Compulsory/Elective Course: Elective for EEE students

Credit & Contact hours : 3 and 45 hours

Course Coordinator : S.UmaMageswaran

Instructors : S.UmaMageswaran

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
S.UmaMageswaran	final year EEE	KS 303	**04422290125**	**u_magesh125@yahoo.co.in**	9.00-9.50 AM

Relationship to other courses:

Pre –requisites **:** BEE501 Control System

Assumed knowledge : knowledge in optical fibres

Syllabus Contents

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Principles of light propagation through a fiber - Different types of fibers and their properties, fiber Characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splices –Fiber termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fiber optic sensors – Fiber 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.

UNIT III LASER FUNDAMENTALS 9

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.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

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.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

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, gynecology and oncology.

Total: 45 HOURS

Text book(s) and/or required materials

1. J.M. Senior, "Optical Fiber Communication – Principles and Practice", Prentice Hall of India,1st edition,1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2nd Edition,2001

Computer usage:

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	0%
Non major elective	-	100%

Broad area : Control and Instruments

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2nd week	Session 15 to 28	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To contribute to the knowledge of Fiber optics and Laser Instrumentation and its Industrial and Medical Application.	Correlates to program outcome		
	H	**M**	**L**
1. To expose the students to the basic concepts of optical fibers and their properties	a,d,i	b,c,e,g,l	j,k
2. To provide adequate knowledge about the Industrial applications of optical fibers	a,d,e,i	b,c,g,l	j,k
3. To expose the students to the Laser fundamentals	a,d,e,i	b,g,l	j,k
4. To provide adequate knowledge about Industrial application of lasers.	a,d,e,i	b,g,l	j,k
5. To provide adequate knowledge about holography and Medical applications of Lasers	a,d,e,i	b,c,g,l	j,k

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I			
1.	Principles of light propagation through a fiber	No	T1
2.	Different types of fibers and their properties	No	
3.	fiber Characteristics	No	
4.	Absorption losses	No	
5.	Scattering losses	No	
6.	Dispersion	No	
7.	Connectors and splices	No	
8.	Fiber termination	No	
9.	Optical sources, Optical detectors	No	
UNIT II			
10.	Fiber optic sensors	No	T1
11.	Fiber optic instrumentation system	No	
12.	Different types of modulators	No	
13.	Interferometric method of measurement of length	No	
14.	Moire fringes	No	
15.	Measurement of pressure	No	
16.	Measurement of temperature	No	
17.	Measurement of current, voltage	No	
18.	Measurement of liquid level and strain.	No	
UNIT III			
19.	Fundamental characteristics of lasers	No	T2
20.	Three level and four level lasers	No	
21.	Properties of laser	No	
22.	Laser modes – Resonator configuration	No	
23.	Q-switching and mode locking	No	
24.	Cavity damping	No	
25.	Types of lasers	No	
26.	Gas lasers, solid lasers, liquid lasers, semiconductor lasers	No	
27.	Gas lasers, solid lasers, liquid lasers, semiconductor lasers	No	
UNIT IV			
28.	Laser for measurement of acceleration, current,	No	

	voltage and Atmospheric effect		
29.	Laser for measurement of distance	No	
30.	Laser for measurement of length	No	
31.	Laser for measurement of velocity	No	
32.	Material processing	No	T2
33.	Laser heating	No	
34.	Laser heating	No	
35.	Removal and vaporization	No	
36.	Removal and vaporization	No	
UNIT V			
37.	Holography	No	
38.	Basic principle Methods Holographic interferometry	No	
39.	application, Holography for non-destructive testing	No	T1
40.	Holographic components	No	
41.	Holographic components	No	
42.	Medical applications of lasers	No	
43.	Medical applications of lasers	No	
44.	Laser instruments for surgery	No	
45.	Laser instruments for surgery	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by: **Dated :**
S.UmaMageswaran

Addendum

ABET Outcomes expected of graduates of B.Tech / EEE / program by the time that they graduate:

a) An ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) An ability to identify, formulate, and solve engineering problems.

c) An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) An ability to design and conduct experiments, as well as to analyze and interpret data.

e) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

f) An ability to apply reasoning informed by the knowledge of contemporary issues.

g) An ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

h) An ability to understand professional and ethical responsibility and apply them in engineering practices.

i) An ability to function on multidisciplinary teams.

j) An ability to communicate effectively with the engineering community and with society at large.

k) An ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) An ability to recognize the need for,and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION
Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

PEO2: CORE COMPETENCE
Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

PEO3: PROFESSIONALISM
Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL
Electrical Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS
Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

Course Teacher	Signature
S.UmaMageswaran	

Course Coordinator **HOD/EEE**

(Mr.S.UmaMageswaran) ( )