University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK4DSEPHY206**				
Course Title	**FIBRE OPTIC COMMUNICATION**				
Type of Course	**DSE**				
Semester	**IV**				
Academic Level	**200 - 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 Hrs	-	2 Hr	5 Hrs
Pre-requisites					
Course Summary	This course gives the learner a good understanding of the role of fiber optic technology in the current telecommunications industry. It will equip the learner with the ideas of optical fibers and its constitution. Starting from the basics of light and ending with the testing of cables, the proposed modules will ensure that a good knowledge in OFC is transacted.				

BOOKS FOR STUDY:

1. Fiber Optics Installer and Technician Guide: Bill Woodward and Emile B. Hauson, Neil Eddie, San Francisco (2005)

2. Fiber-optic communication systems: Govind P. Agrawal, Wiley Interscience, 3rd edition (2002)

3. Introduction to Fiber Optics: John Crisp and Barry Elliot, Elsevier, Amsterdam, 3rd Edition (2005)

BOOKS FOR REFERENCE:

1. Introduction to Fiber Optics: Ajoy Ghatak and K. Thyagarajan, Cambridge University Press (1997)

2. Troubleshooting Optical-Fiber Networks - Understanding and using your optical time-Domain reflectometer: Duwayne R, Anderson, Larry Johnson and Florian G. Bell, Elsevier Academic Press, Amsterdam, 2nd Edition (2004)

WEB RESOURCES:

1. https://www.vedantu.com/physics/optical-fiber
2. http://krct.ac.in/ktgadmin/assets/php/pdf/1576331029.pdf

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**BASIC CONCEPTS OF LIGHT**	**9**	
	1	Electromagnetic waves, electromagnetic spectrum, modes of light- single mode, multi mode	2	1
	2	Critical angle, acceptance angle, cone of acceptance, numerical aperture	2	2
	3	Losses- absorption, scattering, reflection, dispersion: intermodal, intramodal	3	1
	4	Effect on bandwidth, optical power: gain, loss	2	1
II		**INTRODUCTION TO OPTICAL FIBRE**	**9**	
	5	Structure of Optical fiber	1	1
	6	Types of fibers: based on refractive index, material, modes	2	1
	7	Fiber optic cable construction, geometry of cable	2	2
	8	Cable sizes, colour coding, types of cables: simplex, duplex, multifiber, GI, SI, tight buffer, loose tube, ribbon, breakout cable, distribution cable, hybrid cable, composite, aerial and submarine cables	4	1
III		**FIBRE CABLING TOOLS**	**9**	
	9	General tools, slit and ring tool, stripping tool, buffer stripper, polishing film, polishing pad, polishing puck	2	1
	10	Cleaning devices, crimping tool, inspection microscope, cleavers, fusion splicer	2	1

	11	Light source, power meter, optical loss test set	2	2
	12	Visual fault locator, mechanical splices, splice tray	2	3
	13	Optical time domain reflectometer	1	2
IV		**CABLE SPLICING**	**9**	
	14	Fusion in splicing, mechanical splicing, single fiber fusion splicing, mass fusion splicing	2	1
	15	Stages of splicing, splicing precautions	3	4
	16	Misalignment, end gap, end angle	2	1
	17	Numerical Aperture mismatch, core mismatch	1	3
	18	Axial run-out, bubble, incomplete fusion	1	3
V*		**TESTING OF CABLES**	**9**	
	19	Continuity test, light source power meter, OLTS, visual fault locator	3	2
	20	OTDR testing, measuring cable span, attenuation coefficient, connector/splice loss measurement	3	3
	21	Distance-to-fault, OTDR trace analysis, optical loss budget	3	3

DETAILED SYLLABUS: PRACTICALS

Part A – At least 5 Experiments to be performed		CO No
Sl No	**Name of Experiment**	
1	Introduction to optical fiber cable (i) Study the composition of fiber optic cable (ii) single and ribbon type (iii) underground and overhead and colour coding (iv) pig tail (v) patch chord (vi) splice protection sleeve (vii) fusion splicer (viii) fiber closure	1
2	Measuring instruments identification: (ix) Light source, (x) power meter, ((xi) optical loss test set (xii) OTDR	1
3	Connectors (i) FC/SC/ST/LC/FDDI/ESCON/SMA (ii) various types of ratio couplers (iii) splitters	2

4	Measurement of Numerical Aperture of a fiber	1
5	Study of losses in Optical fiber	1
6	Power vs Current (P-I) characteristics and measure slope efficiency of Laser Diode	1
7	Voltage vs Current (V-I) characteristics of Laser Diode	1
8	Power vs Current (P-I) characteristics and measure slope efficiency of LED	1
9	Voltage vs Current (V-I) characteristics of LED	1
10	Characteristics of Photodiode and measure the responsivity.	1
Part B* – At least One Experiment to be performed		
11	Splicing (i) fusion splicing setup (ii) splicing stages (iii) arranging in splice tray (iv) securing in fiber closure	4
12	Fiber optic testing (i) fiber continuity test using light source and power meter (ii) cable loss test	3
13	OTDR test (i) setting up of OTDR (ii) measuring cable span (iii) measuring attenuation coefficient (iv) connector/splice loss measurement (v) distance to fault	3
14	OTDR trace analysis and optical loss budget in long distance optical links and FTTH networks.	5

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the essential basic elements of Fiber optics and telecommunication systems	U	PSO-1,5
CO-2	Apply the acquired knowledge in the selection of desired optical fibres, cabling tools, splicing and its testing	Ap	PSO-5,7
CO-3	Analyse different aspects of optical Fiber communication including OTDR trace analysis and optical loss budget	An	PSO-1,5

CO-4	Evaluate the different types of cable splicing in selecting the optimum configuration for low-loss communication	E	PSO-1,5,7
CO-5	Create various types of miniature models of optical communication systems, fueling the development of real-time scenarios	C	PSO-1,5,7

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: FIBRE OPTIC COMMUNICATION

Credits: 3:0:1 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Understand the essential basic elements of Fiber optics and telecommunication systems	PO-1,3,6 PSO-1,5	U	F, C	L	-
CO-2	Apply the acquired knowledge in the selection of desired optical fibres, cabling tools, splicing and its testing	PO-1,2,3 PSO-5,7	Ap	P	L	-
CO-3	Analyse different aspects of optical Fiber communication including OTDR trace analysis and optical loss budget	PO-1,2,6 PSO-1,5	An	C, P	L	-
CO-4	Evaluate the different types of cable splicing in selecting the	PO-1,2,3 PSO-1,5,7	E	C, P	L	-

	optimum configuration for low-loss communication				
CO-5	Create various types of miniature models of optical communication systems, fueling the development of real-time scenarios	PO-1,2,3,6 PSO-1,5,7	C	P, M	L	P

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	1	-	-	-	2	-	-	1	-	1	-	1	-	-	-
CO-2	-	-	-	-	3	-	2	3	3	3	-	-	-	-	-
CO-3	1	-	-	-	3	-	-	1	2	-	-	-	2	-	-
CO-4	2	-	-	-	3	-	2	3	2	1	-	-	-	-	-
CO-5	1	-	-	-	3	-	2	3	3	3	-	-	2	-	-

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- ▪ Quiz / Assignment/ Discussion / Seminar
- ▪ Midterm Exam
- ▪ Programming Assignments
- ▪ Final Exam

Mapping of COs to Assessment Rubrics:

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	-	✓	✓
CO-2	✓	✓	-	✓
CO-3	✓	✓	-	✓
CO-4	✓	-	✓	✓
CO-5	✓	✓	✓	-