

DHANALAKSHMI SRINIVASAN ENGINEERING COLLEGE

(AUTONOMOUS)
 (Approved by AICTE & Affiliated to Anna University, Chennai)
 Re-Accredited with 'A' Grade by NAAC, Accredited by TCS
 Accredited by NBA – BME, ECE & EEE
PERAMBALUR - 621 212. Tamil Nadu.
 website : www.dsengg.ac.in

**COURSE PLAN**

Name of the Faculty				
Designation/Department	ASSITANT PROFESSOR – ECE			
Course Code/Name	U20EC703 – FIBER OPTIC COMMUNICATION & NETWORKS			
Year/Section/Department	VII / A / ECE			
Credits Details	<i>L: 3</i>	<i>T: 0</i>	<i>P: 0</i>	<i>C: 0</i>
Total Contact Hours Required	45			

Syllabus:

UNIT I/ OVERVIEW OF OPTICAL FIBER COMMUNICATION	No. Of Periods: 9
Introduction Historical development general system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber single mode fiber, cutoff wave length, mode field diameter. Optical Fibers: fiber materials, photonic crystal, fiber optic cables specialty fibers.	
UNIT II/ OPTICAL SOURCES AND COUPLING	No. Of Periods: 9
Direct and indirect Band gap materials-LED Structures-Light Source Materials-Quantum efficiency and LED Power-Modulation of a LED-lasers Diodes-Modes and Threshold Condition-Rate Equations-External Quantum Efficiency-Resonant Frequencies-Laser Diodes-Temperature Effects-Introduction to Quantum Laser-Fiber Amplifiers-Power Launching and coupling-Lensing Schemes- Fiber-to-Fiber Joints-Fiber splicing-Signal to Noise ratio-Detector response time.	
UNIT III/ TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS	No. Of Periods: 9
Attenuation-Absorption Losses-Scattering Losses-Bending Losses-Core and Cladding Losses-Signal Distortion in Optical Wave Guides-Information Capacity Determination-Group Delay-Material Dispersion-Wave Guide Dispersion-Signal distortion in SM fibers-Polarization Mode dispersion-Intermodal dispersion-Pulse Broadening in GI fibers-Mode Coupling, Design Optimization of SM fibers-RI profile and cut-off wavelength.	
UNIT IV/ FIBER OPTIC RECEIVER AND MEASUREMENTS	No. Of Periods: 9
Fundamental receiver operation- Pre Amplifiers-Error Sources-Receiver Configuration- Probability of Error-Quantum limit. Fiber Attenuation Measurements-Dispersion Measurements-Fiber Refractive index profile Measurements- Fiber Cut - off, Wave Length Measurements -Fiber Numerical Aperture Measurements-Fiber diameter measurements.	
UNIT V/ OPTICAL NETWORKS AND SYSTEM TRANSMISSION	No. Of Periods: 9
SONET / SDH- WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehnder interferometer, multiplexer, Isolators and circulators, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, -Optical CDMA-Ultra High Capacity Networks.	

Objective:

- ❖ Gain the knowledge about optical fiber sources and transmission techniques.
- ❖ Learn the principle of light propagation through optical fibers.
- ❖ Understand signal distortion mechanisms in the fiber.
- ❖ Study optical transmitters and receivers for fiber /free space links.
- ❖ Acquire optical network concepts and components involved.

Text Book:

T1: Gerd Keiser, Optical Fiber Communication, 5th Edition, McGraw -Hill International 2017.
T2: John M.Senior, Optical Fiber Communication, 2nd Edition, Pearson Education, 2007.

Website:

W1:
W2:
W3:
W4:

Online Mode of Study:

W1:
W2:
W3:
W4:
W5:

Course Plan:

Topic Number	Topic	Reference Detail	Page Number	Mode of teaching	Number of Periods Required	Cumulative Period
UNIT I - OVERVIEW OF OPTICAL FIBER COMMUNICATION						
1	Introduction Historical development general system.	<i>T2</i>	1-5	<i>BB</i>	1	1
2	advantages, disadvantages, and applications of optical fiber communication	<i>T2</i>	7-9	<i>BB</i>	1	2
3	optical fiber waveguides	<i>T2</i>	12	<i>BB</i>	1	3
4	Ray theory	<i>T2</i>	14-20	<i>BB</i>	1	4
5	cylindrical fiber single mode fiber	<i>T2</i>	35-46	<i>BB</i>	1	5
6	cutoff wave length	<i>T2</i>	59	<i>BB</i>	1	6
7	mode field diameter	<i>T2</i>	60	<i>BB</i>	1	7
8	Optical Fibers: fiber materials, photonic crystal	<i>T2</i>	75-77	<i>BB</i>	1	8
9	fiber optic cables specialty fibers	<i>T1</i>	60	<i>BB</i>	1	9
Outcome of Unit I:						
CO1:						
UNIT II - OPTICAL SOURCES AND COUPLING						
10	Direct and indirect Band gap materials.	<i>T1</i>	87	<i>BB</i>	1	10
11	LED Structures-Light Source Materials-Quantum efficiency and LED Power	<i>T1</i>	90-92	<i>BB</i>	1	11
12	Modulation of a LED-lasers Diodes-Modes and Threshold Condition	<i>T2</i>	422-428	<i>BB</i>	1	12
13	Rate Equations-External Quantum Efficiency-Resonant Frequencies	<i>T2</i>	451	<i>BB</i>	1	13
14	Laser Diodes-Temperature Effects	<i>T1</i>	99-101	<i>BB</i>	1	14
15	Introduction to Quantum	<i>T2</i>	339	<i>BB</i>	1	15

	Laser					
16	Fiber Amplifiers Power Launching and coupling	<i>T1</i>	<i>119-112</i>	<i>BB</i>	<i>1</i>	<i>16</i>
17	Lensing Schemes- Fiber-to-Fiber Joints- Fiber splicing	<i>T1</i>	<i>129-139</i>	<i>BB</i>	<i>1</i>	<i>17</i>
18	Signal to Noise ratio- Detector response time.	<i>T1</i>	<i>237</i>	<i>BB</i>	<i>1</i>	<i>18</i>

**Outcome of Unit II:
CO2:**

UNIT III - TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS

19	Attenuation-Absorption Losses-Scattering Losses-Bending Losses-Core and Cladding Losses	<i>T2</i>	<i>88</i>	<i>BB</i>	<i>1</i>	<i>19</i>
20	Signal Distortion in Optical Wave Guides	<i>T2</i>	<i>90</i>	<i>BB</i>	<i>1</i>	<i>20</i>
21	Information Capacity Determination	<i>T2</i>	<i>90</i>	<i>BB</i>	<i>1</i>	<i>21</i>
22	Group Delay-Material Dispersion	<i>T2</i>	<i>105-110</i>	<i>BB</i>	<i>1</i>	<i>22</i>
23	Wave Guide Dispersion-Signal distortion in SM fibers	<i>T2</i>	<i>113</i>	<i>BB</i>	<i>1</i>	<i>23</i>
24	Polarization Mode dispersion	<i>T2</i>	<i>140-147</i>	<i>BB</i>	<i>1</i>	<i>24</i>
25	Intermodal dispersion- Pulse Broadening in GI fibers-Mode Coupling	<i>T2</i>	<i>113-122</i>	<i>BB</i>	<i>1</i>	<i>25</i>
26	Design Optimization of SM fibers	<i>T2</i>	<i>132-137</i>	<i>BB</i>	<i>1</i>	<i>26</i>
27	RI profile and cut-off wavelength	<i>T2</i>		<i>BB</i>	<i>1</i>	<i>27</i>

**Outcome of Unit III:
CO3:**

UNIT IV - FIBER OPTIC RECEIVER AND MEASUREMENTS

28	Fundamental receiver operation- Pre Amplifiers	<i>T2</i>	<i>691</i>	<i>BB</i>	<i>1</i>	<i>28</i>
29	Error Sources-	<i>W1</i>	<i>-</i>	<i>BB</i>	<i>1</i>	<i>29</i>

	Receiver Configuration					
30	Probability of Error-Quantum limit	<i>W1</i>	-	<i>BB</i>	<i>1</i>	<i>30</i>
31	Fiber Attenuation Measurements	<i>T2</i>	<i>909-917</i>	<i>BB</i>	<i>1</i>	<i>31</i>
32	Dispersion Measurements	<i>T2</i>	<i>919-923</i>	<i>BB</i>	<i>1</i>	<i>32</i>
33	Fiber Refractive index profile Measurements	<i>T2</i>	<i>926-932</i>	<i>BB</i>	<i>1</i>	<i>33</i>
34	Fiber Cut - off, Wave Length Measurements	<i>T2</i>	<i>934</i>	<i>BB</i>	<i>1</i>	<i>34</i>
35	Fiber Numerical Aperture Measurements	<i>T2</i>	<i>938</i>	<i>BB</i>	<i>1</i>	<i>35</i>
36	Fiber diameter measurements	<i>T2</i>	<i>941-943</i>	<i>BB</i>	<i>1</i>	<i>36</i>

Outcome of Unit IV:

CO4:

UNIT V - OPTICAL NETWORKS AND SYSTEM TRANSMISSION

37	SONET / SDH- WDM concepts	<i>T1</i>	<i>287-296</i>	<i>BB</i>	<i>1</i>	<i>37</i>
38	overview of WDM operation principles, WDM standards	<i>T1</i>	<i>217-229</i>	<i>BB</i>	<i>1</i>	<i>38</i>
39	Mach-Zehnder interferometer, multiplexer	<i>T1</i>	<i>149</i>	<i>BB</i>	<i>1</i>	<i>39</i>
40	Isolators and circulators, MEMS technology	<i>T1</i>	<i>150-152,163</i>	<i>BB</i>	<i>1</i>	<i>40</i>
41	variable optical attenuators, tunable optical fibers	<i>T1</i>	<i>165,166</i>	<i>BB</i>	<i>1</i>	<i>41</i>
42	dynamic gain equalizers	<i>T1</i>	<i>168</i>	<i>BB</i>	<i>1</i>	<i>42</i>
43	optical drop multiplexers	<i>T1</i>	<i>169</i>	<i>BB</i>	<i>1</i>	<i>43</i>
44	Optical CDMA	<i>T2</i>	<i>777</i>	<i>BB</i>	<i>1</i>	<i>44</i>
45	Ultra-High Capacity Networks	<i>T2</i>	<i>890</i>	<i>BB</i>	<i>1</i>	<i>45</i>

Outcome of Unit V:

CO5:

C06:

Course Outcome:

At the end of course: Students should be able to do:

C01: *Examine the various optical fiber modes, configurations.*

C02: *Evaluate the various signal degradation factors associated with Optical fiber.*

C03: *Apply the various optical sources and optical detectors and their use in the optical communication system.*

C04: *Compare the fiber optic receiver and measurements.*

C05: *Analyze the digital transmission and its associated parameters on system performance.*

Course Outcome Vs Program Outcome Mapping:

COs	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
C01														
C02														
C03														
C04														
C05														
C06														
AVG														

Content beyond Syllabus:

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Internal Evaluation Components:

Webportal	Assignment	Components	Topic Number with Topic / Unit Details	Relevance to CO
Webportal 1	--	Assessment - I (60)	Unit I and II	CO 1 & CO2
	1	Assignment - Handwritten (20)	4. Ray Theory, 5. Cylindrical fiber single mode fiber, 6. Cutoff wave length	CO1
	2	Assignment - Poster Presentation / PPT (20)	12. LED Structures-Light Source Materials-Quantum efficiency and LED Power. 15. Laser Diodes-Temperature Effects.	CO2
Webportal 2	--	Assessment - II (60)	Unit III and IV	CO3 & CO4
	3	Seminar (20)	31. Fiber attenuation measurement, 34. Cut-off wavelength measurement, 35. Fiber Numerical Aperture Measurement.	CO3
	4	Case Study Report (20)	39. Mach-Zehnder interferometer (MZI) multiplexer, 40. Isolator Circulator	CO4
Webportal 3	--	Model Exam (75)	Unit I to V	CO1 to CO6
	5	MCQ (15)	Unit I to V	CO1 to CO6
	-	Course Attendance (10)	--	--

Submission Details:

Phase 1(Before AT 1)		Phase 2 (Before AT 2)		Phase 3 (Model)
Assignment 1	Assignment 2	Assignment 3	Assignment 4	Assignment 5

Google Class Code Details:

Class Name:

PLAN OF ASSESSMENT TEST –DISTRIBUTION OF MARKS:

TEST	CO- MARK WISE DISTRIBUTION						BLOOM'S LEVEL MARK WISE DISTRIBUTION					
	C01	C02	C03	C04	C05	C06	BTL1	BTL2	BTL3	BTL4	BTL5	BTL6
AT-1												
AT-2												
MODEL												

Prepared By

Approved By

Verified By