SYLLABUS

1. **Course name:** Optical Communication
2. **Course code:** FOCO432064
3. **Credits:** 3 credits (3/0/6) (3 theoretical credits, 0 practical credit)
   Duration: 15 weeks (3 main periods and 6 self-study periods) /week)
4. **Instructors:**
   a. Primary instructor: Truong Ngoc Ha, MEng
   b. Secondary instructors:
   - Phan Van Ca, Ph.D
   - Le Minh Thanh, MEng
5. **Course conditions**
   Prerequisites: N/A.
   Corequisites:Computer and Communication Networks.
6. **Course Description :**

This course investigates the basic aspects of fiber-optic communication systems. Topics include sources and receivers, optical fibers and their propagation characteristics, and optical fiber systems. The principles of operation and properties of optoelectronic components, as well as the signal guiding characteristics of glass fibers, are discussed. System design issues include terrestrial and submerged point-to-point optical links and fiber-optic networks.

7. **Course Goals:**

Goals	***Goal description*** *(This course provides students:)*	**ELOs**
G1	Ability to apply knowledge about mathematics, probability, signal to recognize, analyse exactitude or approximation, and evaluate optical communication systems.	01 (H)
G2	Ability to realize, calculate, solve problems of bit error, symbol error, average capacity, outage probability … and ability to design a optical communication system.	02 (M)
G3	Ability to use Matlab, Optiwave software in simulating, analyzing, and solving problems of performance.	03 (M)
G4	Ability to self-study and learn more about advanced techniques.	07 (M)
G5	Ability to present application about analyzing optical system.	10 (L) 11 (H)

** Note: H: **H**igh; M: **M**edium; L: **L**ow*

8. **Course Learning Outcomes - CLOs:**

CLOs		***Description*** *(After completing this course, students can have:)*	**Outcome**
G1	G1.1	Understand concepts in optical communication.	01
	G1.2	Solve problems about probability in technology.	01

	G1.3	Understand and apply information theory and coding.	01
	G1.4	Use mathematics knowledge in analyzing and representing optical signal.	01
	G1.5	Understand and apply mathematics transformer in processing and analyzing data.	01
G2	G2.1	Analyze basis of optical signal demodulation.	02
	G2.2	Analyze performance of digital communication.	02
	G2.3	Analyze coding technique.	02
G3	G3.1	Calculate performances: BER, PER, average capacity.	03
	G3.2	Detect data from optical received.	03
G4	G4.1	Learn about: Optical FDM, WDM	07
	G4.2	Understand WDM system and Coherent system	07
	G4.3	Compare modulation and coding techniques.	07
G5	G5.1	Present and design optimal receiver architecture.	11
	G5.2	Understand strong points of optical communication system when comparing with digital system.	11, 10

9. Study materials:

a. *Textbooks:*

[1] Optical Fiber Communications by John Senior, 3rd Edition, Prentice Hall, 2009.

b. *References:*

[2] Fiber Optic Communications,by Joseph Palais, fifth edition, Prentice Hall, 2004.

[3] Fiber optics : principles and practices, by Abdul Al-Azzawi,CRC press,2006.

[4] Software: Optiwave (OptiSystem, OptiBPM & OptiFiber software instruction manuals).

10. Student Assessments:

a. Grading points: 10

b. Planning for students assessment is followed:

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Midterms					**50**
Q	Knowledge of all chapters.	Week 2-15	Individual paper test in class	G1.1, G1.2, G1.3, G2.1, G4.3	20
M.1	Enegery and spectrum performance of modulation techniques.	Week 6	Individual paper test in class	G1.2, G1.4, G1.5, G2.1, G2.2, G2.3, G3.1, G4.3	15
M.2	Design optimal receiver and calculate BER of system.	Week 9	Individual paper test in class	G1.3, G2.4, G3.2, G5.1, G5.2	15

Final exam					**50**
F	Content includes all output standards of the course.		Individual paper assessment in class		50

** Note: Q: **Q**uiz; H: **H**omework; P: **P**roject; M: **M**idterm Exam; F: **F**inal Exam;*

11. Course details:

Week	Contents	CLOs
1	***Chapter 1. Introduction*** *(3/0/6)*	
	Teaching contents: *(3)* 1.1 Historical perspective 1.2 Basic concepts **Teaching methods**: + Theoretical lectures + Questions and discussion	G1.1, G1.3, G5.2
	Self-study contents: *(6)* 1.3 Optical communication systems	
2	***Chapter 2. Optical Fibers*** *(3/0/6)*	
	Teaching contents: *(3)* 2.1 Geometrical optics description 2.2 Wave propagation **Teaching methods**: + Theoretical lectures + Questions and discussion	G1.2, G1.5, G2.3, G3.1
	Self-study contents: *(6)* 2.3 Dispersion in single-mode fibers	
3	***Chapter 2. Optical Fibers (cont.)*** *(3/0/6)*	
	Teaching contents: *(3)* 2.4 Dispersion-induced limitaions 2.5 Fiber losses **Teaching methods**: + Theoretical lectures + Questions and discussion	G1.3, G2.1
	Self-study contents: *(6)* 2.6 Nonlinear optical effects	
4	***Chapter 3. Optical Transmitters*** *(3/0/6)*	
	Teaching contents: *(3)* 3.1 Basic concepts 3.2 Light emitting diodes **Teaching methods**: + Theoretical lectures + Questions and discussion	G1.4, G1.5, G2.1, G2.4
	Self-study contents: *(6)*	

	3.3 Control of longitudinal modes	
5	***Chapter 3. Optical Transmitters (cont.)*** *(3/0/6)*	
	Teaching contents: *(3)* 3.4 Semiconductor Lasers 3.5 Laser characteristics **Teaching methods**: + Theoretical lectures + Questions and discussion	G1.4, G1.5, G2.2, G4.3
	Self-study contents: *(6)* 3.6 Transmitter design	
6	***Chapter 4:*** **Optical Receivers** *(3/0/6)*	
	Teaching contents: *(3)* 4.1 Basic concepts 4.2 Common photodectectors **Teaching methods**: + Theoretical lectures + Questions and discussion	G1.5, G2.2, G2.3, 3.1, 5.1
	Self-study contents: *(6)* 4.3 Receiver design	
7	***Chapter 4:*** **Optical Receivers (cont.)** *(3/0/6)*	
	Teaching contents: *(3)* 4.4 Receiver noise 4.5 Receiver sensitivity **Teaching methods**: + Theoretical lectures + Questions and discussion	G2.2, G3.1, G5.1
	Self-study contents: *(6)* 4.6 Sensitivity degradation	
8	***Chapter 5: Lightwave Systems*** *(3/0/6)*	
	Teaching contents: *(3)* 5.1. System architectures 5.2. Design guidelines **Teaching methods**: + Theoretical lectures + Questions and discussion	G1.2, G1.4, G1.5, G2.3, G3.1
	Self-study contents: *(6)* 5.3. Long haul systems 5.4. Sources of power penalty	
9	***Chapter 6: Optical Amplifiers*** *(3/0/6)*	
	Teaching contents: *(3)* 6.1 Basic concepts 6.2 Semiconductor optical amplifiers 6.3 Raman amplifiers **Teaching methods**:	G1.2, G1.4, G1.5, G2.3, G3.1

	+ Theoretical lectures + Presentation, questions and discussion **Self-study contents**: *(6)* 6.4 Erbium doped fiber amplifiers 6.5 System application	
10	***Chapter 7: Soliton Systems****(3/0/6)*	
	Teaching contents: *(3)* 7.1 Fiber Solitons 7.2 Soliton based communications **Teaching methods**: + Theoretical lectures + Presentation, questions and discussion **Self-study contents**: *(6)* 7.3 Loss managed solitons.	G1.5, G2.2, G2.3, G3.2, G4.3
11	***Chapter 7: Soliton Systems (cont.)*** *(3/0/6)*	
	Teaching contents: *(3)* 7.4 Dispersion managed solitons 7.5 Impact of amplifier noise **Teaching methods**: + Theoretical lectures + Presentation, questions and discussion **Self-study contents**: *(6)* 7.6 WDM soliton Systems	G1.1, G1.2, G2.1, G2.2, G2.3, G3.1, G3.2, G4.1, G4,2, G4.3.
12	***Chapter 8: Coherent Lightwave Systems*** *(3/0/6)*	
	Teaching contents: *(3)* 8.1 Basic concepts 8.2 Modulation formats **Teaching methods**: + Theoretical lectures + Presentation, questions and discussion. **Self-study contents**: *(6)* 8.3 Demodulation schemes	G1.4, G4.1, G4.3, G5.1
13	***Chapter 8: Coherent Lightwave Systems (cont.)*** *(3/0/6)*	
	Teaching contents: *(3)* 8.4 Bit error rate **Teaching methods**: + Theoretical lectures + Presentation, questions and discussion. **Self-study contents**: *(6)* 8.5 Bit error rate (cont.): Asynchronous DPSK Receivers	G1.4, G1.5, G2.3, G2.4, G3.1, G4.1
14	***Chapter 8: Coherent Lightwave Systems (cont.)*** *(3/0/6)*	
	Teaching contents: *(3)* 8.6 Sensitivity degradation	G1.3, G2.4, G3.1, G3.2

	Teaching methods: + Theoretical lectures + Presentation, questions and discussion **Self-study contents**: *(6)* 8.7 System performance	
15	***Review***	

12. Learning ethics:

Home assignments and projects must be done by the students themselves. Plagiarism found in the assessments will get zero point.

13. First approved date: August 1st 2012

Approval level:

Dean	**Department**	**Instructor**

14. Syllabus updated process

1st time: Updated content dated, **August 1st 2014**	Instructors Head of department
2nd time: Updated content dated, **August 1st 2016**	Instructors Head of department