TEL4113 OPTICAL COMMUNICATIONS

Hours per Semester				Weighted Total Mark	Weighted Exam Mark	Weighted Continuous Assessment Mark	Credit Units
LH	PH	TH	CH	WTM	WEM	WCM	CU
45	30	00	60	100	60	40	4

Rationale

This course discussed component and system concepts in optical communications and its application.

Course Objectives

To give students and understanding of the theory of optical devices and systems and their application in optical communication networks.

Detailed Course Content:

Theory and Devices: [12 Hours]

Optical Fibre: The Nature of Light , Transmitting Light on a Fibre , Light Propagation in Multimode and Single-Mode fibres, Plastic Optical Fibre (POF), Hard Polymer (plastic) Clad (silica) Fibre (HPCF) Optical Sources: Light Emitting Diodes (LEDs), Lasers.

Optical Detectors: Photoconductors; Photodiodes including Schottky-Barrier and Avalanche Photodiodes (APDs); Hetero-Interface Photo detectors, Travelling-Wave, Resonant-Cavity, Phototransistors.

Optical Devices: Optical Component Technologies, Optical Amplifiers, Second Harmonic Generation (SHG), Splitters and, Polarization Control, Lenses and Diffraction, Filters, Modulators and Switches, Repeaters

Fibre Manufacture, Cables & Connectors: The Technology of Fiber, Fibre Cables, Joining Fibres (splicing).

Systems: [9 Hours]

Brief Discussion of Point-to-Point Transmission Systems including Modulation, System Engineering, and Control of Dispersion

Optical Link Connections in Electronic Networks: Brief discussion of Fibre Distributed Data Interface (FDDI),Ethernet (IEEE 802.3) , Fibre Channel, Synchronous Optical Network (SONET) and SDH, Asynchronous Transfer Mode (ATM)

Wavelength Division Multiplexing: Components for WDM Systems, Standards for WDM

Operations: [9 Hours]

Optical connectors and multiplexors:

Measuring instruments and techniques: power meter, optical spectrum analyzer, OTDR, BER meter.

Link Budget and loses: Measuring optical fiber cable loses; optical network simulation packages (PTDS); safe working practices.

Learning Outcomes

On successful completion of this module the learner will be able to...

- Identify the main parameters of laser diodes, optical fibre, and optical receivers that effect the performance of optical communications systems
- Analyse the equations that explain the modulation of an optical carrier with electrical data signals and
  apply these equations to determine the maximum modulation rate that can be attained
- Derive solutions for how non-linearity and dispersion affect the propagation of data signals in optical
  fibre, and apply these solutions to analyse the maximum data rate and transmission distance of optical transmission links
- Determine the various parameters of an optical receiver that affect Bit-Error-Rate and eye diagrams,
  and identify how an eye-diagram may be used in quantifying system performance

- Identify the different type of networking configurations that may be used in an optical network and
  analyse how component selection effects network design
- Design a basic optical communication systems and analyse how it performance would be effected by the
  various components used in the system design
- Implement a wavelength division multiplexed systems and formulate how altering the parameters of
  the components used would change system capacity
- Operate all the main components required to develop a basic optical communication systems, and

  conduct experiments to develop and analyse an optical transmission

system **Method of Teaching/Delivery**
The course will be taught by using lectures, tutorials and assignments.
Mode of Assessment
Assignments, tests and final examination. Their relative contributions to the final grade are :

Requirement	Percentage contribution
Course work (Assignments, tests)	40%
Final examination	60%
Total	100%

Recommended and Reference Books

- Fiber-Optic Communication Systems, 3rd Edition, by Govind P. Agrawal (Wiley) (ISBN: 0-47121571-6)
- Optics, 4th Edition, by Eugene Hecht (Addison-Wesley) (ISBN: 0-8053-8566-5)
- Fiber-Optic Communications Technology, by Djafar K. Mynbaev and Lowell L. Scheiner (Prentice-Hall) (ISBN: 0-13-962069-9)
- Fiber Optic Commmunications, 4th Edition, by Joseph C. Palais (Prentice Hall) (ISBN: 0-13895442-9). This is a standard undergraduate text on optical communication systems. As such, it's not at the level needed for this course, but it may be useful as a supplement to Agrawal's book.

Possible Lecturers:
Dr. J. Butime
Dr. D. Okello
Dr. Ing. L. L. Kaluuba
Mr. D. Nsubuga Mubiru
Mr. S. Mwanje
Mr. A Wasswa Matovu
Mr. D. Sebbaale
Mr. I. Kitone