TEL3112 RADIO WAVE PROPAGATION & ANTENNAS

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 builds on the Electromagnetics courses to discuss the conditions and constraints of wave propagation and the design of antennas to be used to achieve radio wave probation.

Course Objectives

By the end of the course the student should

- Understand the concepts of electromagnetic wave propagation as used in different communication systems
- Understand the principles of design and operation of antennas used in different communication systems.

Detailed Course Content:

Propagation: **[9 Hours]**

The Earth's Atmosphere: The troposphere: composition and compositional fluctuations; precipitation and rain and their characteristics; effects on propagating signals at different frequencies (scattering/scintillation; absorption).

The Ionosphere: Origins, behaviour and characteristics; effects on ground wave propagation. Sky wave propagation. Terrestrial line of sight propagation; direct, reflected and refracted waves; Fresnel zones. Transionospheric line of site propagation. Propagation in a mobile environment: multipath effects; log-normal and Rayleigh fading; Propagation modelling and propagation models: synthesis and evaluation for low frequencies to Ka- band.

Radiation: **[12 Hours]**

Retarded potentials; Lorentz gauge conditions. The alternating current element: Fields starting from the retarded vector potential; Radiation, induction and electrostatic fields; Near and far field; Hertzian dipole; Radiated power and radiation resistance. Short antennas: Radiation resistance in terms of the alternating current element half-wave dipole: Field expressions and radiation patterns starting from the retarded vector potential. Small loop antenna: Radiation pattern in terms of a small dipole; Radiation resistance. Antenna fundamentals: gain, directivity, efficiency and effective area. Antenna arrays: Uniform linear array-field expressions; Principle and Secondary maxima; Broadside and end-fire arrays; Pattern multiplication; Binomial arrays.

Antennas: **[9 Hours]**

Medium wave broadcast antennas: monopole and monopole arrays above perfect ground. Short wave antennas: International radio coverage/communications; Rhombic antennas/arrays: Dipole (curtain) arrays; Local coverage-horizontal dipoles and Vee antennas. TV and FM antennas: Loop-type antennas; Dipoles and Yagi-Ud arrays. Frequency independent antennas: equiangular and log-periodic principles with examples. Microwave antennas: electromagnetic horns; reflector antennas; micro-strip antennas; phased arrays. Micro Strip Antenna

Learning Outcomes

On completion of this course the student will be able to:

- Identify and analyse the purpose and the function of structural elements in radio frequency (RF) links.
- Construct RF systems, i.e. emitter, antennas and measurement tools.
- Assess the performance of a line-of-sight and non-line-of-sight RF links.

- Solve RF link problems.
- Design and evaluate the performance of receiver, transmitter, transceiver systems and RF link.

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

- Freeman, R.L., Radio System Design for Telecommunications, Wiley,
- Rappaport, T.S, Wireless Communications, Prentice Hall,
- Doble, J., Mobile Radio Communications", Steele, S., Pentech Press, 1992. "Introduction to Radio Propagation for Fixed and Mobile Communications, Artech House,

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
Mr. A. Muguwa