AEN 4205 OPERATIONS RESEARCH (3 CU)

Lecturer: Mr. Collins Paul Sewanyana (B.Sc. Mech. Eng., M.Sc. Agric. Eng., PhD Candidate)

Course ype: CORE (B.Sc. Agric. Eng IV)

Course Credits (CU): 3 CU i.e. 45 Contact Hours per semester

Course Duration: 15 weeks (45 hours) i.e. 30 LH, 30 PH

COURSE DESCRIPTION
An introduction to systems analysis and optimization techniques. Outline of linear and dynamic programming, queuing theories and their use in agricultural systems design and farm machinery management. Application of simulation technique to agricultural systems. Sensitivity analysis and network analysis.

2. COURSE OBJECTIVES

The overall objective of this course is to introduce the student to the theory and practice of management decision making based on systems design and mathematical programming. This course is intended to give a thorough understanding of the relevance of systems, planning, analysis and evaluation. The course is critical for informed decision making.

The specific objectives are to:

i) provide students with an overview of the subject of Operations Research in relation to agricultural systems planning and evaluation and the rationale of decision making.
ii) provide students with an understanding of concepts and appropriate techniques for solving particular problems and identification and evaluating alternative courses of actions and solution development.
iii) equip students with competences for decision analysis for executive actions based on analytical methods and mathematical modelling.

3. RECOMMENDED REFERENCES FOR READING

1. Taylor III, B.W.R. 1999. Introduction to Management Science. 6th Ed. Prentice-Hall
2. Wagner, H.M. 1975. Principles of Operations Research with applications to Managerial Decisions 2nd Ed. Prentice-Hall International
3. Taha, H.A. 1989. Operations Research 4th ed. MacMillan Publishing Co.
4. Winston, W.L. 1993. Operations Research-Applications and algorithms 3rd Ed. Duxbury Press
5. Reklaitis, G.V. 1983. Engineering Optimization. Wiley-Interscience.
6. Starfield, A.M. 1990. How to model it: problem solving for the computer age. McGraw-Hill.
7. Reference Journals:
    - ✓ Production and Operations Management
    - ✓ Computers and Operations Research
    - ✓ Journal of the Operational Research Society
    - ✓ Mathematical and Computer Modelling
    - ✓ Decision Sciences

4. COURSE CONTENT, METHODS OF INSTRUCTION, TOOLS AND EQUIPMENT REQUIRED

TOPIC	CONTENT	METHOD OF INSTRUCTION / Time allocated	TOOLS / EQUIPMENT NEEDED
LECTURE 1 . INTRODUCTION	• Operations and Management approaches in Agricultural systems • Optimisation in Continuous and step-wise systems	Interactive lectures (3 hrs) Seminar (2 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector/laptop
LECTURE 2. LINEAR PROGRAMMING I	• Maximisation and minimisation problems • Resource allocation Model Formulation • Visual/ Graphical solution approach	Interactive lectures (3 hrs) Practical (2 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector/laptop / graph paper/ rulers
LECTURE 3. LINEAR PROGRAMMING II	• Simplex (Mathematical) solution approach	Interactive lectures (3 hrs) Practical (2 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector
LECTURE 4. SENSITIVITY ANALYSIS	• Graphical Sensitivity analysis • Tabular sensitivity analysis and interpretation	Interactive lectures (3 hrs) Practical (2 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector/laptop / graph paper/ rulers/ Computer lab
LECTURE 5. SCHEDULING & ALLOCATION PROBLEMS I	• Transportation Model formulation • Transportation Simplex analysis • Sensitivity Analysis for Transportation Models	Interactive lectures (3 hrs) Practical (2 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector
LECTURE 6. SCHEDULING & ALLOCATION PROBLEMS II	• Trans-shipment Model • Assignment Model • Multi-farm Machinery scheduling and allocation systems	Interactive lectures (3 hrs) Practical (2 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector
LECTURE 7. MULTISTAGE PROGRAMMING	• Dynamic programming modelling • Forward and backward recursive analysis • In-step and stage-wise optimisation	Interactive lectures (3 hrs) Seminar (3 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector/laptop
LECTURE 8. NETWORK ANALYSIS	• Network diagram formulation • Critical Path analysis • Project Evaluation and Review Techniques • Industrial Processes and flow design applications	Interactive lectures (3 hrs) Practical (2 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector/laptop/ Compu lab
LECTURE 9. SIMULATION TECHNIQUE	• Discrete event simulation • Monte-Carlo simulation • Machinery breakdown and maintenance simulation • Statistical Analysis in simulations	Interactive lectures (3 hrs) Practical (3 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector/laptop/ Compu lab
LECTURE 10. QUEUING THEORIES	• Modelling Arrival and Service processes • Queuing systems • The Machine repair models • Series and open Queuing Networks	Interactive lectures (3 hrs) Seminars (3 hrs)	Chalk / BB or Markers / Flip charts/LCD Projector/laptop/ Compu lab
	• Evaluation	Tests (4 hrs)	Paper, printer, photocopier

5. SUMMARY OF TIME NEEDED

Interactive lectures covering theory	30 hrs
Class and computer-based practicals	15 hrs
Seminars	8 hrs
Evaluation	4 hrs

6. OVERALL COURSE EVALUATION

Continuous Assessment Test	20%
Class seminars, computer practicals & programs	30%
Final examination	50%