**ABM 3103 AGRIBUSINESS OPERATIONS RESEARCH**

**2. INSTRUCTOR(s):** George Omiat (BSc Agric, MUK; MSc, Agric Econ, MUK) (Assistant Lecturer).

**3. COURSE TYPE and location**: B. Agribusiness Management (III); Faculty of Agriculture; Department of Agricultural Economics and Abgribusiness

**4. COURSE STRUCTURE**

3 Credit units: 30 lecture hours (2 contact hour per week for 15 study weeks) and 30 Practical/Tutorial hours (2 contact hour per week for 15 study weeks)

**5. COURSE DESCRIPTION:**

The origin, nature and impact of operations research.Introduction to theory and practice of mathematical programs including linear programming and network analysis.Equations and graphical presentations of business problems and solutions, linear equations and graphs, slopes, intercepts. Functions: concepts and definitions. Applications of nonlinear functions in business.Linear algebra, solving linear equations with matrix algebra.Business and economic applications of linear algebra. Linear programming: graphical and simplex methods. Applications of linear programming to business problems.Differential calculus, the derivatives and the rules of differentiation, uses of derivatives in business.

**6. COURSE OBJECTIVES:**

**General Objective**

## **Operations Research studies analysis and planning of complex systems. The course will focus on mathematical modeling and A strong emphasis will be given to model formulation.**

**Specific Objective**

## Introduce students to Linear and Integer programming techniques.

## To enable students gain skills in building their own formulations

## To enable students gain skills to expand existing formulations

## To enable students critically evaluate the impact of model assumptions and to choose an solution technique for a given formulation

7. RECOMMENDED REFERENCES FOR READING

* Anderson D R, Sweeney D J & Williams T A, An Introduction to Management Science, 10th edition, Thomson/SouthWestern Publishing, 2003.
* Hillier F S and Hillier M S, Introduction to Management Science, McGraw Hill, 2002.

**8. COURSE CONTENT, METHODS OF INSTRUCTION AND TOOLS AND REQUIRED**

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| **TOPIC** | **CONTENT** | **METHOD OF INSTRUCTION / Time allocated** | **TOOLS/ NEEDED** |
| 1.Operational Research and Decision Modelling | * What is Operations Research? * Origins of Operations Research * Phases of Operations Research | Lecture (2 hr) | LCD Projector,  BB/Chalk, |
| 2.Basic Linear Programming - the Graphical Solution Method | * Formulation of LP models for simple problems with just two variables. * Use of the graphical method to solve LP problems * Tutorial/Practical: Solving LPs using the graphical method | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector,  BB/Chalk, Charts, Graph Paper |
| 3.Basic Linear Programming - the Graphical Solution Method | * Understanding the importance of extreme points in obtaining the optimal solution * Knowing the use and interpretation of slack and surplus variables * Understanding key concepts such as alternative optimal solutions, infeasibility and unbounded ness. | Lecture (2 hr) | LCD Projector,  BB/Chalk, |
| 4. Excel Solution of Simple LP Problems | * Use of computers to solve LP model formulations * Describe the general process of modelling with Spread sheets * SOLVER in MS Excel * Interpretation of the SOLVER MS Excel output answer report * Tutorial/Practical: Solving LPs using spreadsheets and interpreting results | Lecture (2 hr)  Tutorial/Practical (3 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 5. Sensitivity Analysis in the Solution of Linear Programming Problem | * Define sensitivity analysis and it benefits * Using MS Excel spreadsheets to do sensitivity analysis * Using SOLVER table for sensitivity analysis * Interpretation of sensitivity analysis results from SOLVER * Interpretation of concepts such as allowable range for objective function coefficients and the right-hand side constraints and the Shadow price or dual price * Tutorial/Practical: Creating sensitivity outputs using Solver and interpreting them | Lecture (2 hr)  Tutorial/Practical (3 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 6. Applications of Linear Programming | * Examples of applications of Linear programming * Blending models in animal feed mixing * Blending models in the Petroleum industry * Blending models in the mining industry * Tutorial/Practical: Formulating LP Blending models, constructing spreadsheets and interpreting results | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 7.More Applications of Linear Programming | * Production Scheduling models applications in determining production level; scheduling shifts; using overtime * Factory Planning models * Financial Planning models * Portfolio Investment models * Tutorial/Practical: Formulating LP models, constructing spreadsheets and interpreting results | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 8. The Simplex method | * Defining the simplex method and its uses * Linear Programs in Standard form * Setting up the simplex method * Key properties of Linear programs * The Simplex Tableau * Breaking in the simplex method * Tutorial/Practical: The simplex method | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; |
| 9. The Simplex method | * Adapting to other LP Models * The Big M method * The Two Phase method * Tutorial/Practical: The Big M method and Two Phase Method | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; |
| 10. Integer Linear Programming Models | * Defining integer programming and how it differs from Linear programming * Formulation of Integer programming models * Shift Scheduling and Staffing models * Formulation of binary integer models * Either or constraints * Tutorial/Practical: Integer Programming using spreadsheets | Lecture (2 hr)  Tutorial/Practical (3 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel)) |
| 11. Further Integer Programming Problems | * Blending with a limited number of ingredients * Depot location * Job shop scheduling * Assembly line balancing Problem * Airline crew scheduling Problem * Timetabling Problem * Tutorial/Practical: Binary integer Programming Using spreadsheets | Lecture (2 hr)  Tutorial/Practical (3 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 12. Network Models for Transportation and Transshipment | * Special Types of LP Problems Transportation and Transshipment Problems * The Transportation model * Formulation of model * Spreadsheet application and areas of application * Tutorial/Practical: Transportation model solutions Using spreadsheets | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 13. Network Models for Transportation and Transshipment | * The Transhipment model * Formulation of model * Spreadsheet application and areas of application * Tutorial/Practical: Transshipment model solutions Using spreadsheets | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 14. Network Models for Shortest Paths, Maximum Flows and Optimal Assignments | * Shortest Path Models * Formulation of Shortest Path models * Application of Shortest Path Models * Maximum flow models * Formulation of maximum flow models * Application of maximum flow models Tutorial/Practical: Network model solutions Using spreadsheets | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |
| 15. Critical Path Analysis and Linear Programming for Project Management | * Defining Critical Path analysis and its uses * The role and application of Critical Path analysis in project scheduling * Use of spread sheets to solve Critical path analysis problems * Tutorial/Practical: Critical Path model solutions Using spreadsheets | Lecture (2 hr)  Tutorial/Practical (2 hrs) | LCD Projector;  BB/Chalk; Computers and Computer Software (MS Excel) |

**9. SUMMARY OF TIME NEEDED**

Lectures 30 hrs

Tutorials/Practical (and assignments) 30 hrs

**10. COURSE ASSESSMENT:**

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| Continuous assessment (Quizzes): | There will be Quizzes arising from Lectures covered | 10% |
| Continuous assessment (Tutorial/Practical): | For each Tutorial/Practical there will be an assignment | 10% |
| Continuous assessment (Mid-semester Test): | There will be 2 mid semester tests | 20% |
| University Examination: | Final examination | 60% |