**Jimma University**

**College of Natural Science**

**Department of Statistics**

**Old Code**: Stat 477  
**Module title/code**: Operations Research (Stat-M3112)   
**Course Type**: **Elective**

**Instructor Name: Fikadu Zewudie (MSc)**

Course descriptionIntroduction, Origin, Development, Meaning, Scope, Techniques, Phases and Limitations of  
Operations Research. Linear programming (Algebraic and Simplex methods); Sensitivity  
analysis; Duality theory in linear programming; Transportation problem; Queuing Theory;  
Game Theory.  
Objectives

To introduce the basic concepts of linear programming  
To present the basic theory of linear programming  
To develop a thorough understanding of linear programming algorithms  
To present the basics of transportation problem  
To introduce queuing and game theories.

**Learning outcomes**Upon successful completion of this course students are expected to:

understand the basics of linear programming, transportation problems, queuing and  
game theories;  
understand the application of operation research methods to real life problems.

**Course outline**:

**1. Introduction (4 lecture hours)**1.1. The meaning of OR

1.2. The history of operations research

1.3. Nature and significance of operations research

1.4. Features of operations research approach

1.5. Operations research: some definitions

* 1. Scientific methods in operations research
  2. Models and modeling in operations research
  3. advantages of models
  4. Methodology of operation research

**2. Linear Programming (10 lecture hours)**2.1. Linear Programming problem (LPP)  
2.2. Graphical method of solution of LPPs with two variables  
2.3. The simplex method of solution of LPPs  
2.4. Tableau Form:  
2.4.1. The general case  
2.4.2. Greater than or equal to constraints  
2.4.3. Equality Constraints  
2.4.4. Eliminating negative right hand side values  
2.5. Solving a minimization problem  
2.6. Special Cases  
2.6.1 Infeasibility  
2.6.2 Unboundedness  
2.6.3 Alternative optimal solutions  
2.6.4 Degeneracy  
**3. Simplex Based Sensitivity Analysis and Duality (10 lecture hours)**3.1. Sensitivity analysis with the simplex tableau  
3.2 The range of optimality  
3.3 The range of feasibility  
3.4 Duality  
3.4.1 Economic interpretation of dual variables  
3.4.2 Using the dual to identify the primal solution  
3.4.3 Finding the dual of any primal problem  
**4. Transportation Problem (8 lecture hours)**4.1 General linear programming model of the transportation problem

4.2 Balancing transportation tableau  
4.3 Starting basic solutions (north – west corner method, least cost method, VAM)  
4.4 Optimality test  
4.5 Transportation algorithm; degeneracy, perturbating a degenerate basic feasible  
solution  
**5. Queuing Theory (12 lecture hours)**5.1.The Structure of waiting line system  
5.1.1 The single channel waiting line  
5.1.2 The process of arrivals  
5.1.3 The distributions of service times  
5.1.4 Queue discipline  
5.1.5 Steady state operation  
5.2.The Single channel Waiting Line Model With Poison Arrival and Exponential  
Service Time  
5.2.1 The Operating Characteristics  
5.2.2 The Decision Maker’s Use of Waiting Line Models  
5.2.3 Improving the Waiting Line Operation  
5.3. Multiple Channel Waiting Line Model with Poison Arrival and Exponential  
Service Times: the Operating Characteristics and Their Interpretation.  
5.4 Some General Relationships for Waiting Lines  
5.5 Economic Analysis of Waiting Lines  
5.6 Other Waiting Line Models  
**6. Introduction to Game Theory (4 lecture hours)**6.1 Introduction  
6.2 Definitions of some common terms  
6.3 Two person zero sum games  
6.4 The Maximin-Minimax Principle  
6.5 Games without saddle points-Mixed strategies  
6.6 Reducing the game problem to LPP  
6.7 Fundamental theorem of games  
**Textbook**Taha, H.A. (2006). Operations Research: An Introduction (8th edition). Prentice-Hall, India,  
New Delhi.  
**References**1. Carter, M.W. and Price, C.C. (2000). Operations Research: A Practical Introduction  
CRC.  
2. Philips, D. T., Ravindra, A. and Solberg, I. Operations Research Principles and  
Practice. John Wiley and Sons, New York.  
3. Ravindran, A., Phillips, D.T. and Solberg, J.J. (1987). Operations Research:Principles  
and Practice. (2nd edition). Wiley.

**Teaching and learning methods**Lectures, tutorials, discussions, presentation, computer lab practice.  
**Modes of Assessment**

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| **Continuous Assessment** | **50%** |
| **Final Exam** | **50%** |