LECTURE HANDOUTS

L

MBA

I/II

Course Name with Code :19MBB05- Quantitative Methods and Techniques

Course Faculty : V.Shanmugapriya

Unit : I **Date of Lecture:**

Topic of Lecture: Introduction of Operations Research

Introduction : (Maximum 5 sentences)

Operations Research (OR) is a discipline that helps to make better decisions in complex scenarios by the application of a set of advanced analytical methods.

Applications of OR techniques spread over various fields in engineering, **management** and public systems

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)

It is most often used to analyze complex real life problems typically with the goal of improving or optimizing performance.

It is a science which deals with problem, formulation, solutions and finally appropriate decision making.

It is an Art and Science.

operational research has expanded into a field widely **used** in industries ranging from petrochemicals to airlines, finance, logistics, and government, moving to a focus on the development of mathematical models

Detailed content of the Lecture:
Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

Introduction of Operations Research

Meaning of operations research:

Operation Research is a relatively new discipline. The contents and the boundaries of the OR are not yet fixed. Therefore, to give a formal definition of the term Operations Research is a difficult task. The OR starts when mathematical and quantitative techniques are used to substantiate the decision being taken. The main activity of a manager is the decision making. In our daily life we make the decisions even without noticing them. The decisions are taken simply by common sense, judgment and expertise without using any mathematical or any other model in simple situations. But the decision we are concerned here with are complex and heavily responsible. Examples are public transportation network planning in a city having its own layout of factories, residential blocks or finding the appropriate product mix when there exists a large number of products with different profit contributions and production requirement etc.

Stages of Development of Operations Research

The stages of development of O.R. are also known as phases and process of O.R, which has six important steps. These six steps are arranged in the following order:

Step I: Observe the problem environment

Step II: Analyze and define the problem

Step III: Develop a model

Step IV: Select appropriate data input

Step V: Provide a solution and test its reasonableness

Step VI: Implement the solution

Step I: Observe the problem environment The first step in the process of O.R. development is the problem environment observation. This step includes different activities; they are conferences, site visit, research, observations etc. These activities provide sufficient information to the O.R. specialists to formulate the problem.

Step II: Analyze and define the problem This step is analyzing and defining the problem. In this step in addition to the problem definition the objectives, uses and limitations of O.R. study of the problem also defined. The outputs of this step are clear grasp of need for a solution and its nature understanding.

Step III: Develop a model This step develops a model; a model is a representation of some abstract or real situation. The models are basically mathematical models, which describes systems, processes in the form of equations, formula/relationships. The different activities in this step are variables definition, formulating equations etc. The model is tested in the field under different environmental constraints and modified in order to work. Some times the model is modified to satisfy the management with the results.

Step IV: Select appropriate data input A model works appropriately when there is appropriate data input. Hence, selecting appropriate input data is important step in the O.R. development stage or process. The activities in this step include internal/external data analysis, fact analysis, and collection of opinions and use of computer data banks. The objective of this step is to provide sufficient data input to operate and test the model developed in Step_III.

Step V: Provide a solution and test its reasonableness This step is to get a solution with the help of model and input data. This solution is not implemented immediately, instead the solution is used to test the model and to find there is any limitations. Suppose if the solution is not reasonable or the behaviour of the model is not proper, the model is updated and modified at this stage. The output of this stage is the solution(s) that supports the current organizational objectives.

Step VI: Implement the solution At this step the solution obtained from the previous step is implemented. The implementation of the solution involves mo many behavioural issues. Therefore, before implementation the implementation authority has to resolve the issues. A properly implemented solution results in quality of work and gains the support from the management. The process, process activities, and process output are summarized in the following.

O.R. Tools and Techniques

Linear Programming:

Game Theory:

Decision Theory:

Queuing Theory:

Inventory Models:

Simulation:

Non-linear Programming:

Dynamic Programming:

Network Scheduling:

Video Content / Details of website for further learning (if any):

Can be added as link

Important Books/Journals for further learning including the page nos.:

Operation Research - Paneerselvam.R- Page No:1-4

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Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: I** **Date of Lecture:**

Topic of Lecture: Linear Programming

Introduction : (Maximum 5 sentences)

Linear Programming is a special and versatile technique which can be applied to a variety of management problems viz. Advertising, Distribution, Investment, Production, Refinery Operations, and Transportation analysis.

The linear programming is useful not only in industry and business but also in non-profit sectors such as Education, Government, Hospital, and Libraries.

The linear programming method is applicable in problems characterized by the presence of decision variables.

The objective function and the constraints can be expressed as linear functions of the decision variables.

The decision variables represent quantities that are, in some sense, controllable inputs to the system being modeled..

Prerequisite knowledge for Complete understanding and learning of Topic:

(Max. Four important topics)

Objective Function: is a linear function of the decision variables representing the objective of the manager/decision maker.

Constraints: are the linear equations or inequalities arising out of practical limitations.

Decision Variables: are some physical quantities whose values indicate the solution.

Feasible Solution: is a solution which satisfies all the constraints (including the non-negative) presents in the problem. Feasible Region: is the collection of feasible solutions.

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

Linear Programming Problem Formulation

The linear programming problem formulation is illustrated through a product mix problem. The product mix problem occurs in an industry where it is possible to manufacture a variety of products. A

product has a certain margin of profit per unit, and uses a common pool of limited resources. In this case the linear programming technique identifies the products combination which will maximize the profit subject to the availability of limited resource constraints.

Suppose an industry is manufacturing two types of products P1 and P2. The profits per Kg of the two products are Rs.30 and Rs.40 respectively. These two products require processing in three types of machines.

The following table shows the available machine hours per day and the time required on each 19 machine to produce one Kg of P1 and P2. Formulate the problem in the form of linear programming model. Profit/Kg P1 Rs.30 P2 Rs.40 Total available Machine hours/day Machine 1 3 2 600 Machine 2 3 5 800 Machine 3 5 6 1100 Solution:

The procedure for linear programming problem formulation is as follows:

Introduce the decision variable as follows:

Let x1 = amount of P1 x2 = amount of P2 In order to maximize profits,

we establish the objective function as $30x1 + 40x2$ Since one Kg of P1 requires 3 hours of processing time in machine 1 while the corresponding requirement of P2 is 2 hours.

So, the first constraint can be expressed as $3x1 + 2x2 \leq 600$ Similarly, corresponding to machine 2 and 3 the constraints are $3x1 + 5x2 \leq 800$ $5x1 + 6x2 \leq 1100$ In addition to the above there is no negative production, which may be represented algebraically as $x1 \geq 0$; $x2 \geq 0$

Thus, the product mix problem in the linear programming model is as follows:

Maximize $30x1 + 40x2$

Subject to: $3x1 + 2x2 \leq 600$ $3x1 + 5x2 \leq 800$ $5x1 + 6x2 \leq 1100$

$x1 \geq 0$, $x2 \geq 0$

Formulation with Different Types of Constraints

Example 2.2: A company owns two flour mills viz. A and B, which have different production capacities for high, medium and low quality flour. The company has entered a contract to supply flour to a firm every month with at least 8, 12 and 24 quintals of high, medium and low quality respectively. It costs the company Rs.2000 and Rs.1500 per day to run mill A and B respectively. On a day, Mill A produces 6, 2 and 4 quintals of high, medium and low quality flour, Mill B produces 2, 4 and 12 quintals of high, medium and low quality flour respectively. How many days per month should each mill be operated in order to meet the contract order most economically.

Solution: Let us define x1 and x2 are the mills A and B. Here the objective is to minimize the cost of the machine runs and to satisfy the contract order.

The linear programming problem is given by

Minimize $2000x1 + 1500x2$

Subject to: $6x1 + 2x2 \geq 8$ $2x1 + 4x2 \geq 12$ $4x1 + 12x2 \geq 24$

$x1 \geq 0, x2 \geq 0$

Video Content / Details of website for further learning (if any):

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MBA

I/II

Course Name with Code :**19MBB05- Quantitative Methods and Techniques**

Course Faculty : **V.Shanmugapriya**
Unit : **I** **Date of Lecture:**

Topic of Lecture: Graphical Methods

Introduction : (Maximum 5 sentences)

Geometric **method**, allows solving simple linear programming problems intuitively and visually. This **method** is limited to two or three problems decision variables since it is not possible to **graphically**.

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)

The **graphical method** is applicable to solve the LPP involving two decision variables x_1, and x_2, we usually take these decision variables as x, y instead of x_1, x_2.

To solve an LP, the **graphical method** includes two major steps.

The determination of the solution space that defines the feasible solution.

Graphical methods are quick and easy to use and make visual sense. Calculations can be done with little or no special software needed. Visual test of model (i.e., how well the points line up) is an additional **benefit**.

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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Course Faculty : **V.Shanmugapriya**

Unit : **I** **Date of Lecture:**

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(Max. Four important topics)

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To solve an LP, the **graphical method** includes two major steps.

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I/II

Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: I** **Date of Lecture:**

Topic of Lecture: Simplex Methods

Introduction : (Maximum 5 sentences)

Simplex method, Standard technique in linear programming for solving an optimization problem, typically one involving a function and several constraints expressed as inequalities. The inequalities define a polygonal region (see polygon), and the solution is typically at one of the vertices.

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)

- Make a change of variables and normalize the sign of the independent terms. ...
- Normalize restrictions.
- Match the objective function to zero.
- Write the initial tableau of Simplex method.
- Stopping condition.
- Choice of the input and output base variables.
- Update tableau

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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Important Books/Journals for further learning including the page nos.: Operation Research - Paneerselvam.R- Page No:25-28

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Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: I** **Date of Lecture:**

Topic of Lecture: Simplex Methods
Introduction : (Maximum 5 sentences) **Simplex method**, Standard technique in linear programming for solving an optimization problem, typically one involving a function and several constraints expressed as inequalities. The inequalities define a polygonal region (see polygon), and the solution is typically at one of the vertices.
Prerequisite knowledge for Complete understanding and learning of Topic: **(Max. Four important topics)** • Make a change of variables and normalize the sign of the independent terms. ... • Normalize restrictions. • Match the objective function to zero. • Write the initial tableau of Simplex method.

- Stopping condition.
- Choice of the input and output base variables.
- Update tableau

Detailed content of the Lecture:

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MBA

I/II

Course Name with Code :**19MBB05- Quantitative Methods and Techniques**

Course Faculty : **V.Shanmugapriya**

Unit : **I** **Date of Lecture:**

Topic of Lecture: Big Method
Introduction : (Maximum 5 sentences) **Big M method** is a **method** of solving linear programming problems using the simplex algorithm. The **Big M method** extends the simplex algorithm to problems that contain "greater-than" constraints.
Prerequisite knowledge for Complete understanding and learning of Topic: **(Max. Four important topics)** **Big M method is** a version of the Simplex Algorithm that first finds a basic feasible solution by adding "artificial" variables to the problem creating the artificial region and then moves to real region thus improving the objective solution

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: I** **Date of Lecture:**

Topic of Lecture: Dual Simplex Method

Introduction : (Maximum 5 sentences)
Dual Simplex Method will pivot from **dual** feasible dictionary to **dual** feasible dictionary working towards feasibility. This new pivoting strategy is called the **Dual Simplex Method** because it really is the same as performing the usual **Simplex Method** on the **dual** linear problem

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)
1) Understanding the **dual** problem leads to specialized algorithms for some important classes of linear programming problems. 2) The **dual** can be useful for sensitivity analysis. 3) Sometimes finding an initial feasible solution to the **dual** is much easier than finding one for the primal

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: I** **Date of Lecture:**

Topic of Lecture: Two Phase Method

Introduction : (Maximum 5 sentences)
In **Two Phase Method**, the whole procedure of solving a linear programming problem (LPP) involving artificial variables is divided into **two phases**. ... In **phase** II, the original objective function is introduced and the usual simplex algorithm is used to find an optimal solution.

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)
First Phase:
(a) All the terms on R.H.S. should be non negative. If some are -ve then they must be made +ve as explained earlier.
(b) Express constraints in standard form.
(c) Add artificial variables in equality constraints or (>) type constraints.
(d) Form a new objective function W which consisted of the sum of all the artificial variables

W = A1 + A2 + …… + Am
Function (W) is known as infeasibility form.
(e) Function W is to be minimized subject to constraints of original problem and the optimum basic feasible solution is obtained.
Any of the following three cases may arise:
(i) Min. W > 0 and at least one artificial variable appears in column "Basic variables" at Positive level. In such case, no feasible solution exists for the original L.P.P. and the procedure is stopped.
(ii) Min. W = 0 and at least one artificial variable appears in column "Basic Variables" at zero level. In such a case, the optimum basic feasible solution to the infeasibility form may or may not be a basic feasible solution to the given (original) L.P.P. To obtain a basic feasible solution, we continue phase I and try to drive all artificial variables out of the basis and then proceed to phase II.
(iii) Min. W=0 and no artificial variable appears in the column "Basic variables" current solution'. In such a case a basic feasible solution to the original L.P.P. has been found. Proceed to phase II.

Second Phase:

Use the optimum basic feasible solution of phase I as a starting solution for the original L.P.P. Using simplex method make iterations till an optimal basic feasible solution for it is obtained. It may be noted that the new objective function W is always of minimization type regardless of whether the given (original) L.P.P. is of maximization or minimization type. Let us take the following example**.**

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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I/II

Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: I** **Date of Lecture:**

Topic of Lecture: Principles of Duality

Introduction : (Maximum 5 sentences) **Duality**, in mathematics, **principle** whereby one true statement can be obtained from another by merely interchanging two words. It is a property belonging to the branch of algebra known as lattice theory, which is involved with the concepts of order and structure common to different mathematical systems

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)
According to **principle of duality** "Dual of **one** expression is obtained by replacing AND (.) with OR (+) and OR with AND together with replacement of 1 with 0 and 0 with 1.
For **example**: consider the expression A+B=0. The dual of this expression is obtained by replacing + with . and 0 by 1. i.e., A.B=1 is dual of A+B=0.

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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I/II

Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: I** **Date of Lecture:**

Topic of Lecture: Principles of Duality

Introduction : (Maximum 5 sentences) Duality, in mathematics, **principle** whereby one true statement can be obtained from another by merely interchanging two words. It is a property belonging to the branch of algebra known as lattice theory, which is involved with the concepts of order and structure common to different mathematical systems

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)
According to **principle of duality** "Dual of **one** expression is obtained by replacing AND (.) with OR(+) and OR with AND together with replacement of 1 with 0 and 0 with 1.
For **example**: consider the expression A+B=0. The dual of this expression is obtained by replacing + with . and 0 by 1. i.e., A.B=1 is dual of A+B=0.

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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I/II

Course Name with Code :**19MBB05- Quantitative Methods and Techniques**

Course Faculty : **V.Shanmugapriya**

Unit : **II** **Date of Lecture:**

Topic of Lecture: Transportation
Introduction : (Maximum 5 sentences) The transportation problem was probably one of the first significant problems studied. The problem can be expressed by the formulation of a linear model, and it can be solved using the simplex algorithm. However, and because of the special structure of the linear model, it can be solved with a more efficient method
Prerequisite knowledge for Complete understanding and learning of Topic: **(Max. Four important topics)** The matrix format for the transportation problem Formulating transportation problems Theorems and definitions Finding an initial basic feasible solution

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

The relevant data for any transportation problem can be summarized in a matrix format using a tableau called the transportation costs tableau (see Figure 5.1). The tableau displays the origins with their supply, the destinations with their demand and the transportation per-unit costs.
D1 D2 · · · Dn
Supply O1 c11 c12 · · · c1n a1 O2 c21 c22 · · · c2n a2 . . . . Om cm1 cm2 · · · cmn am
Demand b1 b2 · · · bn

Formulating transportation problems
We defined the transportation problem as a problem of goods transportation. However, there is a wide range of different areas of application where it is very useful to formulate other problems by means of the matrix format for the transportation problem, and to apply the specific solution techniques that will be explained along this chapter. In this section, we give two examples to show how to model an inventory planning problem and a production problem as transportation problems.

Theorems and definitions
As we previously said, the transportation problem is just a special type of linear programming problem. We can take advantage of its special structure to adapt the simplex algorithm and to have a more efficient solution procedure. In this section we state some theorems and give some definitions that permit us derive the solution method for transportation problems.

Finding an initial basic feasible solution
The procedure of calculating an initial basic feasible solution is performed in a tableau of the same dimensions as the transportation costs tableau; the transportation solution tableau, where each position (i, j) is associated with the decision variable xij , that is, the number of units of product to be transported from origin Oi to destination Dj

1. The Northwest Corner method
2. Least Cost Method
3. Vogel's approximation method

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I/II

Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: II** **Date of Lecture:**

Topic of Lecture: Transportation Models (Minimization and Maximization Problems)
Introduction : (Maximum 5 sentences) **Maximization Transportation Problem**. There are certain types of **transportation problems** where the objective function is to be maximized instead of being minimized. These **problems** can be solved by converting the **maximization problem** into a minimization **problem**
Prerequisite knowledge for Complete understanding and learning of Topic: **(Max. Four important topics)** **Optimal Solution**- a feasible **solution** is said to be **optimal solution** if it minimize total **transportation** cost Balanced **Transportation Problem** - a **transportation problem** in which the total supply from all sources is equal to the total demand in all the destinations.
Detailed content of the Lecture: **Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any**

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Course Name with Code :**19MBB05- Quantitative Methods and Techniques**

Course Faculty : **V.Shanmugapriya**

Unit : **II** **Date of Lecture:**

Topic of Lecture: Initial Basic Feasible Solution (IBFS)
Introduction : (Maximum 5 sentences) This involves **Initial solution** to the given balanced Transportation Problems or Resource Allocation or Cost Allocation problem. This is known as **Initial Basic Feasible Solution** (IBFS)
Prerequisite knowledge for Complete understanding and learning of Topic: **(Max. Four important topics)** A **feasible solution** is said to be **basic** if the number of positive allocations equals m+n-1; that is one less than the number of rows and columns in a **transportation problem**. A **feasible solution** (not necessarily **basic**) is said to be optimal if it minimizes the total **transportation** cos
Detailed content of the Lecture: **Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any**

Video Content / Details of website for further learning (if any):

Can be added as link

Important Books/Journals for further learning including the page nos.:
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I/II

Course Name with Code :19MBB05- Quantitative Methods and Techniques

Course Faculty : V.Shanmugapriya

Unit : II **Date of Lecture:**

Topic of Lecture: N-W Corner Rule, Least Cost and Vogel's Approximation Methods

Introduction : (Maximum 5 sentences)

It has three steps: Find the **north west corner** cell of the **transportation** tableau. Allocate as much as possible to the selected cell, and adjust the associated amounts of supply and demand by subtracting the allocated amount. Cross out the row or column with 0 supply or demand

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)

Step 1: Formulate the problem.

Step 2: Obtain the initial feasible solution.

Algorithm for North-West Corner Method (NWC)

Algorithm for Least Cost Method (LCM)

Algorithm for Vogel's Approximation Method (VAM)

Detailed content of the Lecture:
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Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: II** **Date of Lecture:**

Topic of Lecture: Check for optimality- MODI Method
Introduction : (Maximum 5 sentences) The modified distribution **method**, is also known as **MODI method** or (u - v) **method** provides a minimum cost solution to the transportation problems. ... The objectives are to develop and review an integral transportation schedule that meets all demands from the inventory at a minimum total transportation cost.
Prerequisite knowledge for Complete understanding and learning of Topic: **(Max. Four important topics)** It consists in considering each potential new basic variable, and checking its impact on the **objective function**. ... For a maximization (minimization) problem, if the reduced costs of all non basic variables are negative (positive), the solution is **optimal**.

Detailed content of the Lecture:

Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

Video Content / Details of website for further learning (if any):

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Course Name with Code :**19MBB05- Quantitative Methods and Techniques**

Course Faculty : **V.Shanmugapriya**

Unit : **II** **Date of Lecture:**

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(Max. Four important topics)

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I/II

Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: II** **Date of Lecture:**

Topic of Lecture: Case of Degeneracy

Introduction : (Maximum 5 sentences)

In a standard **transportation problem** with m sources of supply and n demand destinations, the test of optimality of any feasible solution requires allocations in m + n – 1 independent cells. If the number of allocations is short of the required number, then the solution is said to be **degenerate**.

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)

Degeneracy in Transportation problem. If number of positive independent allocations is less than m+n-1, then Initial Basic Feasible Solution is **Degenerate**. To Remove **Degeneracy** we allocate very small positive number epsilon (£) to the unoccupied cell which have minimum cost and should be on Independent position

Detailed content of the Lecture:
Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: II** **Date of Lecture:**

Topic of Lecture: Assignment Models

Introduction : (Maximum 5 sentences)

Assignment models is one of topics of operations research. It consists of assigning a specific (person or worker) to a specific (task or job) assuming that there are the number of persons equal to the number of tasks available

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)

The **assignment problem** is classified into balanced **assignment problem** and unbalanced **assignment problem**. If the number of rows is equal to the number of columns, then the **problem** is termed as a balanced **assignment problem**; otherwise, an unbalanced **assignment problem**

Detailed content of the Lecture:
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Course Name with Code **:19MBB05- Quantitative Methods and Techniques**

Course Faculty **: V.Shanmugapriya**

Unit **: II** **Date of Lecture:**

Topic of Lecture: Minimizing and Maximizing problems

Introduction : (Maximum 5 sentences)

The fundamental idea which makes calculus useful in understanding **problems** of **maximizing** and **minimizing** things is that at a peak of the graph of a function, or at the bottom of a trough, the tangent is horizontal. That is, the derivative f′(xo) is 0 at points xo at which f(xo) is a maximum or a minimum.

Prerequisite knowledge for Complete understanding and learning of Topic:
(Max. Four important topics)

Minimization and maximization. Minimize and Maximize yield lists giving the value attained at the minimum or maximum, together with rules specifying where the minimum or maximum occurs

Detailed content of the Lecture:
Diagram/ Description/Algorithm/Procedure for solving problems/ Derivation component with supporting content if any

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Course Faculty : V.Shanmugapriya

Unit : III **Date of Lecture:**

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Course Name with Code :19MBB05- Quantitative Methods and Techniques

Course Faculty :K.Mayakkannan

Unit : III **Date of Lecture:**

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