# GUJARAT TECHNOLOGICAL UNIVERSITY
## MECHATRONICS ENGINEERING (20)

**SUBJECT NAME: Production Optimization Techniques**
**SUBJECT CODE: 2172004**
**B.E. 7th SEMESTER**

**Type of course: Engineering Science**

**Prerequisite: N.A.**

**Rationale:** This subject is a robust tool and offers directions in making the best decisions possible given the data available. It may provide the executive with an analytical and quantitative basis to identify the problem area. The most frequently adopted applications in this category deal with production scheduling and inventory replenishment.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | | Practical Marks | | | |
| | | | | ESE (E) | PA (M) | | PA (V) | | PA (I) | |
| | | | | | PA | ALA | ESE | OEP | | |
| 3 | 2 | 0 | 5 | 70 | 20 | 10 | 20 | 10 | 20 | 150 |

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

**Content:**

| Sr. No. | Content | Total Hrs | % Weightage |
|---|---|---|---|
| 1 | **GENERAL CONCEPTS**<br>Evolution of Modern Management; Functional approach, systems approach; Decision making; Models and Model building; Models to solve production problems. | 2 | 5% |
| 2 | **LINEAR PROGRAMMING**<br>General L. P. Format, formulation of production problems, Methods of Solution: Graphical, Simplex, Modified simplex, Big M and 2 Phase methods; Duality, degeneracy and redundancy in L.P., Sensitivity analysis, Application of L.P. to solve problems of Production systems. | 6 | 14% |
| 3 | **TRANSPORTATION MODEL**<br>Formulation, methods of solution: NW Corner, Least cost and Vogels approximation methods; Optimality test: Stepping stone and MODI methods; Degenerate and unbalanced transportation problems; | 5 | 12% |

| | | | |
|---|---|---|---|
| | Sensitivity analysis; Application to Production systems. | | |
| **4** | **ASSIGNMENT MODEL**<br>Formulation; Methods of solution: Enumeration, transportation, Hungarian methods; Areas of application in the solution of production problems. | **4** | **9%** |
| **5** | **NETWORK ANALYSIS**<br>CPM and PERT, Concept of slack/float and its significance; Project cost analysis, crashing, resource smoothing and leveling, Applications in production systems | **6** | **14%** |
| **6** | **SEQUENCING PROBLEMS**<br>Johnson's Rule and its logic, methods of solution; n jobs two machines, n jobs 3 machines, 2 jobs M machines and n jobs M machines problems; Graphical and Heuristic methods; Applications and limitations. | **3** | **7%** |
| **7** | **DECISION THEORY**<br>Expected Value and Break even analysis; Decision tree concept; Relevance to production systems. | **5** | **12%** |
| **8** | **REPLACEMENT**<br>Basic replacement model, replacement of items that deteriorate with time, replacement of items that fail completely, group replacement; Failure tree concept; Statistical and algebraic methods; Application to production problems. | **4** | **9%** |
| **9** | **QUEUING MODELS**<br>Simple queues, multiple service channels; Arrival and service characteristics; Optimization of queuing systems; Application to production problems. | **4** | **9%** |
| **10** | **INVENTORY CONTROL**<br>Inventory parameters and properties; Deterministic and probabilistic inventory models; Concept of zero inventory; Sensitivity analysis; Application to production problems. | **4** | **9%** |

**Suggested Specification table with Marks (Theory):**

| **Distribution of Theory Marks** | | | | |
|---|---|---|---|---|
| **Remembrance**<br>**R Level** | **Understanding**<br>**U Level** | **Application**<br>**A Level** | **Analyze**<br>**N Level** | **Evaluate**<br>**E Level** |
| **20** | **30** | **20** | **20** | **10** |

**Legends: R : Remembrance ; U = Understanding; A = Application and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table

**Text Books:**

Quantitative Techniques in Management, Vohra N D, Tata McGraw Hill

**Reference Books:**

1. Operational Research, Analysis and Applications, Wilkes Michael, McGraw Hill
2. Applied OR and Management Science, Fabrycky, Ghare and Torgersen, Prentic Hall of India
3. Quantitative approaches to Management, Richard Levin McGraw Hill.

**Course Outcome:**

After learning the course the students should be able to:

1. Identify and develop models for optimizing the management and production systems from the verbal description of the real system.
2. Facilitate quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.
3. Acquaint him / her with applications of optimization techniques to solve manufacturing and other industry related problems.
4. Expose him / her to the significance of various scientific tools and models that are available in the subject to take decisions in a complex environment.

**List of Experiments:**

1. Tutorial on Modeling and graphical method.
2. Tutorial on Simplex Method.
3. Tutorial on Big M and Two Phase Method.
4. Tutorial on Duality and Sensitivity analysis.
5. Tutorial on Transportation Techniques.
6. Tutorial on Assignment Problem.
7. Tutorial on network analysis techniques.
8. Tutorial on Decision Making.
9. Tutorial on Replacement.
10. Tutorial on Queuing and Inventory models.

**Design based Problems (DP)/Open Ended Problem:**

Student may be given a task to exhibit their knowledge of the course studied during the academic year.

**Major Equipment:**

Nil

**List of Open Source Software/learning website:**

The website of NPTEL may be utilized for additional learning.

**ACTIVE LEARNING ASSIGNMENTS:** Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to

be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.