GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Mechanical/Production/Manufacturing Engineering
SUBJECT NAME: Operations Research
SUBJECT CODE: 2171901
BE semester VII

Type of course: Core

Prerequisite: Nil

Rationale:
Operations Research now a day widely used in the area of decision making for the real life problems. Managers and decision makers get idea for optimizing and approximating industrial problems. They not only strive to devise appropriate measures for problem solving but also apply scientific techniques to monitor the organizations ongoing activities such as production mix, transportation, queuing, assignment, dynamic, Integer, goal and game problem.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	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;

Learning Objectives:

1. To build concrete foundation for their core branch as a thinker, inter disciplinary thoughts
2. To educate students by covering different aspects of Operations Research.
3. To create strong problem solving skills as an engineer along with an understanding of the approach, methods and requirements of linear Programming Problem for a successful career in advancing technology.
4. To educate students to understand different Real Life problems in the Operations Research area.

Content:

Unit No.	Topic	Teaching Hours	Weightage
1	**Operations Research:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.	02	05%

2	**Linear Programming Problem:** Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Sensitivity Analysis, Primal and Dual Problems, Economic Interpretation.	08	20%
3	**Transportation and Assignment:** Transportation Problems definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, Unbalanced problems and profit maximization problems. Transshipment Problems. Assignment Problems and Travelling sales man Problem.	06	15%
4	**Queuing Theory:** Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Preliminary examples of M/M/1:∞/FCFA	05	10%
5	**Inventory Control:** Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis.	04	08%
6	**Replacement theory:** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy.	03	08%
7	**Game Theory:** Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and graphical methods. .	04	10%
8	**Decision Theory:** Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, hurwicz criterion, Decision tree.	04	08%
9	**Project Management:** Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.	06	16%
	Total Hours	**42**	**100%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**15**	**15**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create 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.

Reference Books:

1. Operations Research: An Introduction by Hamdy Taha, Pearson
2. Operations Research by A M Natarajan, P Balasubramani, A Tamilarasi, Pearson Education Inc
3. Operations Research by P Mariappan, Pearson
4. Operations Research by H N wagner, Prentice hall.
5. Optimization in Operations Research by Ronald Rardin, Pearson Education Inc.
6. Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
7. Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill

Course Outcome:

After learning the course the students should be able to:

1. Students will be able to describe characteristics and scope of OR.
2. Students will be able to define and formulate mathematical problems.
3. Students will be able to select optimal problems solving techniques for a given problem using LP.
4. Students will be able to formulate and solve transportation, travelling sales man and transshipment problems.
5. Students will be able to formulate and solve optimization problems related to job/ work assignments.
6. Students will be able to demonstrate and solve simple models of Game theory.
7. Students will be able to evaluate optimum solution using dynamic programming for different applications.
8. Students will be able to choose / devise appropriate queuing model for practical application.
9. Students will be able to solve different problems related to Network.

List of Experiments:

1. Exercise on definition, formulation of linear programing problems.
2. Exercise on Graphical solution of linear programing problems
3. Exercise and case problems on Simplex, Big M and Two phase LP Problems
4. Exercise and case problems on Dual and Primal LP Problems
5. Exercise and case problems on Sensitivity Analysis
6. Exercise and case problems on Transportation and Transhipment Problems.
7. Exercise and case problems on Assignment and Travelling sales man Problems
8. Exercise and case problems on Queuing theory

9. Exercise and case problems on Game theory
10. Exercise on Inventory model
11. Exercise on Replacement theory
12. Exercise and case problems on PERT/CPM

Design based Problems (DP)/Open Ended Problem:

1. Industrial Problems of Linear Programming
2. Industrial Problems on Transportation
3. Industrial Problems on Assignment
4. Industrial Problems on Queuing
5. Industrial Problems on PERT and CPM

Major Equipment:

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List of Open Source Software/learning website:

www.nptel.ac.in/