Course Syllabus
Gyanmanjari Degree Engineering College
Semester-7 (B. Tech)

Subject: Operation Research- BETME17330.

Type of course: Professional Core.

Prerequisite: Basic knowledge of engineering mathematics.

Rationale: The course aims to provide fundamental knowledge of Operations Research techniques used in engineering decision-making. The principles of optimization, resource allocation, and problem-solving are discussed. The course serves as a foundation for applying mathematical models to real-life industrial problems, enabling students to improve efficiency and productivity. It equips students with the necessary skills to actively participate in planning, scheduling, and decision-making processes within mechanical and manufacturing industries.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No	Course content	Hrs.	% Weightage
1	**Operations Research** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research. 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, Special Case of LP Problem, Graphical Sensitivity Analysis. Introduction of Primal and Dual Problems, Economic Interpretation. Introduction of Goal and Integer Programing. Dynamic Programming Steps involved in dynamic programming, characteristics and explanation of dynamic programming, formulation of Deterministic and probabilistic dynamic programming.	16	25%
2	**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. Transhipment Problems. Assignment Problems and Travelling sales man Problem. **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/1:8/8/FCFS	14	25%
3	**Replacement Theory** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy. **Game Theory** Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, M x2), Algebraic and graphical methods.	15	25%
4	**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. **Project Management** Introduction to PERT and CPM, Critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.	15	25%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Optimization Problem Analysis: -** The faculty will allocate one Linear Programming or Transportation Problem to each student group. Students will solve the given problem using suitable methods such as graphical method, North-West Corner Method, or Least Cost Method and identify the optimum solution. Each group will prepare a PowerPoint presentation based on their solution methodology and findings and upload it on the GMIU Web Portal.	10
2	**PERT-CPM Analysis: -** The faculty will assign one project scheduling activity based on PERT or CPM to each student group. Students will prepare a network diagram, identify the critical path, and calculate float values using the given data. Each group will develop a poster or chart explaining the complete scheduling process and upload it on the GMIU Web Portal.	10
3	**Queuing Case Study: -** The faculty will allocate one simple real-life case related to queuing system, replacement theory, or decision theory to each student group. Students will observe the selected system, collect basic information, and explain the suitable Operations Research technique used for solving the problem. Each group will prepare a short PDF report and submit it through the GMIU Web Portal.	10
	Total	30

Suggested specification table with marks (Theory):

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	**Remembrance (R)**	**Understanding (U)**	**Application (A)**	**Analyze (N)**	**Evaluate (E)**	**Create (C)**
Weightage	10 %	10 %	30 %	30 %	20 %	-

Course Outcome:

After learning the course, the students should be able to:	
CO1	Apply Operations Research techniques to solve optimization and decision-making problems.
CO2	Analyze transportation, assignment, and queuing problems for industrial applications.
CO3	Evaluate replacement and game theory problems for decision-making applications.
CO4	Analyze decision-making and project management techniques for industrial applications.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs.
1	Exercise on definition, formulation of linear programing problems.	1	2
2	Exercise on Graphical solution of linear programing problems	1	2
3	Exercise and case problems on Simplex, Big M and Two-phase LP Problems	1	4
4	Exercise and case problems on Dual and Primal LP Problems	1	2
5	Exercise and case problems on Sensitivity Analysis	1	2
6	Exercise and case problems on Transportation and Transhipment Problems.	2	2
7	Exercise and case problems on Assignment and Travelling sales man Problems	2	4
8	Exercise and case problems on Queuing theory	2	2
9	Exercise and case problems on Game theory	3	2
10	Exercise on Inventory model	3	2
11	Exercise on Replacement theory	3	2
12	Exercise and case problems on PERT/CPM	4	4

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of Active Learning Assignment

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

[1] Operations Research: An Introduction by HamdyTaha, Pearson Education Inc

[2] Operations Research: Principles and Practice by Pradeep PrabhakarPai, Oxford Higher Education, Oxford University press

[3] Operations Research: Principles and Practice by Ravindran Phillips and Solberg by Wiley India Edition,

[4] Operations Research by P Mariappan, Pearson

[5] Operations Research by A M Natarajan, P Balasubramani, A Tamilarasi, Pearson Education Inc

[6] Operations Research by H N Wagner, Prentice hall.

[7] Optimization in Operations Research by Ronald Rardin, Pearson Education Inc.

[8] Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.

[9] Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill