FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Mechanical Engineering)**

Semester: **V**

Course Code: **202090507**

Course Title: **Operations Research**

Course Group: **Professional Elective Course-I**

Course Objectives: This course aims to acquaint students with different techniques of constructing, solving and interpreting mathematical models addressing industrial and managerial decisions.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction of Operations Research:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.	2
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, Special Case of LP Problem, Graphical Sensitivity Analysis. Introduction of Primal and Dual Problems, Economic Interpretation.	13
3	**Transportation Model:** Transportation Problems definition, Linear form, Initial Basic Feasible Solution (IBFS): Northwest corner method, Least cost method, Vogel's approximation method. Degeneracy in transportation, Optimality tests: Stepping stone method, Modified Distribution method, Unbalanced problems, and profit maximization problems. Transhipment Problems.	6

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4	**Assignment Model:** Formulation, Hungarian method, Variations in Assignment problem, Travelling salesman Problem.	**3**
5	**Replacement theory:** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy.	**5**
6	**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.	**4**
7	**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: ∞/∞/FCFS.	**4**
8	**Project Management:** Introduction to PERT and CPM, Critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.	**8**
	Total	**45**

List of Practicals / Tutorials:

1	Exercise on problem formulation
2	Exercise on solving two variables LPP using graphical method
3	Exercise on LPP using Simplex, Big-M (penalty method) and Two-phase method
4	Exercise on Transportation problems (balanced and unbalanced) and transshipment: IBFS and Optimal solution
5	Exercise on Assignment model and traveling salesman problem
6	Exercise on Replacement of capital goods including time value of money and group & individual replacement
7	Exercise on Two-person zero sum mixed strategy (Graphical and analytical)
8	Exercise on different queuing models
9	Estimation of probability of project completion based on PERT
10	Exercise on identification of critical path for given network and crashing

Reference Books:

1	Operations Research by Manohar Mahajan, Dhanpat Rai & Co.
2	Operations Research by Dr. D.S. Hira and Premkumar Gupta, S. Chand
3	Operations Research: An Introduction by HamdyTaha, Pearson Education Inc
4	Operations Research: Theory and Applications by J. K. Sharma, 4th Edition, Macmillan Publication
5	Principles of Operations Research, with Applications to Managerial Decisions by Harvey M. Wagner, PHI publication
6	Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
7	Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill

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Supplementary learning Material:	
1	NPTEL Resources
2	Coursera resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10	20	25	20	15	10	

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.

Course Outcomes (CO):

Sr.	**Course Outcome Statements**	**%weightage**
CO-1	Student will learn developing mathematical model from verbal description of production problem.	**10**
CO-2	Student will learn use of mathematical technique such as simplex, big-M, two phase, transportation and assignment theory to solve real life based industrial problems.	**35**
CO-3	Student will learn engineering and managerial principles and apply the same to minimize project management time, cost, and effective utilization of resources.	**20**
CO-4	Student will learn how to apply quantitative techniques such as machine replacement, queuing theory, game theory in manufacturing and service sector under competitive condition to excel in respective field.	**35**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025

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