ENVIRONMENT SYSTEM OPTIMIZATION

Paper Code: ETEN-302	**L**	**T/P**	**C**
Paper: Environment System Optimization	**3**	**1**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 12.5 marks.

Objective: The course aims to introduce fundamentals and need for optimization techniques in engineering problems. Various techniques such as Linear Programming, Geometric Programming, Dynamic Programming and Non-Linear Programming are taught to students to solve various environmental engineering problems for optimal solutions.

UNIT–I

Introduction to Optimization: Engineering Applications of Optimization, Statement of an Optimization Problem, Design Constraints, Constraint Surface, Objective Function, Optimization Techniques, Single-Variable Optimization, Multivariable Optimization with no Constraints, Multivariable Optimization with Equality Constraints, Multivariable Optimization with Inequality Constraints, Convex Programming Problem.

[T1, T2][No. of Hours: 11]

UNIT–II

Linear Programming: Applications, Standard form, Pivotal Reduction, Simplex Algorithm, Two Phases of the simplex Method, Primal- Dual Relations, Transportation Problem, Integer Linear Programming. Assignment Problem. Examples- reservoir for irrigation and power production, river water quality (including treated effluent component). Water supply and drainage network optimization- case study.

[T1, T2][No. of Hours: 11]

UNIT–III

Geometric Programming: Introduction, Polynomial, Unconstrained Minimization Problem, Constrained Minimization, Applications of Geometric Programming.

Dynamic Programming: Introduction, Multistage Decision Processes, Representation of a Multistage Decision Process, Concept of Sub-optimization and the principle of the Optimality, Computational Procedure in Dynamic Programming, Continuous Dynamic Programming, Design of a Minimum-Cost Drainage System. Water allocation problem, capacity expansion problem, reservoir operation, case study.

[T1, T2][No. of Hours: 12]

UNIT–IV

Nonlinear Programming: Unrestricted Search, Exhaustive Search, Dichotomous Search, Interval Halving Method, Golden Section Method, Interpolation Method, Quadratic Interpolation Method, Cubic Interpolation Method, Direct Root Method, Case studies in Environmental Engineering.

[T1, T2][No. of Hours: 11]

Text Books:

[T1] Douglas A.H., "Environmental System Optimization", John Wiley and Sons, New York.

[T2] Vedula S. and Mujumdar P.P., "Water Resources Systems: Modeling Techniques and Analysis", TMH

Reference Books:

[R1] Rao S.S., "Engineering Optimization- Theory and Optimization", New Age International Publishers

[R2] Haith D.A., "Environmental System Optimization", Wiley and Sons, New York.

[R3] Geem Z.W., "Optimization In Civil and Environmental Engineering", Old City Publishing, USA.

[R4] Sieniutycz S and Jezowski J., "Energy Optimization In Process Systems", Elsevier, U.K.

[R5] Floudas A and Perdolas M., "Encyclopedia of Optimization- Volume 2", Springer, United States.