# SCHEME OF COURSE WORK

| | | | |
|---|---|---|---|
| Course Title | OPERATIONS RESEARCH | | |
| Course Code | 19ME21P1 | L P C | : 2 0 2 |
| Program: | M.Tech. | | |
| Specialization: | Thermal Engineering | | |
| Semester | II | | |

**Course Outcomes (COs):**
At the end of the course, the student will be able to

| | |
|---|---|
| 1 | Formulate a linear programming problem for given problem and solve this problem by using Simplex techniques |
| 2 | Evaluate sensitivity analysis to the given input data in order to know sensitive of the output. |
| 3 | Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives. |
| 4 | Solve deterministic and Probabilistic inventory control models for known and unknown demand of the items |
| 5 | Apply the dynamic programming to solve problems of discrete and continuous variables |

## Program Outcomes (POs)

At the end of the program, the students in CAD/CAM will be able to

| PO Code | Program Outcome (PO) |
|---|---|
| **PO1** | exhibit in-depth knowledge in thermal engineering specialization |
| **PO2** | think critically and analyse complex engineering problems to make creative advances in theory and practice |
| **PO3** | solve problem, think originally and arrive at feasible and optimal solutions with due consideration to public health and safety of environment |
| **PO4** | use research methodologies, techniques and tools, and will contribute to the development of technological knowledge |
| **PO5** | apply appropriate techniques, modern engineering tools to perform modeling of complex engineering problems with knowing the limitations |
| **PO6** | understand group dynamics, contribute to collaborative multidisciplinary scientific research |
| **PO7** | demonstrate knowledge and understanding of engineering and management principles and apply the same with due consideration to economical and financial factors |
| **PO8** | communicate complex engineering problems with the engineering community and society, write and present technical reports effectively |
| **PO9** | engage in life-long learning with a high level of enthusiasm and commitment to improve knowledge and competence continuously |
| **PO10** | exhibit professional and intellectual integrity, ethics of research and scholarship and will realize the responsibility towards the community |
| **PO11** | examine critically the outcomes of actions and make corrective measures |

**Course Outcome** versus **Program Outcomes:**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO-1** | S | S | M | M | | M | | | | | | |
| **CO-2** | S | S | S | M | | M | M | | M | | | |
| **CO-3** | S | S | S | S | | M | M | | M | | | |
| **CO-4** | S | M | | | | | | | M | | | |
| **CO-5** | M | | M | M | | M | | | M | | | |

*S* - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation S* - Strongly correlated, *M* - *Moderately* correlated, *Blank* - *No correlation*

## Teaching-Learning and Evaluation

| Week | Topic/Contents | Course Outcomes | Sample Questions | Teaching- Learning Strategy | Assessment Method & Schedule |
|---|---|---|---|---|---|
| 1 | Optimization techniques | CO1 | 1. Explain the various types of Optimization techniques.<br>2. Discuss about simplex techniques.<br>3. Explain about inventory control models | Lectures<br>PPT,<br>Seminar | Seminar<br>(week 3-7) |
| 2 | model formulation and models | CO1 | | | |
| 3 | simplex techniques | CO1 | | | |
| 4 | . inventory control models | CO1 | | | |
| 5 | Formulation of a LPP - graphical solution for LPP | CO2 | 1. Using graphical method, the optimum solution of the LPP of maximizing z = 10x+15y subject to the 2x+y≤26, x+2y≤28, y-x≤5 and x≥0, y≥0 is obtained as x= ---------- and y = ------<br>2. Write the dual of the following LPP Maximize z = 5x1+3x2 subject to the constraints: 3x1+5x2≤15, 5x1+2x2≤10, where x1≥0 and x2≥0<br>3. Discuss the effect of variation or changes in objective function coefficients Cj's for a given LPP. | Lectures<br>PPT,<br>Seminar | |
| 6 | revised simplex method | CO2 | | | |
| 7 | duality theory, dual simplex method | CO2 | | | |
| 8 | sensitivity analysis - parametric programming | CO2 | | | |
| 9 | Mid-Test 1 | CO-1, CO-2 | | | |

| | | | | | |
|---|---|---|---|---|---|
| 10 | Nonlinear programming problem - Kuhn-Tucker conditions | CO3 | 1. Writ any three differences between PERT and CPM.<br>2. Maximize<br>$Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$<br>Subject to the constraints<br>$x_1 + x_2 \le 2$<br>$2x_1 + 3x_2 \le 12$<br>$x_1, x_2 \ge 0$<br>Using Kuhn-Tucker conditions<br><br>3. Define total float, free float and independent float | Lectures PPT, Seminar | |
| 11 | CPM/PERT | CO3 | | | |
| 12 | single server and multiple server models | CO4 | 1. Derive Wilson harris formula for EOQ.<br>2. Give an average arrival rate of 20 per hour there are two options for a customer: A single channel with service rate 22 customers per hour or a two service channel with service rate of 11 customers per hour. Determine which is a better option. ( with respect to waiting time)<br>3. Define degree of difficulty. | Lectures PPT, Seminar | Seminar (week 11-16) |
| 13 | deterministic inventory models - probabilistic inventory control models | CO4 | | | |
| 14 | geometric Programming | CO4 | | | |
| 15 | Single and multi-channel problems , sequencing models, | CO5 | 1. Explain about bellmans principle of optimality.<br>2. Define total elapsed time, idle time and no passing rule.<br>3. Explain about principle of dominance.. | Lectures PPT, Seminar | |
| 16 | dynamic programming, flow in networks, | CO5 | | | |
| 17 | elementary graph theory, game theory simulation | CO5 | | | |
| 18 | Mid-Test 2 | CO-3, CO-4, CO-5 | | | |
| 19/20 | END EXAM | All COs | | | |