

A. Course Handout

Institute/School/College Name	Chitkara University Institute of Engineering & Technology		
Department/Centre Name	Department of Computer Science & Engineering		
Programme Name	Bachelor of Engineering- Computer Science & Engineering (Artificial Intelligence)		
Course Name	Optimization Techniques	Session	2024-25
Course Code	22AI011	Semester/Batch	4 th /2023
Lecture/Tutorial (Per Week)	3-0-0	Course Credit	3
Course Coordinator Name	Dr. Reetu Malhotra		

1. Objectives of the Course:

The purpose of the course is to make the students familiar with concepts, theories, and changing realities in the field of operations research. The course will enable students to take decisions with the optimum utilisation of resources with minimum loss, under utilisation or waste. Its purpose is to give administration, a basis for predicting quantitatively the most effective results of an operation under given set of variable conditions and thereby to provide a sound basis for “decision-making. The main objectives of the course are:

- To make the students understand the basic concepts, theories and principles of operations research.
- To apply the concepts of scientific approach to decision making which seeks to determine how best to design and operate a system.
- To understand concepts and computational techniques.
- To manage resources efficiently, maximize profits and/or minimize costs

2. Course Learning Outcomes:

CLO-PO Mapping grid |Program outcomes (POs) are available as a part of Academic Program Guide

CLO	Course Outcomes	POs	CL *	KC*	Lectures
CLO01	Identify and critically assess the concepts of operation research and tools to problems involving the operations of a system so as to provide those in the control of the system with optimum solutions to the problems.	PO1,PO2,P11	K2	Factual Conceptual	15
CLO02	Recognise and appreciate the connections between theory and applications.	PO1,PO2,PO4	K2	Factual Conceptual	10
CLO03	Formulate the real world problems into mathematical models.	PO2,PO3	K3	Fundamental Conceptual	10
CLO04	Analyse, conceive, and apply different optimization techniques to provide better quantitative information's for making decision. Analyse the given business problem analytically.	PO1,PO2,PO3	K3	Fundamental Conceptual	10
Total Contact Hours					45

Revised Bloom's Taxonomy Terminology

*CL = Cognitive Level

*KC = Knowledge Categories

CLO-PO-PSO Mapping grid |Program outcomes (POs) and Program Specific Outcomes (PSOs) are available as a part of Academic Program Guide

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO01	H	H									H		M		
CLO02	H	H		M									M		
CLO03		H	M											M	H
CLO04	H	M	H											M	H

H=High, M=Medium, L=Low

3. ERISE Grid Mapping

Feature Enablement	Level (1-5, 5 being highest)
Entrepreneurship	3
Research	5
Innovation	4
Skills	4
Employability	4

4. Recommended Books (Reference Books/Textbooks):

- B01:** Linear Programming: An introduction to finite improvement algorithms; Daniel Solow; 2nd Edition, Elsevier Science Ltd
- B02:** Linear Programming: Methods and applications; Saul I. Gass, 5th Edition, Dover Publications Inc.
- B03:** Project planning and control with PERT and CPM; B C Punmia 4th Edition, Laxmi Publications Pvt Ltd
- B04:** Introduction to Operation Research, Hilier and Liebermann, 11th Edition, McGraw-Hill
- B05:** Operation Research: Applications and Algorithms; Winston W., 4th Edition, Duxbury Press
- B06:** Introductory Operation Research: Theory and Applications; Kasana, H.S., 2004th Edition, Springer Verlag
- B07:** Operation Research: An Introduction; Taha H., 8th Edition Prentice –Hall

5. Other readings & relevant websites:

S. No.	Link of Journals, Magazines, websites and Research Papers
1.	[PDF] Project Planning and Control with PERT and CPM By Dr. B.C Punmia and K.K Khandelwal Book Free Download – EasyEngineering
2.	Linear Programming and the Simplex Method, Volume 54, Number 3 (ams.org)
3.	An Illustrated Guide to Linear Programming - Saul I. Gass - Google Books
4.	Project management-critical path method (CPM) and PERT simulated with ProcessModel IEEE Conference Publication IEEE Xplore

6. Recommended Tools and Platforms

Python, VS Code, Anaconda

7. Course Plan:
a. Lecture Plan

Lecture Number	Topics	Recommended Books
1-3	Formulation of linear programming problems	B01, B02
4-7	How to solve LPP using a graphical method (maximization, minimization)	B01, B02
8-9	How to solve LPP using the simplex method (maximization, minimization)	B01, B02
Formative Assessment-1 (1-9 Lectures)		
10-12	Degeneracy problem-solving in simplex method	B01, B02
13-14	Unbounded solution problem-solving in the simplex method	B01, B02
15-17	Big M method (Maximization and minimization)	B01, B02
18-20	Big M method for no feasible solution	B01, B02
21-24	Two phase method (maximization and minimization)	B01, B02
25-26	Two phase method for no feasible region	B01, B02
Sessional Test-1 (1 – 26 Lectures)		
27-30	Primal to dual conversion	B01, B02
31-32	Dual Simplex method	B01, B02
33-36	Transportation problem (Northwest corner rule, unbalanced transportation, least cost method or matrix minima method, Vogel's Approximation, Modi Method)	B01, B02
37-38	Assignment (Hungarian Method)	B02, B01
Sessional Test-2 (27 – 36 Lectures)		
39	Sensitivity Analysis	B01, B02
40-42	CPM	B03
43-45	Project evaluation and review technique (PERT)	B03
END-TERM EXAM (FULL SYLLABUS)		



8. Delivery/Instructional Resources

Lecture Number	Topics	PPT (Link of ppts on the central server)	Industry Expert Session (If yes: link of ppts on the central server)	Web References	Audio-Video
1-3	Formulation of linear programming problems			https://www.whitman.edu/Documents/Academics/Mathematics/lewis.pdf	
4-7	How to solve LPP using a graphical method (maximization, minimization)	http://www.slideshare.net/unemployedmba/lp-graphical-solution https://www.slideshare.net/KamelAttar/linear-programming-graphical-method-246144965		https://www.geeksforgeeks.org/graphical-solution-of-linear-programming-problems/	
8-9	How to solve LPP using the simplex method (maximization, minimization)			https://www.youtube.com/watch?v=W6rLf47pIMQ	
10-12	Degeneracy problem-solving in simplex method	https://www.slideshare.net/derejeslide/chapter-4-simplex-method-ppt			
13-14	Unbounded solution problem-solving in the simplex method	https://www.slideshare.net/itsmedv91/special-cases-in-simplex			
15-17	Big M method (Maximization and minimization)	https://www.slideshare.net/NiteshSinghPatel/big-m-32360766			
18-20	Big M method for no feasible solution	https://www.slideserve.com/salena/the-big-m-method			
21-24	Two phase method (maximization and minimization)			https://www.youtube.com/watch?v=ewjv2NxzjRs	
25-26	Two phase method for no feasible region			https://www.mate.unam.mx/~omar/math340/2-phase.html	
27-30	Primal to dual conversion			https://www.youtube.com/watch?v=16ecu-Ks3I4	
31-32	Dual Simplex method	https://www.slideshare.net/HishamAlKurdi1/operations-research-the-dual-simplex-method			



33-36	Transportation problem (Northwest corner rule, unbalanced transportation, least cost method or matrix minima method, Vogel's approximation, modi method)			http://businessmanagementcourses.org/Lesson14TransportationModels.pdf http://www.universaltteacherpublications.com/univ/ebooks/or/Ch5/transshipment.htm https://www.geeksforgeeks.org/travelling-salesman-problem-set-1/	
37-38	Assignment (Hungarian Method)	https://www.slideshare.net/rajajntu/algorithm-for-hungarian-method-of-assignment		https://www.geeksforgeeks.org/hungarian-algorithm-assignment-problem-set-1-introduction/	
39	Sensitivity Analysis	https://www.slideshare.net/cndu05/sensitivity-analysis-43087683			
40-42	CPM	https://www.geeksforgeeks.org/difference-between-pert-and-cpm/			
43-45	Project evaluation and review technique (PERT)	https://www.geeksforgeeks.org/difference-between-pert-and-cpm/			

9. Action plan for different types of learners:

Slow Learners	Average Learners	Fast Learners
Understand the concepts and practice questions	Doubt-sessions, and practice questions	Extra Assignments

10. Evaluation Scheme & Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessments
Component 1	Formative Assessments (FAs)	01*	10%	Offline
Component 2	Subjective Test/Sessional Tests (STs)	02**	30%	ST1: Online (remotely) ST2: Online (remotely)
Component 3	End Term Examinations	01	60%	Online
Total			100%	

*ERP system automatically picks the average of the 02 STs Marks for evaluation of the STs as final marks.

11. Details of Evaluation Components:

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
Component 1	Formative assessment	FA1	10%	Offline
Component 2	Sessional Tests(STs)	ST1 ST2	30%	Online

Evaluation Component	Description	Syllabus Covered (%)	Timeline of Examination	Weightage (%)
Component 1	FA1	Upto 15%	Week 5	10%
Component 2	ST1	Upto 30%	Week 6	30%
	ST2	Upto 60%	Week 12	
Component 3	End Term Examination*	100%	To be notified by Dean Examination	60%
	End Term Examination	01	60%	Online
Total		100%		

* As per Academic Guidelines minimum 75% attendance is required to become eligible for appearing in the End Semester Examination

Evaluation Components

Type of Assessment	Timeline of Conduct	Total Marks	Question Paper Format			
			1 Marks	2 Marks	5 Marks	10 Marks
Formative Assessment-I	Week 5	10			2	
Sessional Test 1	Week 6	30	10	10		
Sessional Test 2	Week 18	30	10	10		
End Term Examination		60	20	15	2	

B. Syllabus of the Course:

Subject: Optimization Techniques			Subject Code: 22AI011	
S. No.	Topic (s)	No. of Lectures	Weightage %	
1.	Formulation of linear programming problems	3	12	
2.	How to solve LPP using a graphical method (maximization, minimization)	4		

3.	How to solve LPP using the simplex method (maximization, minimization)	2	12
4.	Degeneracy, Unbounded solution problem-solving in simplex method,	5	
5.	Big M method (Maximization and minimization), Big M method for no feasible solution	6	12
6.	Two phase method (maximization and minimization)	4	12
7.	Two phase method for no feasible region	2	
8.	Primal to dual conversion	4	12
9.	Dual Simplex method	2	
10.	Transportation problem (Northwest corner rule, unbalanced transportation, least cost method or matrix minima method, Vogel's approximation, modi method)	4	10
11.	Assignment (Hungarian Method)	2	10
12.	Sensitivity Analysis	1	5
13.	CPM, Project evaluation and review technique (PERT)	6	15

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Dr. Reetu Malhotra	
Program Head	Dr. Kamal Deep Garg	
Dean (CSE-AI)	Dr. Sushil Kumar Narang	
Date		