

COURSE TEMPLATE

1.	Department/Centre proposing the course	MATHEMATICS
2.	Course Title (<i>< 45 characters</i>)	OPTIMIZATION METHODS AND APPLICATIONS
3.	L-T-P structure	3-1-0
4.	Credits	4
5.	Course number	MAL 210
6.	Status (<i>category for program</i>)	Core for students of B.Tech in Maths and Computing - Program-Linked BS course for other depts.
7.	Pre-requisites (<i>course no./title</i>)	MAL 110 and MAL 120
8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	MAL 526
8.2	Overlap with any UG/PG course of other Dept./Centre	CHL774 (20%), MEL 221 (25%)
8.3	Supercedes any existing course	NO
9.	Not allowed for (<i>indicate program names</i>)	NOT APPLICABLE. It is a BS linked course.
10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
11.	Faculty who will teach the course Dr Aparna Mehra, Prof B S Panda, Dr. S. Dharmaraja	
12.	Will the course require any visiting faculty?	NO
13.	Course objective (<i>about 50 words</i>): The objectives of this course are to introduce the theory and methods to solve linear programming problem in a rigorous way and to demonstrate how various problems in science and engineering can be modeled using linear programming.	
14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Linear programming, basic feasible solution, simplex method, variants of simplex method, duality and its principles, dual simplex method, linear integer programming, cutting plane method, transportation problems, assignment problems, complexity issues of simplex method, Karmarkar's interior point method, Applications of LPP to Network optimization problems such as shortest path, minimum spanning trees and Network flows problems, and to Matrix Game	

15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Linear programming problems (LPP), notion of optimal solution, graphical interpretation of optimality	2
2	convex sets, convex functions, their applications in context of LPP, extreme point, basic feasible solutions (BFS), fundamental theorem of LPP, relationship between extreme point of feasible set and BFS of LPP.	6
3	Canonical form of LPP, initial BFS and a method of improving current BFS, simplex algorithm, artificial variable and its interpretation in context of feasibility, case of unbounded LPP, two phase method.	7
4	Introduction to duality, formulation of dual LPP, duality theorems and their interpretations,	4
5	complementary slackness theorem, Economic interpretation and applications of duality, dual simplex method	4
6	Complexity issues of LPP, introduction to interior point methods,	2
7	Karmarkar's interior point method, and its complexity issues	4
8	Linear integer program and Gomory cut algorithm,	4
9	Transportation programming problems (TPP), idea of uni-modular matrix, optimal solution of TPP	3
10	assignment problems and Hungarian Method	3
11	Applications of LPP to problems such as Matrix games and Network optimization problems like shortest path and Network flows	3
12		
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities

The tutorials will be designed so as to understand both theoretical and geometrical concepts associated with the course as well as the potential applications of the course in modeling and solving real life problems. Some assignments can definitely be part of course wherein especially the students will be encouraged to test their classroom understanding by applying the same to some problems that are frequently encountered in industries.

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	NOT APPLICABLE	
2		
3		
4		
5		
6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Vasek Chvatal, Linear Programming, W. H. Freeman Publishers, 1983.
2. Robert J. Vanderbei , Linear Programming: Foundation and Extension, Springer, 2001.
3. S. Chandra, Jayadeva, A. Mehra, Numerical Optimization with Applications , Narosa, 2009.
4. Hamdy A. Taha, Operations research: An introduction, Pearson Education, 2006.

19. Resources required for the course (*itemized & student access requirements, if any*)

19.1	Software	LINDO, CPLEX (Though lab is not a component of course structure yet it would be a good to have hand on some large industrial linear optimization problems. This experience can be gained by students only if a good software is preferable available in department computer labs).
19.2	Hardware	NO
19.3	Teaching aides (videos, etc.)	LCD and audio system (mike etc.) for large classes
19.4	Laboratory	NO
19.5	Equipment	NO
19.6	Classroom infrastructure	YES
19.7	Site visits	NO

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1	Design-type problems	NA
20.2	Open-ended problems	NA
20.3	Project-type activity	10 - 15% (Some assignments involving understanding, modeling and solving some real life problems can be included besides regular exams).
20.4	Open-ended laboratory work	NA
20.5	Others (please specify)	85-90% theory based analytic examples/problems

Date: Feb 28, 2013


(Signature of the Head of the Department)