Foundations of Optimization - Video course

COURSE OUTLINE

This course will deal with the fundamentals of optimization theory and algorithms. This course will be delivered for a wide audience consisting of science and engineering students. Mathematically oriented business students will profit from it.

This course will stress on the basic theory of optimization of differentiable functions and also discuss in detail the important numerical algorithms to solve such problems.

Motivating examples will be provided throughout the course

COURSE DETAIL

S. No.	Lectures/ Topics
1	Basic facts about maxima and minima
2	Examples and modeling
3	Mathematical Prerequisites
4	Optimality conditions for Unconstrained Optimization
5	The Steepest Descent Method
6	Convergence analysis of Steepest Descent Method
7	Newtons Method and Convergence Analysis
8	Quasi Newton Methods-1
9	Quasi Newton Methods -2
10	Conjugate Gradient Method-1
11	Conjugate Gradient Method-2
12	Fundamentals of Constrained Optimization

NP-TEL

NPTEL

http://nptel.ac.in

Mathematics

Pre-requisites:

Calculus of several variables and linear algebra

Hyperlinks:

Will be told during the lectures.

Coordinators:

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13	Minimizing a differentiable function over a convex set
14	Karush-Kuhn-Tucker Conditions-1
15	Karush-Kuhn-Tucker Conditions-2
16	Active-Set Method
17	Quadratic Optimization-1
18	Quadratic Optimization-2
19	Quadratic Optimization-3
20	Penalty Function Method
21	Penalty Functions and Karush-Kuhn-Tucker Conditions
22	Sequential Quadratic Programming-1
23	Sequential Quadratic Programming-2
24	Conic Optimization
25	Semi-definite Programming-1
26	Semi-definite Programming-2
27	Lagrangian Relaxations for Integer Programming
28	SDP relaxations for quadratic integer programming
29	The S-Lemma and Quadratic Programming Duality-1
30	The S-Lemma and Quadratic Programming Duality-2
31	Duality in optimization

32	Duality in conic and semidefinite programming
33	Trust Region Methods-1
34	Trust Region Methods-2
35	Derivative Free Optimization-1
36	Derivative Free Optimization-2
37	Derivative Free Optimization-3
38	Derivatie Free Optimization-4
39	Derivative Free Optimization-5
40	Introduction to Calculus of Variations.

'DESIGN PARADIGM: SOURCE OF INNOVATION & INVENTION'

Amit Ray

LECTURES & COURSE MODULE

Module No.	Title	Issues	No. of lectures
01.	**Introduction to Design Paradigm**	What is Design Paradigm? ; Recognizing Paradigm; Paradigm & Metaphors; Paradigm & Design Relationship	**03**
02.	**Design & Natural Phenomenon**	Paradigm in Nature; About Biomimicry	**02=05**
03.	**Human Body**	Paradigm in Human Body	**01=06**
04.	**Where Does Form Come From?**	'Form Follows Function'	**01=07**
05.	**Design, Paradigm & Science of Design**	A comparison between the modern design and a brief historical look at the traditional; not wholly conscious ways of designing and developing artifacts	**02=09**

06.	**Natural Development in Traditional Design**	Man's adoption of changing environment, rigidity in traditional design	**02=11**
07.	**Design-Nature Relationship**	Wealth of nature's design; modular design	**02=13**
08.	**Simple Shape Paradigm**	Basic Geometrics; Platonic Solids (Five Simple Solids); Simple applications in Packaging Design	**03=16**
09.	**Paradigm in Nature**	Simple Paradigms- Ball, Disc, Tube, Coil, Helicoids, Spiral, Spoon, Cup, Jar, Bottle, Bubble, Blister, Skin, etc. Möbius Strip, Wrap, Pipe, Bag,	**04=20**
10.	**Bending & Flexing**	Sapling, Hinges, Elbow, Ball & Socket, Gooseneck, Nitinol	**03=23**
11.	**Bigger & Smaller**	Growth, Expansion & Contraction, Swelling & Squashing, Spring, Arms & Legs, Wing, Scissors, Screw, Flower, etc.	**04=27**
12.	**Joining**	Zipper, Sewing, Wielding, Ball & Socket, Universal Joints, Knots, Bridge, etc.	**03=30**
13.	**Attaching**	Glue, Adhesive Tape, Clips & Clamps, Magnet	**02=32**
14.	**Passages**	Pipe, Bottleneck, Wire, Filter, Strainer, Canal, etc.	**02=34**
15.	**Complex Paradigms**	Combination of multiple simple paradigm forming complex paradigms- Nested Spoon, etc.	**02=36**
16.	**Objects within Objects**	Peas, Egg, Coconut, Pregnant Woman, Oyster, etc.	**02=38**
17.	**Application of Paradigm**	Using Paradigm for Product Design	**02=40**
		Total	**40**

References:

Will be mentioned during the lectures.