

Indian Institute of Technology Kanpur
Department of Economic Sciences
Proposal for a New Course

1. Course No: ECO7XX

2. Course Title: Markets in the Digital Age

3. Per Week Lectures: 3 (L), Tutorial: 0 (T), Laboratory: 0 (P), Additional Hours: 0

Credits: (3*L+T+P+A): 9 credits

Duration of Course: Full semester course

4. Proposing Department: Economic Sciences

Other Departments which may be interested: None

Other faculty members interested in teaching the proposed course: None

5. Proposing instructor: Aditya Vikram

Level of the course: PG (PhD and 2nd-year MSc students of Economics)

6. Course Description:

A) Objectives: To introduce students to the economics of modern marketplaces – how platforms, auctions and matching systems allocate resources in the digital age – and to equip them with the tools to understand, design and improve such markets, leading up to current research in the field.

B) Contents

S. No.	Broad Title	Topics	No. of Lectures
1.	Introduction	Markets in the internet era: from bazaars to online platforms and AI-run marketplaces; why markets fail and how to fix them; the economist as engineer; what makes marketplaces work; forbidden markets – why we cannot buy kidneys; success stories – the doctors' job market, spectrum auctions, school admissions, etc.	3
2.	Markets without money	Matching doctors to hospitals and students to colleges; stable matchings and deferred acceptance; gaming the system – strategy-proofness; trading houses without money; kidney exchange; school choice around the world; quotas, reserves and affirmative action in Indian admissions	12
3.	Markets with money	How to sell anything – from art to ad slots; optimal auctions and revenue; interdependent values; bilateral	10

		trade and double auctions; selling spectrum – the world's largest auctions; clock auctions; Google's ad auctions and position auctions; automated bidding by AI agents	
4.	Allocating resources in the digital age	Allocating scarce resources at scale; the assignment problem and market-clearing prices; Course allocation problem; refugee resettlement; scheduling and queueing – from cloud servers to operating rooms to road tolls; allocating computing power in the age of AI ; electricity markets	6
5.	Miscellaneous topics	Assorted topics and applications: prediction markets; platforms; AI agents and LLMs in the marketplace; markets for computing power and AI services; AI pricing and algorithmic collusion; automated mechanism design; market design in financial markets	8

*50-minute lecture each, total of 39 lectures

C) Prerequisites: Any course in probability and statistics.

D) Short summary for including in the Courses of Study Booklet: Markets today are increasingly digital: rides, ads, groceries, spectrum and even kidneys are allocated by platforms and algorithms, and increasingly, AI agents themselves bid, price and trade on our behalf. This course studies how such marketplaces work and how they can be designed to work better. It develops the tools of matching and auctions, and applies them to real markets from India and around the world, including emerging markets for computing power and AI services. The course builds the theory from the ground up, connects it to current research, and prepares students to study, design and improve the markets of the digital age.

7) Recommended textbooks

Algorithmic Game Theory, Noam Nisan, Tim Roughgarden, Éva Tardos and Vijay V. Vazirani (eds.). Cambridge, U.K.: Cambridge University Press, 2007

Online and matching-based market design, Federico Echenique, Nicole Immorlica and Vijay V. Vazirani (eds.). Cambridge, U.K.: Cambridge University Press, 2023

Two-Sided Matching: A study in game-theoretic modeling and analysis, Alvin E. Roth and Marilda Sotomayor. Cambridge, U.K.: Cambridge University Press, 1990

Discovering Prices: Auction Design in Markets with Complex Constraints, Paul Milgrom. New York, NY: Columbia University Press, 2017

Mechanism Design: A linear programming approach, Rakesh V. Vohra. Cambridge, U.K.: Cambridge University Press, 2011

Market Design: auctions and matching, Guillaume Haeringer. Cambridge, MA: MIT Press, 2017

In addition, a substantial part of the course will draw on journal articles, surveys and recent working papers, a reading list of which will be circulated by the instructor. Representative articles include:

Roth, A. E. (2002), “The Economist as Engineer: Game Theory, Experimentation, and Computation as Tools for Design Economics,” *Econometrica*, 70(4), 1341–1378.

Edelman, B., M. Ostrovsky and M. Schwarz (2007), “Internet Advertising and the Generalized Second-Price Auction: Selling Billions of Dollars worth of Keywords,” *American Economic Review*, 97(1), 242–259.

Milgrom, P. R. and S. Tadelis (2019), “How Artificial Intelligence and Machine Learning Can Impact Market Design,” in A. Agrawal, J. Gans and A. Goldfarb (eds.), *The Economics of Artificial Intelligence: An Agenda*, Chicago: University of Chicago Press, 567–586.

Budish, E., P. Cramton and J. Shim (2015), “The High-Frequency Trading Arms Race: Frequent Batch Auctions as a Market Design Response,” *Quarterly Journal of Economics*, 130(4), 1547–1621.

8) Any other remarks: None

Dated: _____

Proposer: Aditya Vikram

Dated: _____

DPGC Convener: _____

The course is approved / not approved

Chairman, SPGC

Dated: _____