

Paper 03: MATHEMATICAL METHODS IN ECONOMICS –I

Course Description

This is the first of a compulsory two-course sequence. The objective of this sequence is to transmit the body of basic mathematics that enables the study of economic theory at the undergraduate level, specifically the courses on microeconomic theory, macroeconomic theory, statistics and econometrics set out in this syllabus. In this course, particular economic models are not the ends, but the means for illustrating the method of applying mathematical techniques to economic theory in general. The level of sophistication at which the material is to be taught is indicated by the contents of the prescribed textbook.

Course Outline

1. Preliminaries

Logic and proof techniques; sets and set operations; relations; functions and their properties; number systems.

2. Functions of one real variable

Graphs; elementary types of functions: quadratic, polynomial, power, exponential, logarithmic; sequences and series: convergence, algebraic properties and applications; continuous functions: characterizations, properties with respect to various operations and applications; differentiable functions: characterizations, properties with respect to various operations and applications; second and higher order derivatives: properties and applications.

3. Single-variable optimization

Geometric properties of functions: convex functions, their characterizations and applications; local and global optima: geometric characterizations, characterizations using calculus and applications.

4. Integration of functions

Areas under curves; indefinite integrals; the definite integral.

5. Difference equations

First order difference equations.

Readings:

K. Sydsaeter and P. Hammond, *Mathematics for Economic Analysis*, Pearson Educational Asia, Delhi, 2002.

Department of Economics
University of Delhi

Minutes of Meeting

Subject: B. A. (Hons) Economics, Course 02: Mathematical Methods for Economics
Chairpersons: Abhijit Banerji and Sudhir A. Shah
Date of meeting: Tuesday, July 26, 2011

The following teachers from the Colleges attended the meeting:

Bhumika Hingorani - Daulat Ram College
Shalini Saksena - D. C. A. C.
Sandhya Varshney - Dyal Singh College
Sanjeev Kumar - Dyal Singh College
Sonam - Hansraj College
Niti Bhutani - Hindu College
Anindita Roy Saha - I. P. College
Indu Choudhary - Kalindi College
Rupa Basu Kamala Nehru College
Neelam Malhotra- L. S. R. College
Asha Kashyap - Lakhshmbai College
Sutapa Das - Miranda House
S. K. Taneja - Ramlal Anand College (Eve)
Aniruddha Prasad - Satyawati College
Manjul Singh - Satyawati College (Evening)
Ram Gati Singh - Shaheed Bhagat Singh College
Nidhi Gupta - Shri Ram College of Commerce
Geeta Golani - Shyama Prasad Mukerjee College
Smruti Bhera - Shyam Lal College
Surendra K. Sharma - Shyam Lal College (Eve)

Report: A New Common Minimum Program

There are no significant changes from previous years as this course is the first of two semester-length courses that replace the previous year-long Mathematical Methods course. The material of the original course is expected to be distributed across the two next courses. While the structure of the first of the semester long replacements is known, the other one is awaited.

Specific decisions pertaining to the new first semester course are:

1. The textbook (Sydsaeter and Hammond) is retained. Chapters 1 to 9 are to be covered, except Section 6.7.

2. The rough weights attached to the four sections mentioned in the new syllabus are: I (Preliminaries) has 10% weight, II (Single variable analysis) has 20% weight, III (Differential calculus of one variable) has 45% weight, IV (Optimization with one variable) has 25% weight. These weights are only indicative and not ironclad guarantees of the weights attached to these sections in examinations. The examinations should broadly reflect these weights, but may vary from them by as much as 10% points.

3. A concern was expressed that, assuming the remaining part of the old annual course will be taught in the second semester, the material will not be well-balanced across semesters. Specifically, it was felt that the currently framed first semester course is some-what light in comparison to the expected second semester course. Thus, re-balancing of the two courses needs to be addressed when the entire B. A. (Hons) Economics syllabus is drawn up.

4. This concern is particularly important as now the course is taught more intensively with five lectures a week instead of the previous four lectures a week.

5. It was felt that, keeping in view the expected requirements of the microeconomic and macroeconomic theory courses that will be framed, it would be useful to introduce some material that was previously excluded in the annual course. In particular, it was felt that exposure to elementary integration theory, ordinary differential equations, difference equations and dynamics is desirable.

6. Examinations and internal assessment for this course will be as *per* the pattern set by the University.

For the general philosophy underlying this course, I can do no better than selectively quote the 2005 Minutes.

Philosophy of the Course

(a) This is **not** a "Mathematical **Economics**" course, but a "**Mathematical Methods for Economics**" course. The intention is not to transmit any particular body of economic theory, but to transmit the body of basic mathematics that enables the creation of economic theory in general. In this course, particular economic models are not the ends, but the means for illustrating the method of applying mathematical techniques to economic theory in general. A pedagogical corollary of this attitude is that economic applications should be chosen as illustrations, not on the basis of their "importance" or "relevance" in economic doctrine, but on the basis of their appropriateness for illustrating particular aspects of mathematical techniques being taught in this course. (Of course, if pedagogical relevance and substantive doctrinal importance coincide in some application, then covering such a Pareto superior application is recommended.) Classroom instruction should stress the understanding and skill in the application of

mathematical theorems and techniques, rather than the mastering of any particular set of economic applications.

(b) Stress should be placed on learning mathematical theorems and techniques and **recognizing classes** of applications where particular theorems and techniques, or their combinations, are applicable and useful.

(c) The prescribed textbook defines the level of sophistication of material to be transmitted to students and the problems contained therein indicate the level of difficulty of questions that may be asked in examinations.

(d) There is no presumption that examination questions will/can be chosen only from the prescribed textbook. However, the examiner should ensure that the level of difficulty is at par with the difficulty of problems in the textbook; the evaluation of "difficulty" is best left to the prudence and academic judgement of the examiner within the institutional context of examination-setting.

(e) Instructors should feel free to draw upon any appropriate supplementary sources for problems and material that they feel is handled inadequately or poorly in the prescribed textbooks.

(f) Proofs of propositions that are relatively straightforward may be asked in the examinations. However, questions should not be such as to allow mere regurgitation of theorems proved in the textbook and memorized by the students. Ideal questions should test the student's ability to **understand and correctly apply** theorems proved in the textbooks rather than merely reproduce their proofs.

(g) Examiners should avoid questions whose solution involve mere memorization of formulae and computation.

(h) Questions may require students to apply techniques learned in this course to applications drawn from economic theory. However, such questions should be framed with great care. Such questions should explicitly state the **mathematical structure** required to derive the answer, not leave it implicit, assuming that students will be aware of the economic model in question and the assumptions underlying it. The examiner may assume that students are **mathematically** sophisticated at a level indicated by this course, but there should be no presumption of economic sophistication or knowledge of economic doctrine beyond what is taught in the Principles course.

(i) Economic applications available in the textbooks and covered in class should not be assumed to be an exhaustive list of potential applications that may be used for framing examination questions.

(j) There should be no presumption that a particular pattern or style of the examination will be replicated from year to year. The examiner shall have latitude to make academically prudent changes subject to the above-mentioned weightage guidelines.