

## 1. Details of Module and its structure

Module Detail	
Subject Name	Economics
Course Name	Economics 03 (Class XII, Semester - 1)
Module Name/Title	Micro economics / Demand theory with Indifference Curve Analysis – Part 3
Module Id	leec_10203
Pre-requisites	Meaning and nature of human wants, consumption, utility, budget line and budget sets
Objectives	After going through this lesson, the learner will understand: <ul style="list-style-type: none"><li>• What is an Indifference Curve</li><li>• Properties of Indifference Curves</li><li>• Consumer's equilibrium using Indifference Curve Analysis</li></ul>
Keywords	Utility, Indifference Curves, Indifference Maps, Marginal rate of substitution, Consumer Equilibrium

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### Introduction:

Consumer theory analyses decisions made by consumers regarding what goods to buy and in what quantities. What a consumer buys depends on two things:

1. What does the consumer want?
2. What can the consumer afford to buy?

In this module we examine the first question again. How does the consumer decide what to buy and how much of it to buy?

In the last module we discussed how the Marshallian Utility theory deals with this question. We saw how a severe limitation of the Marshallian approach is the assumption that satisfaction can be measured. The problem is that we cannot really measure satisfaction that we get from eating a pizza or a mango or a banana. If utility cannot be measured, it would be difficult to give it a unit like 'utils'. So measuring Total Utility and Marginal Utility becomes difficult.

While we cannot measure utility, what we *can* do is to rank goods in terms of the satisfaction they give us. So it is possible for me to say that I like mangoes more than bananas, or even more specifically, I could say that I like 2 mangoes as much as I like 3 bananas. Such an approach allows me to rank commodities, or even bundles of commodities, in the order in which I like them, without having to measure the utility of any individual commodity. We use this concept when trying to analyze how consumers decide what to buy. Since we are dealing with rankings

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or ‘ordering’ of bundles, this approach is called the **ordinal** approach to utility. We shall study one such approach - called the **Indifference Curve Approach** - in this module.

### **Preferences of Consumers:**

Let us start with a description of what makes me prefer one bundle of commodities over the other. We keep the Marshallian assumption that consumers consume because commodities give them utility. What we reject is the idea that this utility can be measured. In fact we don’t need to measure utility to analyse consumer’s behaviour. All that we need to figure out is this: given a set of available bundles, which one would a consumer choose? The answer is simple: the consumer would choose the bundle that gives her the most utility. How do we know which bundle gives the consumer the most utility? We ask the consumer to rank the bundles available in order of preference.

Let us go back to the bundles of movies and books we were examining in the module on budget constraints. Think about the following bundles:

Bundle A: (8 movies, 12 Books)

Bundle B: (8 movies, 24 Books)

Bundle C: (16 movies, 16 Books)

Bundle D: (24 movies, 24 Books)

How would Bundle A compare to Bundle B? Bundle B has more books and the same number of movies as bundle A. Naturally, I would choose bundle B over bundle A. Can you say which of these bundles a consumer would like the most? Clearly this would be Bundle D, because Bundle D has more books *and* more movies than any other bundle. Which is the least preferred bundle? (Ans: Bundle A, because it has the least number of movies *and* books)

How would I compare Bundle B and Bundle C? I have more movies in bundle C, but fewer books. These bundles are more difficult to rank outright. If I like books a lot (more than movies, anyway), then I will prefer Bundle B to C. If I prefer movies more, then I may prefer Bundle C to B.

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If I were told to order these bundles in **increasing order** of *my* preferences, this is how I would rank them:

Bundle A < Bundle C < Bundle B < Bundle D

Where Bundle A is the one I like the least, and Bundle D is the one I like the best; and I prefer bundle C to bundle B.

On the other hand, you may draw up the following ranking, again in increasing order of preferences:

Bundle A < Bundle B < Bundle C < Bundle D

Where Bundle A is the one you like the least, and Bundle D is the one you like the best; and you prefer bundle C to bundle B.

Similarly, your best friend may draw up the following ranking in increasing order of preferences:

Bundle A < Bundle B = Bundle C < Bundle D

Where Bundle A is the one she likes the least, and Bundle D is the one she likes the most; and she likes bundle B as much as bundle C.

Indifference Curve Theory uses these intuitive ideas to analyse consumers' preferences. It assumes the following about preferences of individuals:

1. An individual is able to rank *all* bundles in order of preference. Economists often state this as '**preferences are complete**'. So I may like some bundles more than others, and some bundles as much as others, but I can always draw up a complete ranking.
2. An individual always prefers more to less. So any bundle which has more of at least one commodity is preferred to one that has less. Notice that in the examples above, all of us liked Bundle A the least, and bundle D the most. Why? Because Bundle A has the *least number of movies and books* among all the bundles, and Bundle D has *the most*. The underlying idea is that if I consume more of a commodity, my utility from that commodity always goes up. So my total utility from consuming a bundle with more of any commodity (and no less of the others) is always more. And I will always prefer a

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bundle that gives me more utility to a bundle that gives me less. There are two underlying, but related, assumptions here:

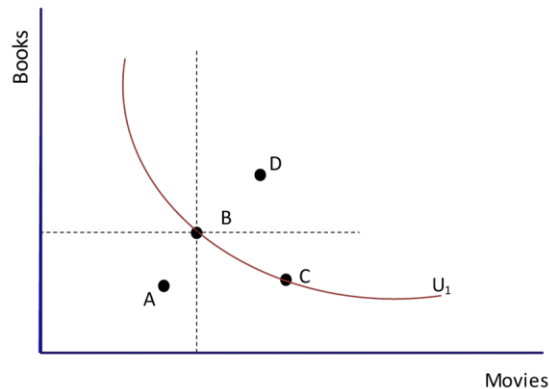
- a. Consumers always prefer more to less. This is called **rationality** of the consumer. (Why would you want less if you can have more in any case?)
  - b. Consuming more gives more utility. In other words, utility always increases when consumption increases. Consumers who prefer bundles with more of any commodity (and no less of the others) are said to have **monotonic preferences**.
3. Consumers are **consistent**. In other words, if a consumer has ranked one bundle over the other, she will always prefer the first bundle to the second. She will not switch preferences.

A consumer is said to be **indifferent** between bundles if she prefers them equally. Your best friend, in the example above, likes bundle B as much as bundle C, and so, she is said to be indifferent between the two bundles. Indifference between two bundles implies that they both give her the same utility. So, your friend derives as much utility from Bundle B: (8 Movies, 24 Books) as she does from Bundle C: (16 Movies, 16 Books). Notice what has changed between the two bundles. Bundle C has 8 more books, but it also has 8 less movies. In other words, as your friend is able to **substitute** movies for books. How many books your friend would need in order to compensate her for giving up each movie is called the **rate of substitution**. In this case, notice that the rate of substitution for your friend is 1. Typically, economists are concerned with what the rate of substitution is at the ‘margin’: i.e., when the consumption of one commodity changes by a very small amount, how much of the other commodity is needed to keep the total utility from the bundle unchanged. This is usually called the Marginal Rate of Substitution (MRS)

**Marginal Rate of Substitution** = (Change in number of books/Change in number of movies)

### **Representing preferences diagrammatically: Indifference Curves**

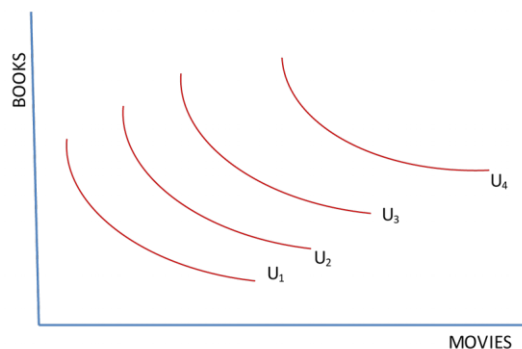
Consider Figure 1. We have represented movies on the X axis and Books on the Y axis. Various points in this diagram, such as A, B and D, represent bundles of Movies and Books.



**Figure 1: Indifference Curves**

What can we say about the points A, B and D? Clearly A has less of *both* movies and books than B, whereas D has more of both. A consumer would therefore derive greater utility from a bundle like B than from A, and she would derive even more utility from the bundle D than from B. So the consumer would clearly prefer B to A, and D to B. But what about a bundle like C? At C, the consumer has more movies than in bundle B, but less books. It is possible that the consumer is indifferent between B and C. If that is the case, then B and C are said to lie on the same **Indifference Curve**.

**Indifference curves plot all the bundles that give a consumer equal utility.** The curve  $U_1$  represents one such curve. There would be similar curves passing through points A and D as well. In fact ‘complete’ preferences mean that every bundle in this diagram must lie on some indifference curve. The set of indifference curves representing a consumer’s preferences is called an **Indifference Map**. The diagram below (Figure 2) represents one such Indifference Map.



**Figure 2: Indifference Map**

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## The shape of indifference curves (IC):

### 1. Indifference Curves are downward sloping:

It is easy to see why this is so. If my utility is to stay constant, which it must by definition along an indifference curve, then, as I increase my consumption of movies, my consumption of books must go down. If it doesn't, my total utility will increase and I will not be on the same indifference curve.

### 2. The farther away the Indifference Curve is from the origin, the higher the level of utility it represents.

Again as I move further from the origin, the amounts of both goods in each bundle are likely to increase. In my diagram, this can be seen as we move from A to B to D. The IC passing through A will represent a smaller utility than the one passing through B. The IC that passes through D will represent still higher utility.

### 3. Indifference curves are convex to the origin

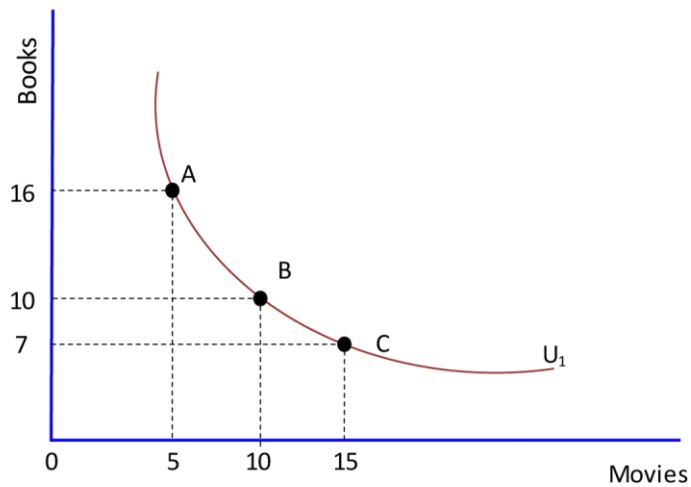
This is a little less obvious. Consider the IC below. At point A, I am consuming 5 movies and 16 books. If I move to B, I can consume 10 movies and 10 books with the same amount of total utility. I have given up 6 books to get 5 more movies.

My rate of substitution from A to B =  $(6/5) = 1.2$

If I move from B to C, my total utility is unchanged, and I am consuming 15 movies and 7 books. I have only given up 3 books for 5 movies.

My rate of substitution from B to C =  $(3/6) = 0.5$ . Notice that the rate of substitution has fallen, as I have moved along the IC, that is, that is, from point A to B and then from point B to C.

The bowed shape of the IC reflects this behaviour. It reflects the fact that preferences typically follow a **diminishing rate of substitution along the IC**.



**Figure 3: Indifference curves are convex to the origin**

The intuitive reason for this diminishing rate of substitution is based on the notion of diminishing marginal utility. As I consume more and more of one commodity (in this case movies) I derive progressively less satisfaction from each additional unit. So I need to give up fewer units of the other commodity (in this case books) to keep my total utility constant. Also, as the number of books I have goes down, each book, on the margin, gives me more and more utility. So I have to give up fewer books for each extra movie I ‘consume’.

This also leads us to two very important properties of indifference curves:

1. The **slope of the IC** is the **Marginal rate of substitution (MRS)** between the commodities on the axes.
2. The **marginal rate of substitution (MRS)** is the **ratio of the marginal utility of the commodity on the X- axis to that on the Y-axis**. In my example above, the MRS of IC at A is the following ratio:

$$MRS_A = \frac{\text{Marginal Utility of movies at A}}{\text{Marginal Utility of books at A}}$$



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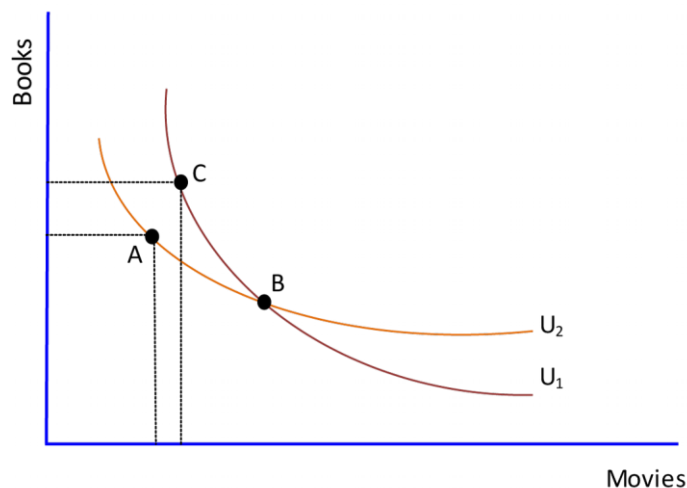
In general, for any two commodities X and Y we can define the MRS as follows:

$$MRS_{X,Y} = \frac{\Delta Y}{\Delta X} = \frac{MU \text{ of } X}{MU \text{ of } Y}$$

### Indifference curves can never cross

Consider what happens if two indifference curves on the same map were to cross each other. This is represented in the diagram below (Figure 4), where  $U_1$  and  $U_2$  are indifference curves that cross each other. Here, since point C and B both lie on the Indifference curve  $U_1$ , the consumer must be indifferent between them. Similarly, since point A and B both lie on the Indifference curve  $U_2$ , the consumer must be indifferent between them. This implies that the consumer must be indifferent between A and C as well. But C has more of *both* movies and books. So the consumer cannot possibly be indifferent between A and C. To do so would make the consumer irrational. (Remember, monotonic preferences and rationality mean that ‘more is always preferred to less’)

Hence, indifference curves cannot cross each other.



**Figure 4: Indifference curves can never cross**

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## The Consumer's Equilibrium

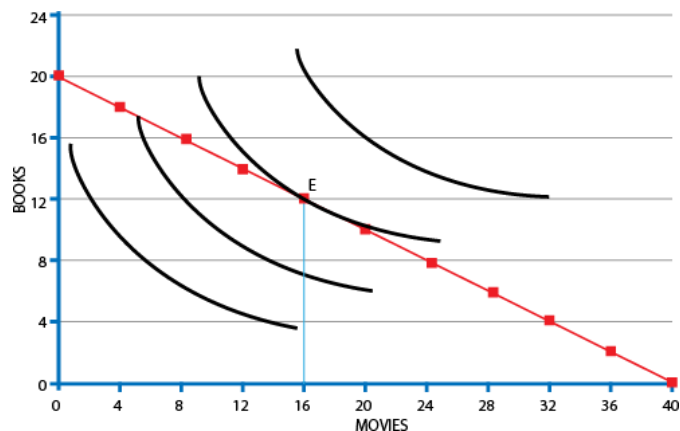
We can now put together what we have learnt about budget sets and indifference curves to figure out what the consumer consumes, and in what quantities. The diagram below (Figure 5) reproduces the budget set discussed in the earlier module. The budget set represents what the consumer can afford to buy, given a certain income (Rs 2000) and prices of commodities (Rs.50/movie and Rs. 100/book). Superimposed on this is a consumer's indifference map. This represents the consumer's preferences. The consumer will try to achieve the highest level of satisfaction that he can achieve, given his budget, and the prices of commodities. Notice that the highest possible IC that the consumer can reach is the one that just touches, or is tangent to, the budget line. This occurs at the point E, where the consumer is consuming 16 movies and 12 books. This is the consumer's 'equilibrium'. At E, his utility is maximum, given his income and the prices of movies and books. The consumer can do no better than this, and has no incentive to change, unless prices change, or his income changes.

**At E the slope of the budget line equals the slope of the indifference curve.** Recall that the slope of the budget line is the ratio of prices of the commodity on the X-axis to that on the Y-axis; and the slope of the Indifference Curve is the MRS.

Thus, **at equilibrium,  $MRS_{x,y} = P_X/P_Y$**

In our example:

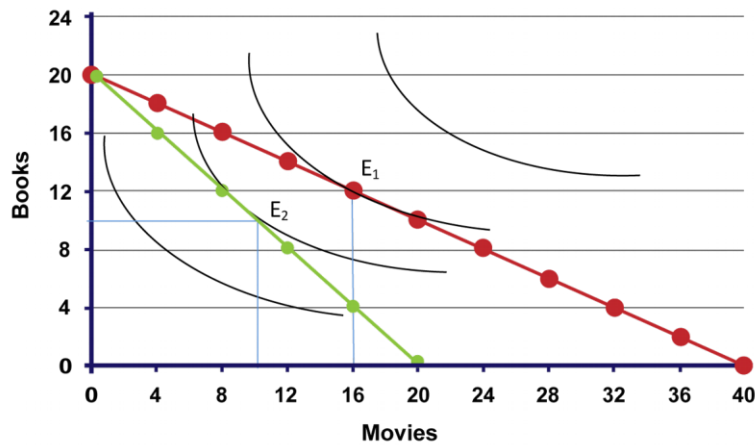
$$\begin{aligned} \text{MRS of movies for books} &= (\text{Price of Movies})/(\text{Price of Books}) \\ &= \text{Rs.50}/\text{Rs.100} \\ &= 1/2 \end{aligned}$$



**Figure 5: The Consumer's Equilibrium**

We have thus answered the questions we had started this module with. What does our consumer buy? Our consumer buys books and movies. In what quantities? He buys 16 movies and 12 books. We are restricted to two commodities because we are working with two-dimensional diagrams. In principle, we can extend this analysis to many more commodities.

What happens if the price of movies changes? Suppose the price of movies goes up to Rs.100. We saw in the previous module how the budget line changes. This is depicted in the diagram given below. Superimposed on the budget lines is the consumer's indifference map. The consumer's old equilibrium,  $E_1$ , is now beyond his new (green) budget line. He cannot afford it any more. His new equilibrium is where his *new* budget line is tangent to the highest indifference curve ( $E_2$ ). He now consumes only 10 movies and 10 books, rather than 16 and 12. Notice that the number of movies consumed has gone down as the price of movies has gone up. This forms the basis of the **theory of demand** that you will study in a subsequent module.



**Figure 6: Change in budget line**

### Summary

In this module, you have studied how to depict consumers' preferences through Indifference Curves. Utility can be ranked according to one's preferences and there is no need to measure it, unlike in the case of Marshallian approach. An indifference curve shows all those combinations of quantities of two goods that provide same level of satisfaction to the consumer after consuming them. An indifference curve is downward sloping and it is convex to the origin. Farther indifference curves from the origin depict higher satisfaction. We assume that the consumer is rational in making preferences and that he is always consistent with his preferences. Consuming more quantity of a commodity and no less quantity of another commodity will give higher satisfaction to the consumer and such a combination of two goods is always preferred. The concept of Marginal Rate of Substitution (MRS) has been explained. It is the slope of the Indifference Curve. You have also learnt how Indifference Curves and Budget Lines can be combined to derive the consumer's equilibrium. The bundle that lies on the point where the Indifference Curve is tangent to the Budget Line, gives the point where the Consumer is in equilibrium. This is the affordable bundle which gives maximum satisfaction to a consumer. At this point, the slope of budget line equals the slope of the indifference curve that is tangent to the budget line.