Lecture - 11
Production in the Short-run:

We begin the analysis of short-run production with a situation where only one fixed input and one variable input is used in the process of production.

$$Q = f(L, \overline{K})$$

The only way the producer can change output is only by changing labour (L) which is our variable input.

We need to understand the following concepts related to short-run production.

TP → Total product or output i.e Q

AP → Average product

MP → Marginal product

Let us understand the relation between TP, AP & MP with the help of the following table.

No. of laborers (L)	TP (Q)	AP (Q/L)	MP ($\partial Q/\partial L$)	$\overline{K}$ 2
0	0	–	–	
1	52	52	52	
2	112	56	60	
3	170	56.7	58	
4	220	55	50	
5	258	51.6	38	
6	286	47.7	28	
7	304	43.4	18	
8	314	39.3	10	

AP_L is total product divided by total number of laborers used in production. i.e Q/L

MP_L is the contribution of every additional unit of labour to total output i.e $\partial Q/\partial L$

The relation between MP & AP can be understood from the 'law of variable proportion'.

This law is otherwise known as the 'law of diminishing marginal product'.

According to this law, "as the number of units of the variable input increases keeping other inputs constant, a point will be reached beyond which the marginal product of the variable input decreases".

This law can be explained with the help of the following diagram.

The stage of increasing returns

Max

TP, MPl, APl

The stage of decreasing returns.

N

II   III

TP

I

The stage of negative returns

R

APl

O   L1   L2   l

Point of inflection

MPl

$OL_1 = 10l$

$OL_2 = 20l$

Let us try to understand the above law with the help of the following example.

A person buys 10 acres of land to cultivate & produces wheat. Here land is our fixed input. On that piece of land he uses labour (L) as the variable input.

This law can be explained in three different Stages.

Stage - I (The stage of increasing returns)
In this Stage, TP, MP_L & AP_L increase. Upto point 'N', TP increases at an increasing rate so MP_L also increases.

Stage - II (The stage of decreasing returns)
In this stage, TP increases at a decreasing rate so MP_L decreases.

Stage-III (The stage of negative returns)

After employing $ol.$ units of labour, TP starts decreasing and hen MP_l becomes negative.

A rational producer would always try to produce in stage-II because in this stage the total output reaches the maximum limit. Though MP_l decreases throughout this stage, the contribution of variable input is positive and hence TP increases through out this stage.

Relation between MP_l & AP_l

$$Q = AP_l \cdot L$$

$$MP_l = \frac{\partial Q}{\partial l} = AP_l + l \frac{\partial AP_l}{\partial l}$$

When $\frac{\partial AP_l}{\partial l}$ increases $MP_l > AP_l$

when $\frac{\partial AP}{\partial l}$ decreases $MP_l < AP_l$

At point R, $MP = AP$

Naohi