and vertical intercepts of isocost line same.

# OPTIMUM FACTOR COMBINATION

**|(UOKCH:2010)(UOB:2010,2011)(UOPR:2004,2006,2008,2009,2010,2012,2013)(IUBWR:2010)|**

After having discussed isoquant and isocost we are in a position to present firm's equilibrium or optimum factor combination. Such will be explained in two cases (1) when the firm wants to minimize costs of production of a given output (2) when the firm wants to maximize the output while the costs are given.

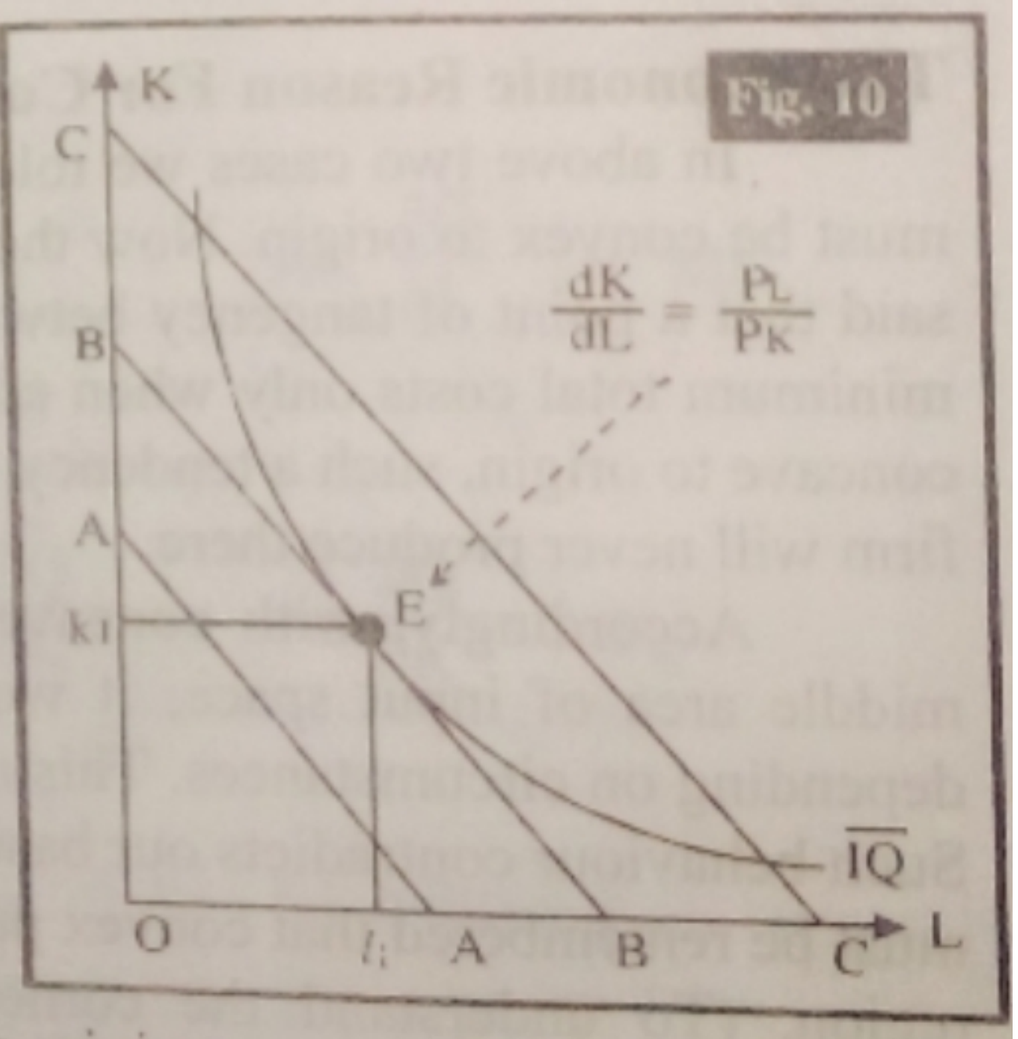
## (1) Minimization of Cost Subject to Output Constraint

**|(UOS:2013)(UAJK:2010,2012,2014)(HUMA:2006,2010)|**

In such situation, the firm will be in equilibrium when its costs are minimized. Accordingly at equilibrium the lowest isocost line must be tangent to the isoquant. In other words, in the light of necessary condition of firm's equilibrium. *"A firm will be in equilibrium when the lowest isocost is tangent to the given isoquant". Technically "a firm will attain least cost factor combination where the absolute slope of the lowest isocost line i.e., factor price ratio ($P_L/P_K$) is equal to the absolute slope of an isoquant (MRTS = dK/dL)"*. It is as: $\frac{PL}{PK} = \frac{dK}{dL}$

While according to the sufficient condition at equilibrium, an IQ must be convex to the origin. It is shown with the help of Fig. 10.

In Fig.10, the firm's equilibrium takes place at E where $\overline{IQ}$ (representing a fixed output) is tangent to the lowest isocost line BB. Accordingly, the firm employs /purchases $ol_1$ of L and $ok_1$ of K. Such combination of L and K represents an optimal combination because here firm's costs have been minimized. As CC line represents higher costs for the output of $\overline{IQ}$. While AA line represents such a lower costs that they fail to produce the output of $\overline{IQ}$. Moreover at E, the slope of of 'Isocost' is equal to slope of isoquant and isoquant is convex to the origin.



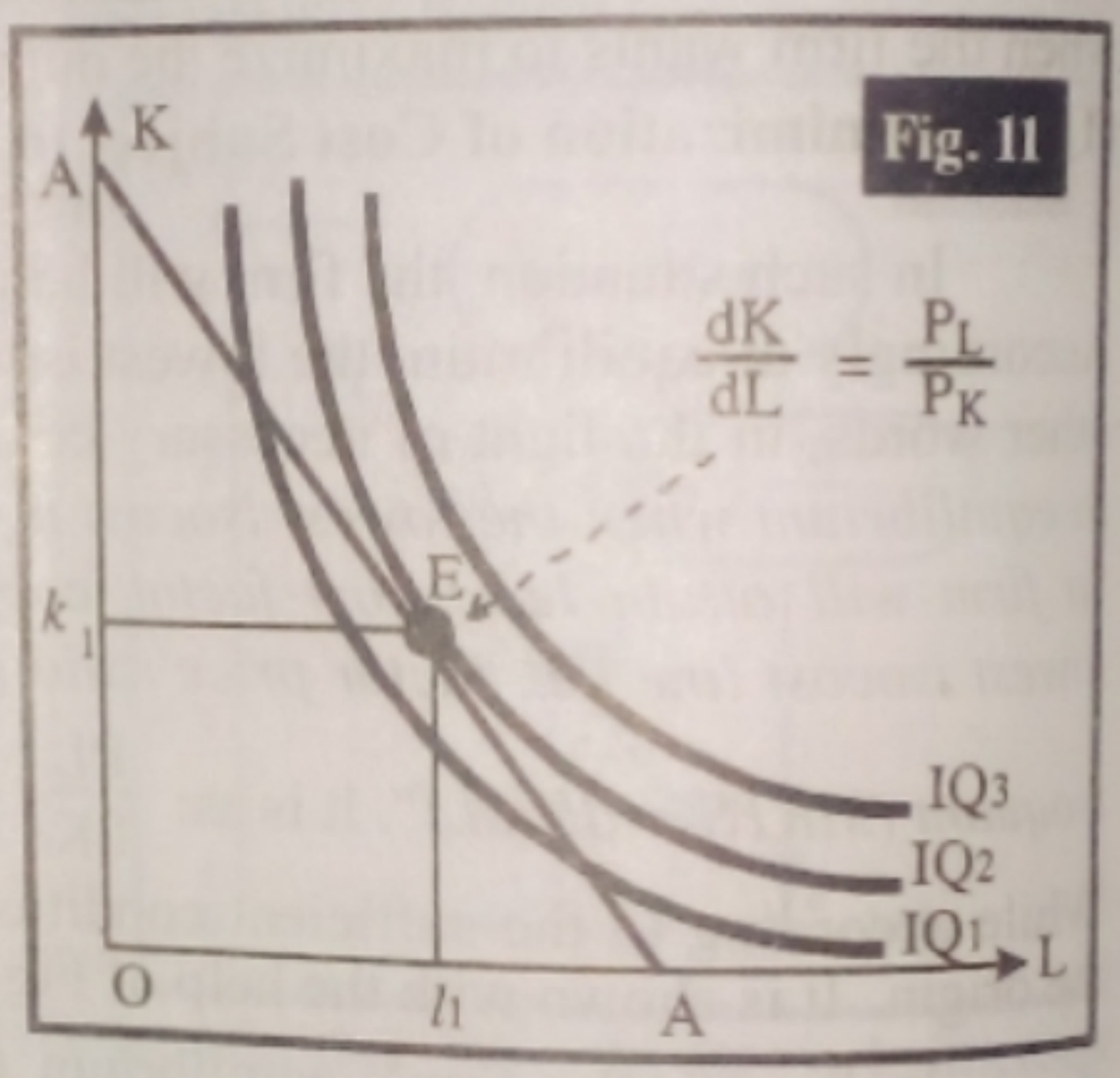
## (2) Maximization of Output Subject to Cost Constraint

**|(IUBWR:2010)(UOS:2013)(UAJK:2010,2012,2014)(UOP:2017)|**

In this situation, the firm will be in equilibrium *"Where an isocost line is tangent to the highest Isoquant"*. In other words, the point where the absolute slope of highest isoquant $\left(\text{MRTS} = \frac{dK}{dL}\right)$ and absolute slope of a given isocost line $\left(\text{Factor price ratio} = \frac{P_L}{P_K}\right)$ are equal the firm will attain optimum factor combination. This is known as necessary condition of firm's equilibrium. While according to sufficient condition at equilibrium, an isoquant must be convex to the origin. All is demonstrated with the help of Fig.11.

Here the firm is in equilibrium at E where according to necessary condition the isocost line AA is tangent to the highest isoquant $IQ_2$. In other words, here the slope of isoquant $\left(\frac{dK}{dL}\right)$ is equal to slope of isocost line $\left(\frac{P_L}{P_K}\right)$. Accordingly, the firm employs $ol_1$ of L and $ok_1$ of K. Moreover at equilibrium, an isoquant is convex to the origin. Remember firm does not attain equilibrium on $IQ_3$ because it is a higher output as compared to the budget of the firm. While $IQ_1$ represents a lower output as compared to the budget of the firm.

**Fig. 11**




### The Economic Reason For Convexity

In above two cases we told that according to sufficient condition an isoquant must be convex to origin. Now the question is what is the logic behind this idea. It is said that a point of tangency between isocost line and isoquant represents a point of minimum total costs only when an isoquant is convex to origin. If an isoquant were concave to origin, such a tendency would represent a point of maximum total cost and firm will never produce there.

Accordingly, with concave isoquants the firm would never produce in the middle area of input space; it would rather move to either axis (corner solution) depending on circumstances. This means that the firm would employ one factor only. Such behaviour contradicts our basic proposition because $Q = f(L, K)$. Moreover, this must be remembered that convex part of an isoquant represents economically relevant region. (To understand the corner solution and equilibrium in case of concave isoquant the theory of consumer equilibrium can be studied).