Let us define, Pressure Coefficient,

$$\Psi = \Delta p \Big/ \left(\frac{1}{2}\rho U_2^2\right) \qquad (40.9)$$

Volume Coefficient,

$$\phi = 4Q/(\pi D_2^2 U_2) \qquad (40.10)$$

and Power Coefficient,

$$\mathbb{P} = \Psi\phi \qquad (40.11)$$

Substitution of (40.8) in the above yields

$$\frac{\Delta p}{\frac{1}{2}(\rho U_2^2)} = 2\left(1 - \frac{Q}{\pi D_2 b_2 U_2}\cot\beta_2\right) \qquad (40.12)$$

or,
$$\Psi = 2\left(1 - \frac{\phi D_2}{4b_2}\cot\beta_2\right) \qquad (40.13)$$

$$\mathbb{P} = 2\phi\left(1 - \frac{\phi D_2}{4b_2}\cot\beta_2\right) \qquad (40.14)$$

Equations (40.13) and (40.14) are plotted in Fig 40.1 for different values of volume coefficient ϕ with β_2 as a parameter.

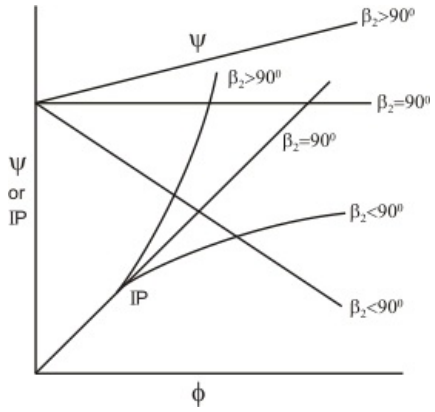

Figure 40.1 Performance curves of a Fan

The characteristics in Figure 40.1 depict the following

(i) Forward curved fans $(\beta_2 > 90^0)$ develop the highest pressure for a given impeller diameter and speed.

(ii) Power requirement of a forward curved fan increases steeply for a small change in flow rate.

(iii) Pressure developed decreases fast with increasing flow rate in a backward curved fan

In conclusion, the forward curved fans have large volume discharge and pressure rise but they demand higher power. However, forward curved fans are unstable for off-design operating conditions.

Backward curved fans are very efficient and the drooping power characteristic makes them suitable for a better off-design performance

Radial curved fans are preferred for dust-laden fluids. Due to their shape, the solid particles are not stuck and deposited on the blade surface.