

7.16) Four jets each of 60 mm diameter strike the buckets of an impulse wheel and each gets deflected by an angle of 165° . The speed of the bucket wheel is 45 m/s. Find the velocity of the jet for maximum efficiency, power developed and the hydraulic efficiency. Assume that the bucket moves linearly.

Soln:-

For maximum efficiency, the jet velocity is

$$V_1 = 2V_b = 2 \times 45 = 90 \text{ m/s.}$$

Flow through the jet,

$$Q = \frac{\pi}{4} d^2 \times V_1$$

$$= \frac{\pi}{4} \times (0.06)^2 \times 90$$

$$= 0.2545 \text{ m}^3/\text{s.}$$

• Power developed, $P = \frac{1 - K \cos \theta}{g} \cdot \frac{V_1^2}{4} \cdot W \cdot g$

↳ Taking friction coefficient K to be unity,

$$P = (1 - \cos(165^\circ)) \cdot \frac{(90)^2}{4} \times 0.2545$$

$$= 1013 \text{ W}$$

For four jets,

$$P = 4 \times 1013 = 4052 \text{ W}$$