

## Lesson 32 NUMERICALS ON PUMPS

### 32.1 Numericals

1. Calculate the discharge of reciprocating pump (single cutting) if area of cylinder is  $0.25 \text{ m}^2$ , length of stroke is  $0.15 \text{ m}$ , number of cylinder =1 and speed of pump is  $50 \text{ rpm}$ .

Sol.

$$\text{Discharge } Q = A \times L \times \frac{N}{60} \times n \times \text{number of cutting}$$

$$A = 0.25 \text{ m}^2$$

$$L = 0.15 \text{ m}$$

$$N = 50 \text{ rpm}$$

$$n = 1$$

$$\text{number of acting} = 1$$

$$Q = 0.25 \times 0.15 \times \frac{50}{60} \times 1 \times 1$$

$$= 0.03125 \text{ m}^3/\text{s}$$

2. Calculate the power required to drive the single cutting reciprocating pump for water of following specification.

Sol.

$$\text{Area of cylinder} = 0.85 \text{ m}^2$$

$$\text{Length of stroke} = 0.35 \text{ m}$$

$$\text{Number of cylinder} = 2$$

$$\text{Speed of pump} = 15 \text{ rpm}$$

$$\text{Suction head} = 0.5 \text{ m}$$

$$\text{Discharge head} = 1 \text{ m}$$

$$\text{Power (hp)} = \frac{WALNn(h_s + h_d)}{4500}$$

$$\text{Where } w = \rho_g$$

$$\text{power} = \frac{1000 \times 9.81 \times 0.85 \times 0.35 \times 15 \times 2 \times (0.5 + 1)}{4500} = 29.1 \text{ h.p.}$$

3. Calculate water horse power for centrifugal water pump if flow rate is  $4500 \text{ liter/h}$ . head added to the flow is  $10 \text{ m}$ .

Sol.

$$1 \text{ m}^3 = 1000 \text{ L}$$

$$Q = \frac{4500 \times 10^{-3}}{60 \times 60} \text{ m}^3/\text{s}$$

$$\begin{aligned} \text{water horse power } WHP &= \rho_g HQ \\ &= \frac{1000 \times 9.81 \times 10 \times 4500 \times 10^{-3}}{60 \times 60} = 12.26 \text{ hp} \end{aligned}$$

4. Calculate brake horse power for centrifugal water pump if flow rate is 1000 litres/h. Head added to the flow is 10 m pump efficiency is 86%.

Sol.

$$1 \text{ m}^3 = 1000 \text{ L}$$

$$Q = \frac{10000 \times 10^{-3}}{60 \times 60}$$

$$\text{Brake horse power } bhp = \frac{\rho_g HQ}{n}$$

$$bhp = \frac{1000 \times 9.81 \times 10 \times 10000 \times 10^{-3}}{0.86 \times 60 \times 60} = 316.86 \text{ hp}$$