Shaft power = $\frac{\text{fluid power} \times 100}{\text{overall efficiency}}$

$= \frac{5830 \times 100}{87}$

$= 6701.149$ watts

(3) Nominal displacement of 50 cm^3/rev $= 50 \times 10^{-5}\ m^3/rev$

Pressure = 100 bar = $100 \times 10^5\ N/m^2$

shaft power = 15 kW = 15000 watt

Actual flowrate = 35 dm^3/min

$= \frac{35 \times 10^{-3}\ m^3}{60}$

$= 5.83 \times 10^{-4}\ m^3/s$

Speed = 850 rev/min $\frac{850}{60}$

$= 14.16$ rev/s

Ideal flowrate = nominal displacement × speed

Ideal flowrate

$= \frac{5.83 \times 10^{-4}}{7.085 \times 10^{-4}}$

$= 82.29\%$

ii) fluid power = $Q \cdot dp$

$= 5.83 \times 10^{-4} \times 100 \times 10^5$

$= 5830$ watt

Overall efficiency $= \frac{5830}{15000} \times 100$

$= 38.867\%$

4) $Z = 2400$ cm $= 24$ m

volumetric flowrate, $Q = 13$ litres/sec

$= 0.013\ m^3/sec$

velocity = 66 m/sec

$P = \rho g Q \left(\frac{p}{\rho g} + \frac{v^2}{2g} + z\right)$

$P = Qp + \frac{\rho Q v^2}{2} + \rho g Q z$

(Power of jet)

pressure head = 0

(ii) Power supplied from reserviour

at atmospheric pressure p=0 and v=0

$\therefore P = \rho g Q z$

$= 1000 \times 9.81 \times 0.013 \times 240$

$= 30607.2$ watts

(iii) Power loss in tramission

= power of reserviour - power of jet

$= (30607.2 - 28314)$

$= 2293.2$ watt

(iv) head lossed to overcome losses

headloss in pipe line $= 2.2932$ k/watt

$h = \frac{\text{power lost in tramission}}{\rho g Q}$

$= \frac{2293.2}{1000 \times 9.81 \times 0.031}$

$= \frac{2293.2}{127.53}$

$h = 17.98$

$= \frac{28314}{30607.2} \times 100$

$= 92.51\%$

5) Sg oil = 0.89

$z = 30,000\text{cm} = 300\text{m}$

$Q = 220$ litres/sec

$= 22 \text{m}^3/\text{sec}$

$v = 7 \text{m/sec}$

$z = 0$, pressure $= 0$

i) Power of jet

$P = \frac{\rho Q v^2}{2}$

but $Sg = 0.89$

$Sg = \frac{x}{1000}$

$x = 0.89 \times 1000$

$x = 890$

$\rho = x = 890$

$P = \frac{890 \times 0.22 \times (7)^2}{2}$

$P = 890 \times 9.81 \times 0.22 \times 300$

$P = 576239.4$ watt

$P = 576239.4$ k/w

iii) power loss in transission

= Power reserivour − power jet

$= (576239.4 - 4.7971)$ k/w

$= 571442.3$ watt

$= 571.4423$ kw

Head used to overcome losses

$$= \frac{571442.3}{890 \times 9.81 \times 0.22}$$

$= 294.5$ m

iv) Efficiency of the pipe and nozzel is tranmitting operation

$$\frac{\text{power of jet}}{\text{power of Reseriour}} \times 100$$

$$= \frac{4797.1}{571442.3} \times 100$$

$= 0.83\%$

$g = 9.81$

$Q = vA$

$d = 10cm = 10 \times 10^{-2}$ m

$A = \frac{\pi d^2}{4} = 7.85 \times 10^{-3} m^2$

∴ hieght of initial velocity equation of motion.

$v = 0$

$v^2 = u^2 - 2gh$

$u = \sqrt{v^2 + 2gh}$

$u = \sqrt{0^2 + 2 \times 9.81 \times 20}$

$u = \sqrt{392.4}$

$u = 19.809 \simeq 19.81$ m/s

The velocity $= 19.81$

∴ $Q = vA$

$= 19.81 \times 7.85 \times 10^{-2}$

$= 0.155.58 m^3/s$

$\simeq 0.156 m^3/s$

$P = \rho g Q z$

$P = 1000 \times 9.81 \times 0.156 \times 20$

$P = 30510.7677$ watts

= 200.4 watts

① Real flowrate = 10 dm³/m

T = 12.5 Nm

$= \frac{10\times10^{-3}}{60} = 1.67\times10^{-4} m^3/s$

Pessure = 12 bar = 12×10^5 N/m

Speed = 1500 rev/min = $\frac{1500}{60}$ = 25 rev/sec

Ideal flowrate = nominal displacement x speed

$= 1\times10^{-5}$ m³/rev x 25 rev/se

$= 2.5\times10^{-4}$ m³/sec

i) volumetric efficiency

$\frac{\text{Real flowrate}}{\text{Ideal flowrate}} \times 100\%$

$= \frac{1.67\times10^{-4}}{2.5\times10^{-4}} \times 100\%$

= 66.8 %

iii) shaft power =

= 2πN

= 2×π×25

= 157.0796

∴ 12.5 × 157.08

= 1963.5 watts

iv) Overall efficiency

$\frac{\text{Fluid power}}{\text{shaft power}} \times 100\%$

$\frac{200.4}{1963.5} \times 100\%$

= 10.21%

② Pump delivery = 35 dm³/min

$\frac{35\times10^{-3}}{60} = 5.83\times10^{-4}$

P = 100 bar = 100×10^5 Nm⁻²

Overall effiency = 87%

fluid power = Q.dP