Q.2

Ans

Given :-

$I_L = 15A$ $\quad I_g = 60A$

$R_a = 0.2\Omega$ $\quad V = 250V$

$I_{fg} = 2.5A$

$I_{fm} = 2A$

To find :- Efficiency of motor, η_m and efficiency of generator, η_g.

(1) Generator armature current

$$I_{ga} = I_g + I_{fg}$$
$$= 60 + 2.5$$
$$= 62.5\ A$$

(2) Input motor current

$$I_m = I_L + I_g$$
$$= 15 + 60$$
$$= 75\ A$$

(3) Motor armature current

$$I_{ma} = 75 - 2$$
$$= 73\ A$$

(4) Copper loss in motor armature

$$I_{ma}^2 \times R_a = \cancel{(62.5)^2 \times 0.2}\ (73)^2 \times 0.2$$
$$= 1065.8\ W$$

(5) Copper loss in generator armature

$I_{ga}^2 \times R_a = (62.5)^2 \times 0.2$

$= 781.25\ W$

(6) Total armature copper loss of set

$= 1065.8 + 781.25$

$= 1847.05\ W$

(7) Total stray loss of set = Input - Total losses in armature

$= 2500 - 1847.05$

$= 652.95$

(8) stray loss per machine $= \frac{652.95}{2}$

$= 326.47\ W$

Motor efficiency :-

(1) Input power = $VI_m = 250 \times 75$

$= 1875\ W$

(2) Armature Copper loss = 1065.8

(3) Field Copper loss = 250×2

$= 500\ W$

(4) Stray loss = 326.47 W

(5) Total loss = $1065.8 + 500 + 326.47$

$= 1892.27\ W$

11
1065.8
500.00
326.47
1892.27

(6) $\eta_m = \frac{\text{Input} - \text{losses}}{\text{Input}} \times 100$

$= \frac{1875 - 1892.27}{1875} \times 100$

$= \frac{16857.73 \times 10}{1875}$

$= \frac{168577.3}{1875}$

$= 89.90\ \%$

Generator efficiency :-

output power $= 250 \times 62.5$

$= 15625$

Armature Copper loss $= 781.25\ W$

Field Copper loss $= 250 \times 2.5$

$= 625\ W$

stray loss $= 326.47\ W$

Total loss $= 781.25 + 625 + 326.47 = 1732.72\ W$

Generator efficiency $\eta_g = \frac{\text{output}}{\text{O/P + losses}} \times 100$

$= \frac{15625}{15625 + 1732.72} \times 100$

$= \frac{1562500}{17357.72} = 90.01\ \%$