BEE Re-examination | Set I | solution for (ES & F) | Sem I | 2017-18

Q.1 (a) $P = 6$, Lap $A = P = 6$

$Z = 600$, $\phi = 0.02$ wb

$E_g = 300$ V (03)

i) $E_g = \frac{\phi Z N P}{60 A}$ (01) $\Rightarrow N = \frac{E_g \cdot 60 \cdot A}{\phi \cdot Z \cdot P} = \frac{E_g \cdot 60}{\phi \cdot Z} = \frac{300 \times 60}{0.02 \times 600} = 1500$ rpm

$\therefore$ N = 1500 rpm

ii) For wave wound $A = 2$

$N = \frac{E_g \cdot 60 \cdot A}{\phi \cdot Z \cdot P} = \frac{300 \times 60 \times 2}{0.02 \times 600 \times 6} = 500$ rpm (02)

$\therefore$ N = 500 rpm

(b) $E_b = V - I_a R_a$ (01)

$\therefore V = E_b + I_a R_a$

$\therefore V I_a = E_b I_a + I_a^2 R_a$ (01)

$\therefore P_{in} = P_{arm} + P_{cu}$

$P_{out} = T \cdot \omega = \frac{2\pi N T}{60}$ (01)

$E_b \cdot I_a = \frac{2\pi N T}{60}$ (01)

$\frac{\phi Z N P}{60 A} \cdot I_a = \frac{2\pi N T}{60}$

$\therefore T = \left(\frac{1}{2\pi}\right)\left(\frac{PZ}{A}\right) \cdot \phi \cdot I_a$

$\therefore T = 0.159 \left(\frac{PZ}{A}\right) \cdot \phi \cdot I_a$ (02)

(c) Diagram of three point starter (04) (03)

OR with label

Q.2 (a) $P = 4$, Lap $A = P = 4$, $Z = 576$

$I_L = 11$ A, $I_f = 1$ A, $I_a = I_L - I_f = 10$ A

$\phi = 0.02$ wb

$E_b = 230.4$ volts

$E_b = \frac{\phi Z N P}{60 A}$ (01) $\Rightarrow N = \frac{E_b \cdot 60 \cdot A}{\phi \cdot Z \cdot P} = \frac{E_b \cdot 60}{\phi \cdot Z} = \frac{230.4 \times 60}{0.02 \times 576}$

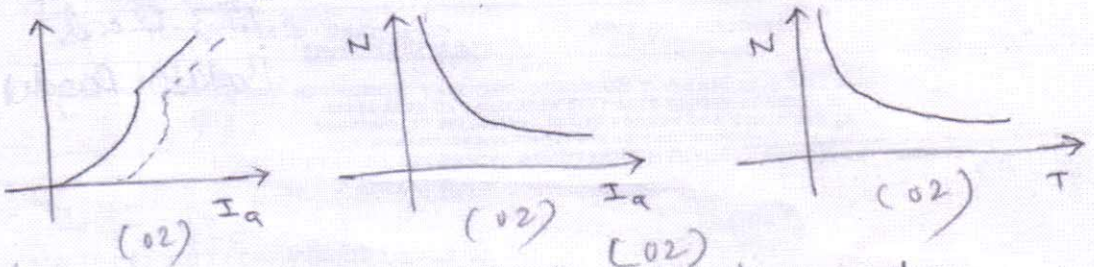
$\therefore$ N = 1200 rpm (02)

$T = 0.159 \left(\frac{PZ}{A}\right) \phi \cdot I_a = (0.159)(576)(0.02)(10)$ (01)

$\therefore$ T = 18.31 N-m (02)

(b) Torque - Arm current, speed - Arm current

speed - torque chara. of D.C. series motor



(02) (02) (02) (02)

(c) Applications of D.C. shunt motor and D.C. series motor (02)

Q.3 (a) Capacitor start single phase induction motor

i) circuit diagram (02)

ii) Advantages (02)

iii) Disadvantages (01)

iv) Applications (01)

(b) Two advantages of squirrel cage rotor (02)

Two advantages of slip ring rotor (02)

(c) P = 4, f = 50 Hz, V = 440 volts.

i) $N_s = \frac{120f}{P} = \frac{120 \times 50}{4} = 1500$ rpm (01)

ii) $N = N_s(1-s) = 1500(1-0.04) = 1500(0.96) = 1440$ rpm (01)

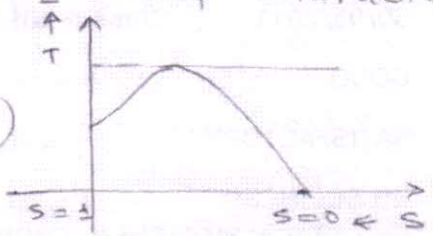
iii) $f_r = sf = (0.03)(50) = 1.5$ Hz (01)

iv) $f_r = sf = f = 50$ Hz (01)

OR

Q.4 (a) Any six significant points of difference between squirrel cage and slip ring induction motor. (01 each)

(b) Torque - slip characteristics of 3 phase induction motor



(02)

Explaination of characteristics (01)

(c) P = 6, f = 60 Hz, V = 440 volts

i) $N_s = \frac{120f}{P} = \frac{120 \times 60}{6} = 1200$ rpm (01)

ii) $N = N_s(1-s) = 1200(1-0.04) = 1200 \times 0.96 = 1152$ rpm (01)

iii) $f_r = sf$ $\quad s = \frac{N_s - N}{N_s} \times 100 = \frac{1200 - 1100}{1200} \times 100 = \frac{100}{1200} \times 100 = 8.33\%$ (01)

iv) $= 8.33 \times 60$

$= 5$ Hz. (01)

Q.5. a → i (2A)

b → iv (4Ω)

c → iv (10 / 94.2)

d → ii (14.14A)

e → ii (752.8W)

f → ii (4.44Ω)

g → ii (three)

h → iii (300)

i → i (80%)

j → ii (1180.88V)

(02 each)