Total No. of Questions – [4]　　　　　　Total No. of Printed Pages 4

G.R. No.	

Paper Code - U127-104B (T2)

MARCH 2018 / IN - SEM (T2)

F. Y. B.TECH. (COMMON) (SEMESTER - II)

COURSE NAME : BASIC ELECTRICAL ENGINEERING

(2017 PATTERN)

Model answer and scheme of marking

Time : [1 Hour]　　　　　　[Max. Marks : 30]

(*) Instructions to candidates:

1) **Answer Q.1 OR Q.2, Q.3 OR Q.4**
2) **Figures to the right indicate full marks.**

Q 1) a) $(P_T)_{3-\phi} = 8\ kW = 8000\ W$, $\cos\phi = 0.8$,

$\therefore \phi = 36.86 \therefore \sin\phi = 0.6$

$V_L = 460\ V$

for ⅄ $V_{ph} = V_L / \sqrt{3} = 460/\sqrt{3} = 265.58\ V$

$Z_{ph} = V_{ph} / I_{ph}$

$P_T = \sqrt{3}\ V_L\ I_L \cos\phi$ $8000 = (\sqrt{3})(460) I_L (0.8)$

$\therefore I_L = 12.55\ A = I_{ph}$

$\therefore Z_{ph} = V_{ph}/I_{ph} = 265.58/12.55 = 21.16\ \Omega$

$R_{ph} = Z_{ph} \cos\phi = 16.93\ \Omega$ (03M) $X_{Lph} = Z_{ph} \sin\phi = 12.69\ \Omega$

b) Neat connection diagram for a three phase balanced delta connected resistive load with correct marking of line currents, line voltages, phase voltages and phase currents. 03M

Neat phasor diagram for a three phase balanced delta connected resistive load with correct marking of line currents, line voltages, phase voltages and phase currents. 03M

c) definition of Balanced load 02M

definition of unbalanced load 02M

OR

Q2) a) $W1 = 10.4\ kW,\ W2 = -3.4\ kW,\ V_L = 400V$

$$p.f. = \cos\phi = \cos\left\{\tan^{-1}\left(\frac{\sqrt{3}(W1-W2)}{W1+W2}\right)\right\} = \cos\left\{\tan^{-1}\left(\frac{\sqrt{3}(10.4+3.4)}{10.4-3.4}\right)\right.$$

$$p.f = \cos\left\{\tan^{-1}\left(\frac{23.90}{7}\right)\right\} = \cos\left\{\tan^{-1}(3.41)\right\} = \cos(73.6$$

$$p.f = \cos(73.67) = 0.28 \text{ —— } (02M)$$

$$(P_T)_{3-\phi} = W1 + W2 = 10.4 - 3.4 = 7\ kW = 7000W \text{ — } (02M)$$

$$(P_T)_{3\phi} = \sqrt{3}\ V_L\ I_L\ \cos\phi \qquad 7000 = (\sqrt{3})(400) I_L (0.28)$$

$$\therefore I_L = 7000/193.98 = 36.08\ A \text{ —— } (02M)$$

b) Phasor diagram (any one line voltage/ all three line voltages) 03M

Derivation steps for relation between line and phase voltages with correct relation 02M

$V_L = \sqrt{3}\ V_{ph}$ 01M

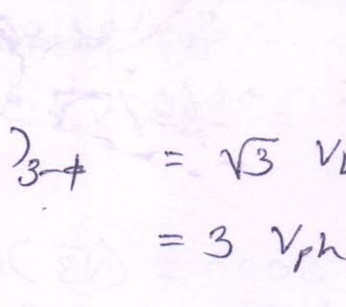
c)

$$\left.\begin{aligned}(P_T)_{3-\phi} &= \sqrt{3}\ V_L I_L \cos\phi \\ &= 3\ V_{ph} I_{ph} \cos\phi\end{aligned}\right\} \text{ —— } (01M)$$

$$(Q_T)_{3-\phi} = \sqrt{3}\ V_L I_L \sin\phi = 3\ V_{ph} I_{ph} \sin\phi \text{ —— } (01M)$$

$$(S_T)_{3-\phi} = \sqrt{3}\ V_L I_L = 3\ V_{ph} I_{ph} \text{ —— } (01M)$$

Power triangle for lagging p.f.



—— (01M)

Q3) a) $P_i = 1.5\,kW \quad (P_{F.L.})_{cu} = 1\,kW$

① $n = \frac{A.L.}{F.L.} = \frac{F.L.}{F.L.} = 1 \quad \cos\phi = 1$

$$\%\eta_{F.L.} = \frac{n(kVA_{Rating})\times10^3 \times \cos\phi}{n(kVA_{Rating})\times10^3 * \cos\phi + P_i + n^2(P_{cu})_{F.L.}} \times 100 = \frac{(1)(100\times10^3)(1)}{N^2 + 1.5\times10^3 + (1)^2(1000)} \times 100$$

$$= 97.5\%.$$

② $n = \frac{A.L.}{F.L.} = \frac{H.L.}{F.L.} = \frac{1}{2}, \cos\phi = 0.8$

$$\%\eta_{H.L.} = \frac{(\frac{1}{2})(100\times10^3)(0.8)}{(\frac{1}{2})(100\times10^3)(0.8) + (1.5\times10^3) + (\frac{1}{2})^2(1000)} \times 100 = 95.81\%$$

b) 4 correct points 1 mark for each point

c) diagram of CT	01M
application of CT	01M
diagram of PT	01M
application of PT	01M

OR

Q4) a) $\frac{E_2}{E_1} = \frac{N_2}{N_1} \qquad \frac{200}{3300} = \frac{80}{N_1} \therefore N_1 = 1320$ — 01

$$(I_1)_{F.L.} = \frac{kVA\,Rating \times 10^3}{V_1} = \frac{100\times10^3}{3300} = 30.30A \text{ — } 02M$$

$$(I_2)_{F.L.} = \frac{kVA\,Rating \times 10^3}{V_2} = \frac{100\times10^3}{200} = 500A \text{ — } 02M$$

$E_1 = 4.44\, f\, \phi_m N_1$

$$\phi_m = \frac{E_1}{4.44\, f\, N_1} = \frac{3300}{(4.44)(50)(1320)}$$

$\phi_m = 11.26\ mWb$ — 01M

b) i)Definition of Voltage Regulation 1M

Formula 1M

$$\% \text{ reg.} = [E_2 - V_2 / E_2] * 100$$

ii) Definition of Efficiency 1M

Formula 1M

$$\% \ \eta = n[V_2 I_2 \cos ø] / \{n[V_2 I_2 \cos ø] + P_i + n^2 P_{cu}\} * 100$$

c) i) types of losses occurring in the transformer 1M

ii) their location - 1M

iii) whether constant or variable loss - 1M

iv) how to minimize it - 1M