MADE EASY PUBLICATIONS

POSTAL BOOK PACKAGE 2025

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ELECTRICAL ENGINEERING

Objective Practice Sets

Power Systems

1 CHAPTER
Performance of Transmission Lines, Line Parameters & Corona

MCQ and NAT Questions

Q.1 Use of bundled conductor increases,
(a) GMR
(b) GMD
(c) Potential gradient
(d) Radius of conductor

Q.2 ACSR conductor have
(a) all conductors made of aluminium
(b) outer conductors made of aluminium
(c) inner conductor made of aluminium
(d) core made of aluminium

Q.3 Regulation of a short transmission line is given by

(a) $\frac{|V_S|-|V_R|}{|V_R|}\times 100\%$ (b) $\frac{|V_R|-|V_S|}{|V_R^2|}\times 100\%$

(c) $\frac{|V_S|-|V_R|}{|V_R^2|}\times 100\%$ (d) $\frac{|V_S|-|V_R|}{|V_S|}\times 100\%$

Q.4 If the p.f. of load decrease, the line losses,
(a) increase (b) decrease
(c) remain same (d) none

Q.5 In a transmission line sag depends upon
(a) conductor material
(b) tension in conductor
(c) weight per unit length of conductor
(d) all the above

Q.6 For a 500 Hz frequency excitation, a 50 km long power line will be modelled as
(a) short line
(b) medium line
(c) long line
(d) data insufficient for decision

Q.7 The good effect of corona on overhead lines is to
(a) increase the line carrying capacity due to conducting ionised air envelop around the conductor.
(b) increase the power factor due to corona loss.
(c) reduce the radio interference from the conductor.
(d) reduce the steepness of surge fronts.

Q.8 A 3-phase transmission line has its conductors at the corners of an equilateral triangle with side 3 m. The diameter of each conductor is 1.63 cm. The inductance of the line per phase per km is
(a) 1.232 mH (b) 1.182 mH
(c) 1.093 mH (d) 1.043 mH

Q.9 The capacitance of an overhead transmission line increases with
1. increase in mutual geometrical mean distance.
2. increase in height of conductors above ground.

Select the correct answer from the following:
(a) Both 1 and 2 are true
(b) Both 1 and 2 are false
(c) Only 1 is true
(d) Only 2 is true

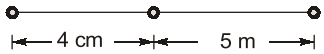
Q.10 Which one of the following statement is correct? Corona loss increases with
(a) decrease in conductor size and increase in supply frequency.
(b) increase in both conductor size and supply frequency.
(c) decrease in both conductor size and supply frequency.
(d) increase in conductor size and decrease in supply frequency.

Q.11 What is the approximate value of the surge impedance loading of a 400 kV, 3-phase 50 Hz overhead single circuit transmission line?
(a) 230 MW (b) 400 MW
(c) 1000 MW (d) 1600 MW

Q.12 If a fixed amount of power is to be transmitted over certain length with fixed power loss, it can be said that volume of conductor is

(d) GMD when conductors are horizontally spaced having spacing of 10 cm between them is 10 cm.

Q.70 A 3 phase, 50 Hz, 33 kV overhead line conductors are placed in a configuration as shown below. The conductor diameter is 1.5 cm. If the line length is 100 km, then



(a) capacitance per phase is 0.52 μF.
(b) capacitance per phase is 0.84 μF.
(c) charging current per phase is 12.1 A.
(d) charging current per phase is 5.028 A.

Q.71 A overhead 3 phase line delivers 10 MW at 33 kV at 0.6 pf (lagging). If the resistance and reactance of each conductor is 3 Ω and 5 Ω respectively, then
(a) sending end line voltage is 20.74 kV
(b) percentage regulation is 4.61%.
(c) transmission efficiency is about 93%.
(d) line current is 291.6 A.

■■■■

Answers — Performance of Transmission Lines, Line Parameters & Corona

1. (a)	**2.** (b)	**3.** (a)	**4.** (a)	**5.** (d)	**6.** (c)	**7.** (d)	**8.** (a)
9. (b)	**10.** (a)	**11.** (b)	**12.** (b)	**13.** (a)	**14.** (b)	**15.** (c)	**16.** (c)
17. (b)	**18.** (d)	**19.** (d)	**20.** (b)	**21.** (22.9)	**22.** (c)	**23.** (d)	**24.** (b)
25. (c)	**26.** (c)	**27.** (b)	**28.** (c)	**29.** (b)	**30.** (a)	**31.** (d)	**32.** (d)
33. (c)	**34.** (c)	**35.** (b)	**36.** (c)	**37.** (a)	**38.** (b)	**39.** (d)	**40.** (d)
41. (d)	**42.** (d)	**43.** (c)	**44.** (a)	**45.** (a)	**46.** (c)	**47.** (a)	**48.** (c)
49. (c)	**50.** (6.35)	**51.** (4000)	**52.** (191)	**53.** (296)	**54.** (0.80)	**55.** (–0.33)	**56.** (22.22)
57. (1.028)	**58.** (14)	**59.** (0)	**60.** (145.51)	**61.** (800)	**62.** (13.63)	**63.** (79.81)	
64. (110.71)	**65.** (95.62)	**66.** (b,c)	**67.** (a,b,d)	**68.** (b,c,d)	**69.** (a,c)	**70.** (b,d)	**71.** (c,d)

Explanations — Performance of Transmission Lines, Line Parameters & Corona

1. (a)

With the use of bundle conductors self GMD or GMR is increased which reduces the inductance of line.

2. (b)

ACSR is Aluminium conductor steel reinforced. In this the outer conductors made of aluminium.

3. (a)

$$\text{Voltage regulation } (V_R) = \frac{\left|\frac{V_S}{A}\right| - |V_R|}{|V_R|} \times 100\%$$

As for short line $\Rightarrow A = 1$

$$\therefore \quad (V_R) = \frac{|V_S| - |V_R|}{|V_R|} \times 100\%$$

4. (a)

$$\because \quad P = VI\cos\phi$$

$$I = \frac{P}{V\cos\phi}$$

For constant power and voltage, $I \propto \frac{1}{\cos\phi}$

$\therefore$ If p.f.↓ then I↑ and power loss↑.

$\because$ Power loss $(P_L) = I^2R$

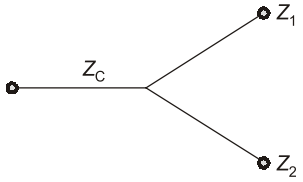
5. (d)

$$\text{Sag} = \frac{WI^2}{8T}$$

where,
$W \rightarrow$ weight of conductor per unit length
$l \rightarrow$ span length
$T \rightarrow$ tension in conductor (depends on the conductor material)

63. Sol.

$\because \quad Z_1 = Z_2$



Parameter of cable:

$L_C = 0.4$ mH/km

$C_C = 0.5\ \mu$F/km

$\therefore$ Surge impedance of the cable,

$$Z_C = \sqrt{\frac{L_C}{C_C}} = \sqrt{\frac{0.4\times10^{-3}}{0.5\times10^{-6}}}$$

$= 28.28\ \Omega$

Parameter of OH lines:

$L_1 = 1$ mH/km

$C_1 = 0.02\ \mu$F/km

$\therefore \quad Z_1 = Z_2 = \sqrt{\frac{L_1}{C_1}} = 223.60\ \Omega$

$\because \quad V_s = 50$ kV

$$\text{Junction voltage} = V_j = \frac{2V_s \times \frac{1}{Z_C}}{\frac{1}{Z_C}+\frac{1}{Z_1}+\frac{1}{Z_2}}$$

$$= \frac{2\times50\times\frac{1}{28.28}}{\frac{1}{28.28}+\frac{2}{223.60}} = 79.81\,\text{V}$$

64. Sol.

Electrical line length =

$$\beta l = \frac{8\times\pi}{180} = 0.1396 \text{ rad.}$$

$\because$ Velocity, $V = \frac{2\pi f}{\beta}$

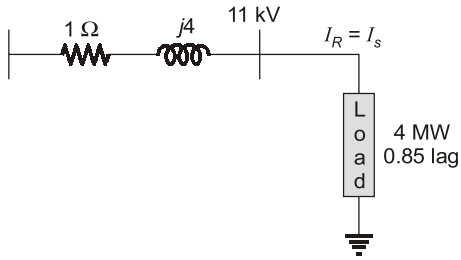
$$\beta = \frac{2\pi f}{V} = \frac{2\pi\times60}{2.99\times10^8}$$

$\because \quad \beta l = 0.1396$

$$l = \frac{0.1396}{\beta}$$

$$= \frac{0.1396}{\left(\frac{2\pi\times60}{2.99\times10^8}\right)} = 110.71\,\text{km}$$

65. Sol.



$\because \quad I_R = I_S = \frac{P_{R3\text{-}\phi}}{\sqrt{3}V_{RL}\cos\phi_R}$

$$= \frac{4\times10^6}{\sqrt{3}\times11\times10^3\times0.85}$$

$I_R = I_S = 246.99$ A

$P_s = P_R + 3(I_s^2R)$

$= 4\times10^6 + 3(246.99^2\times1)$

$= 4.183$ MW

$\therefore \quad \%\eta = \frac{P_R}{R_s}\times100 = \frac{4}{4.183}\times100$

$= 95.62\%$

66. (b, c)

- Zero regulation occurs at $\phi_R = \tan^{-1}\left(\frac{R}{X_L}\right)$ at leading pf.
- For $R = X_L$ (as given) and zero V.R.

$\phi_R = \theta = \tan^{-1}\left(\frac{X_L}{R}\right) = \tan^{-1}(1) = 45°$

$\cos\phi_R = 0.707$ (leading p.f.)

67. (a, b, d)

$$\text{Load current, } I = \frac{5\times10^6}{3\times\left(\frac{11\times10^3}{\sqrt{3}}\right)} = 262.43\text{ A}$$

For short line (approximation)

$V_s = V_R + IR\cos\phi_R + IX\sin\phi_R$

$$V_s = \left(\frac{11\times10^3}{\sqrt{3}}\right) + 262.43[1.5\times0.8 + 4\times0.6]$$

$= 7295.6$ V/ph

$|V_s|_{\text{Line}} = 12.636$ kV

Total line losses $= 3\times I^2R = 3\times(262.43)^2\times1.5$

$= 309.91$ kW