TS NPDCl Key – 2015 :

1. **B**
2. **B**
3. **D**
4. **B**

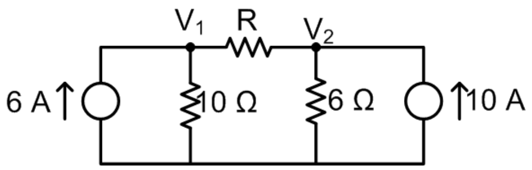
5. **A**

$T_m = s \times \frac{r_2}{x_2}$

$T_m \propto \frac{1}{f}$

T_m at 60Hz = 0.7 T_{m1}.

6. **D**
7. **C**
8. **C**
9. **B**



$\frac{V1-V2}{R} + \frac{V1}{10} = 6$

$10V_1 - 10V_2 + RV_1 = 60\ R \quad \rightarrow$ (i)

$\frac{V2-V1}{R} + \frac{V2}{6} = 10$

$6V_2 - 6V_1 + RV_2 = 60\ R \rightarrow$ (ii)

By solving eq. (i) and (ii), we get $V_1 = 60$ V & $V_2 = 60$ V

No current flows through R.

10. **C**
11. **C**
12. **C**
13. **C**
14. **B**

Under balanced conditions,

$(R_x + j\omega L_x) R_4 = (R_3 + j\omega L_3) R_2$

Equating real and imaginary forms separately,

$R_x = \frac{R2\ R3}{R4}$ and $L_x = \frac{R2\ L3}{R4}$

15. **B**
16. **C**
17. **B**
18. **D**
19. **D**

20. **C**
21. **B**

22. **C**
23. **A**
24. **D**
25. **B**
26. **A**

If l is reduced A & D increases whereas B & C decreases.

27. **A**
28. **A**

$R_{sh} = \frac{0.3}{\frac{20}{5}-1} = 0.1\ \Omega$

29. **C**
30. **C**
31. **C**

RMS input voltage = 220 V

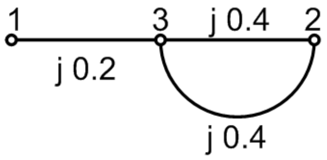
RMS output voltage = $\sqrt{\frac{9}{16}}$ x 120

= 165V.

Input power factor = $\sqrt{\alpha} = \sqrt{9/16}$

= 0.75.

32. **B**
33. **C**
34. **B**



$X_d' = j\ 0.2$ pu => $\frac{1}{x_d'} = j\ 5$pu

$$[Y] = \begin{matrix} -j5 & 0 & j5 \\ 0 & -j5 & j5 \\ j5 & j5 & -j10 \end{matrix}$$

35. **D**
36. **A**

$\alpha = 0.49$

$V_{av} = \alpha\ V_s = 0.49 \times 200 = 98$ V

$I_{av} = \frac{98}{100} = 0.98$ A

$V_{rms} = \sqrt{\alpha}\ V_s = 0.7 \times 200 = 140$ V

$I_{rms} = 140/10 = 14$ A

37. **C**

38. **C**

Z - transform of $a^k = \frac{z}{z-a}$

Z - transform of $k.a^k = az / (z-a)^2$.

39. **C**

$G(s) = \frac{1}{s(s+2)}$

$CLTF = \frac{G(s)}{1+G(s)} = \frac{1/s(s+2)}{1+1/s(s+2)}$

$= \frac{1}{s(s+2)+1} = \frac{1}{s^2+2s+1} = \frac{1}{(s+1)(s+1)}$

Poles are -1 and -1.

40. **B**

41. **B**

During coasting no electrical energy.

42. **D**

$V_s = L\frac{di}{dt}$

$L = \frac{Vs}{di/dt} = \frac{240}{50} = 4.8mH.$

43. **D**

44. **B**

45. **D**

Fundamental component of 1ϕ full bridge inverter is given by

$V_{rms} = \frac{4V_s}{\pi}\sin\omega t = 140\sqrt{2}$ V.

46. **B**

Using R-H criterion

s^3	1	K+2
s^2	K	3
s^1	$\frac{K(K+2)-3}{K}$	0
s^0	3	

for stability, K > 0 and

$\frac{K(K+2)-3}{K} > 0$

∴ K > 0 and K > 1

47. **No answer**

$Y - \Delta$

$N_1 : N_2 = 11 : 1$

$V_{L\Delta} = \frac{V_{LY}}{\sqrt{3}\,K} = 577.35$ V.

48. **A**

49. **B**

Reactance relays are used for earth faults and in short transmission lines. Impedance relays are used in medium length transmission lines.

MHO relays are used for long transmission lines only.

50. **D**

51. **C**

For double cage Induction motor, the inner cage has low resistance and reactance. The outer cage has highest resistance and low reactance.

52. **C**

53. **D**

N is constant in shunt motor.

54. **D**

55. **B**

56. **B**

$T_m \propto I_a \quad T_m = K_t I_a$

$I_a = \frac{T_m}{K_t} = \frac{150 \text{ Nm}}{2 \text{ Nm}/A} = 25 \text{ A}$

$I_a R_a = 25 \times 1 = 25 \text{ V}$

In a 3ϕ semi converter

$\frac{3\sqrt{2}V_{rmsl}}{2\pi}(1+\cos\alpha) = E_b + I_a R_a$

$E = \frac{3\sqrt{2} \times 440}{2\pi}\left(1 + \frac{1}{\sqrt{2}}\right) - 25$

$= 482 \text{ V}.$

57. **A**

For 3ϕ full converter,

$V_{av} = \frac{3V_{ml}}{\pi} \cos\alpha$

$= \frac{3 \times 440\sqrt{2}}{\pi} \times \frac{1}{\sqrt{2}} = 420 \text{ V}.$

58. **B**

59. **A**

60. **C**

Step angle $= \frac{360}{3 \times 12} = 10^o$.

61. **B**

62. **D**

63. **B**

64. **C**

$R_{damp} = \frac{1}{2}\sqrt{L/C}$.

65. **A**

$G(s) = \frac{k(1+ s/z)}{(1+ s/p)}, z > 0$

For lead compensator, $\alpha < 1$

$T = \frac{1}{z}, \alpha.T = \frac{1}{p} \quad \therefore \alpha = \frac{z}{p}$

If $\alpha < 1$ then $\frac{z}{p} < 1 \Rightarrow z < P$

66. **B**

67. **D**

68. **A**

$\eta = \frac{500 \times 4}{500 \times 0.5} = 8$

69. **C**

70. **C**

71. **C**

72. **C**

Area to be illuminated A = 10 x 10 = 100 m^2

Total flux at floor = 240 x 100 = 24 K lumen

Flux radiated by lamps

$= \frac{\text{Total flux at floor}}{\text{utilization factor}}$ x depreciation factor

Depreciation factor =

1 / (maintenance factor)

Flux radiated = $\frac{24000}{0.72} \times \frac{1}{0.7}$ = 47619.04

Total voltage required = $\frac{47619.04}{80}$ = 595.23 W

No.of 30W CFL bulbs required = 595.23 /30 = 19.84 ~ 20 bulbs.

73. **C**

74. **C**

75. **D**

$N_s = \frac{120x50}{6} = 100rpm$

S at $T_{max} = \frac{1000-875}{1000} = 0.125$

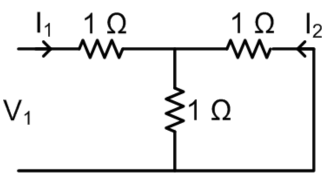
Torque at s% slip $= \frac{2\ Sm\ Sfl}{A = Sm^{2+}Sfl^2}$

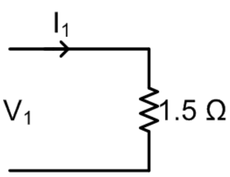
$T = \frac{2\ (0.125+0.05)}{(0.125)^2 + (0.05)^2}$

T = 6.9 N-m.

76. **A**

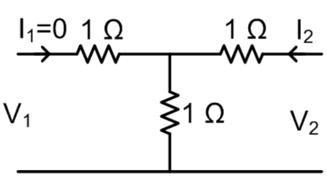
77. **A**





$h_{11} = \frac{V1}{I1} |_{V2 = 0}$ $h_{11} = 1.5\ \Omega$

$h_{12} = \frac{V2}{I2} |_{V1 = 0}$



$V_1 = V_2 \times \frac{1}{1+1}$ $\frac{V1}{V2} = h_{12} = 0.5$

$h_{21} = \frac{I2}{I1} |_{V2 = 0}$

$I_2 = - I_1 \times \frac{1}{1+1}$ $\frac{I2}{I1} = h_{21} = -0.5$

$h_{22} = \frac{I2}{V2} |_{I1 = 0}$

$I_2 = \frac{V2}{1+1}$ $\frac{I2}{V2} = h_{22} = 0.5$

$\begin{bmatrix} h11 & h12 \\ h21 & h22 \end{bmatrix} = \begin{bmatrix} 1.5 & 0.5 \\ -0.5 & 0.5 \end{bmatrix}$.

78. **D**

79. **A**

80. **D**

81. **B**

82. **D**

83. **C**

84. **A**

85. **A**

86. **C**

87. **A**

88. **D**

89. **C**

90. **D**

$1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$ and $1 X 2^{-1} + 0 X 2^{-2} + 2^{-3} x 1$

59 and 0.625.

91. **B**

92. **B**

93. **C**

94. **A**

95. **D**

$$\frac{1}{(32)^{-1/5}} + \frac{1}{(216)^{-2/3}} + \frac{1}{(256)^{-3/4}}$$

$= (32)^{1/5} + (216)^{2/3} + (256)^{3/4}$

$= (2^5)^{1/5} + (6^3)^{2/3} + (2^8)^{3/4}$

= 2 +36 +64 = 102.

96. **B**

97. **A**

Let two consecutive even numbers be x and (x+2)

Difference of their squares is $(x+2)^2 - x^2 = 164$

$x^2 + 4x + 4 - x^2 = 164$

4x = 160 => x = 40

x + (x+2) = 40 + 42 = 82.

98. **A**

99. **C**

Let Rajesh age be A and Raghu age be B

A-B = 20 → (i)

And (A-5) = (B-5) 5 => -A + 5B = 20 → (ii)
Solving (i) and (ii), A = 30 & B = 10.

100. **B**