EE1102 - Basic Electrical Engineering Quiz 2: DC Circuits, Transformers, DC and AC Machines

Name: Roll no: Code : FJNXAATFMN

Scan / click for YouTube playlist on DC Circuits.

Scan / click for YouTube playlist on Transformers.

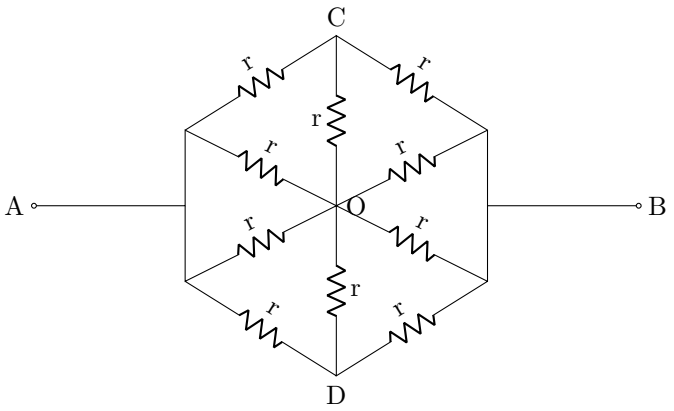
Scan / click for YouTube playlist on DC Machines.

Scan / click for YouTube playlist on Induction Machines.

Scan / click the QR code to submit your answers.

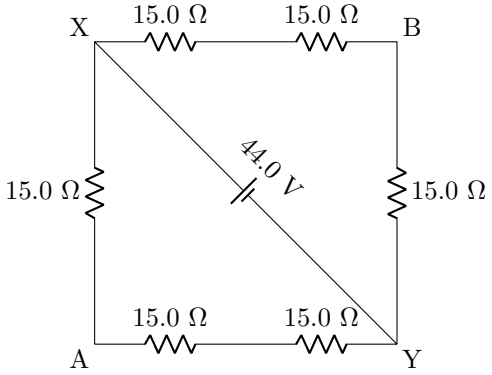
1 DC Circuits

1. Find the equivalent resistance between the points A and B for r = 52 Ω



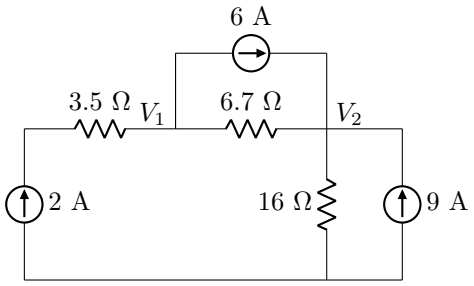
   A. 52 Ω
   B. 104 Ω
   C. 26 Ω
   D. 13.0 Ω

2. Find the potential difference between A and B.



   A. 14.6667
   B. 132.0
   C. 29.3333
   D. 264.0

3. How much is the voltage drop in the 16 Ω resistance?



A. 74 V

B. 64 V

C. 11 V

D. 176 V

4. A student makes a battery by connecting 8 cells each having emf of 2.5 V and internal resistance of 0.37 Ω in series. But by mistake one of the cell is connected in reverse. A load of 4 Ω is connected across the battery. Determine the current supplied by the battery.

A. 2.514 A

B. 2.112 A

C. 2.155 A

D. 2.814 A

5. Which has higher resistance: a 2.3 kW electric heater or a 310 W filament bulb, both rated at 220 V.

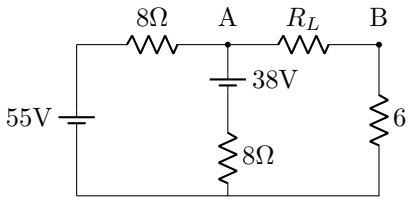
A. Data insufficient

B. Both are equal

C. 310 W bulb

D. 2.3 kW heater

6. Find the Norton's equivalent current I_N when seen from the load terminals A and B.



A. 2.325 A

B. 4.650 A

C. 0.405 A

D. 5.115 A

7. Two resistances R_1 and R_2 are connected in series. This combination is inturn connected to a voltage source of V_1. Given that $V_1 = 125$ V and $R_2 = 35$ Ω, determine value of R_1 such that the power consumption of R_1 is 94.4 W.

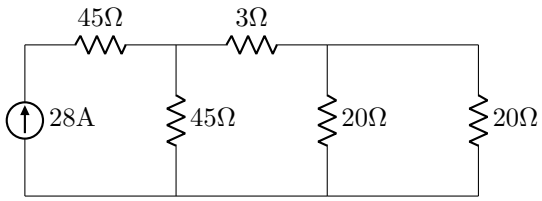
A. 15.264 Ω

B. 47.760 Ω

C. 80.255 Ω

D. both 15.264 Ω and 80.255 Ω

8. Find the power consumed by the 3Ω resistance.



A. 2124 W

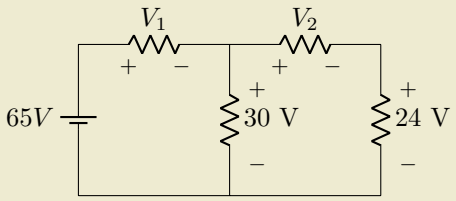
B. 1373 W

C. 1416 W

D. 1387 W

Questions on KVL

Refer to the following circuit and answer the next 2 questions



9. Determine the value of voltage, V_1 using KVL.

A. 65 V

B. 41 V

C. 6 V

D. 35 V

10. Determine the value of voltage, V_2 using KVL.

    A. 35 V

    B. 41 V

    C. 6 V

    D. 30 V

11. A circuit has a Thevenin's equivalent of 26.2 V in series with resistance of 35 Ω across terminals A and B. Now an additional resistance of 60 Ω is connected acorss the terminals A and B. The Thevenin's equivalent is recalculated again by considering this new additonal resistance as a part of network. What will be the Thevenin's Voltage in this condition?

    A. 0 V

    B. 16.55 V

    C. 26.20 V

    D. 15.72 V

12. Two resistors 70 Ω and 20 Ω are in parallel. This combination is in turn connected in series with another resistance of value 28 Ω. Further this entire combination is connected in parallel to another resistance of 28 Ω. Find the effective resistance of the above circuit.

    A. 15.556 Ω

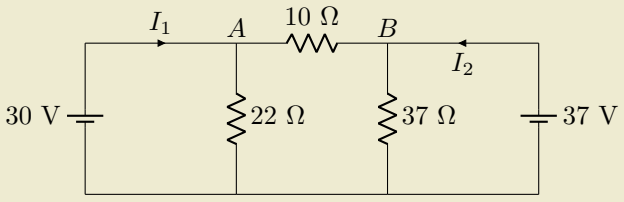
    B. 71.556 Ω

    C. 17.043 Ω

    D. 43.556 Ω

DC Circuit

Refer to the following circuit and the answer the next 3 questions



13. Find the current I_1 in the following circuit using nodal analysis

    A. 0.66 A

    B. 1.36 A

    C. 1.70 A

    D. 1.00 A

14. Find the current I_2 in the following circuit using nodal analysis

    A. 1.00 A

    B. 1.36 A

    C. 1.70 A

    D. -0.70 A

15. Determine the power in the 10 Ω resistance.

    A. 19.91 W

    B. 4.40 W

    C. 4.90 W

    D. 28.90 W

16. A home is connected to a 225 V supply with the rating of the fuse being 11 A. The maximum number of 60 W bulbs that can be connected in parallel without exceeding the rating of the fuse is.

    A. 44

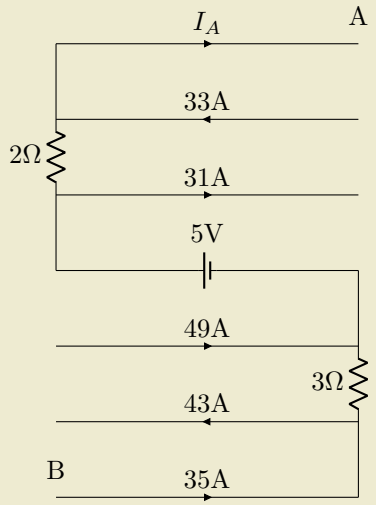
    B. 41

    C. 42

    D. 39

Questions on KCL

Refer to the circuit for next 3 questions.



17. Determine the value of voltage V_{AB}

    A. 9 V

    B. -105 V

    C. 220 V

    D. -49 V

18. Determine the value of current I_A

    A. 66 A

    B. 43 A

    C. -8 A

    D. -4 A

19. Determine the power supplied by the voltage source $5V$

    A. 205 W

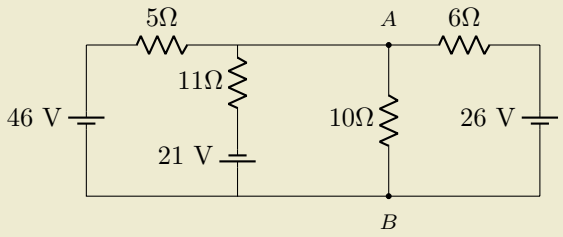
    B. -40 W

    C. -285 W

    D. 52 W

Questions on Thevenins Theorem

Refer to the following circuit and answer the next 2 questions



20. What is the Thevenins voltage V_{TH}, for the above circuit considering 10 Ω as the load resistance?

    A. 24.13 V

    B. 25.06 V

    C. 32.66 V

    D. 25.40 V

21. What is the Thevenins resistance R_{TH}, for the above circuit considering 10 Ω as the load resistance?

    A. 3.438 Ω

    B. 3.882 Ω

    C. 2.295 Ω

    D. 2.185 Ω

22. The energy used by a 1.4 kW heater in 11 minutes is:

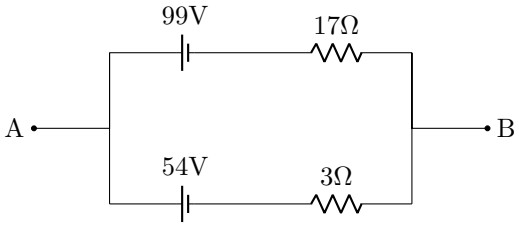
    A. 905520 J

    B. 15400 J

    C. 914760 J

    D. 924000 J

23. In the figure shown below find the voltage V_{AB} in Volts.



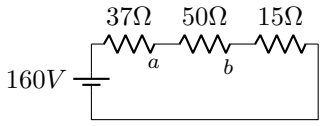
    A. 60.75

B. 38.25

C. 2.25

D. 6.75

24. Calculate the voltage "Vab" across 50 Ω resistor using KVL.



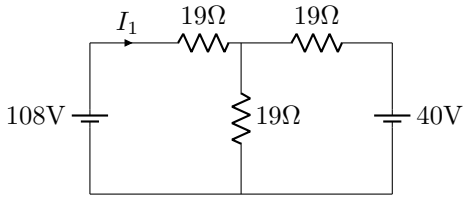
A. 78.431 V

B. 81.569 V

C. 101.961 V

D. 84.706 V

25. In the figure shown below find the value of current I_1 in Amperes.



A. 3.088 A

B. 3.789 A

C. 1.404 A

D. 2.386 A

2 Transformers

26. A single-phase transformer has the maximum efficiency of 98%. The core losses are 245 W and the equivalent winding resistance as seen from the primary side is 0.65 Ω. The rated current on the primary side is 35 A. At what percentage of the rated input current does the maximum efficiency occur?

A. none of these choices

B. 55.259 %

C. 55.470 %

D. 55.915 %

EMF Equation of Transformer

A 20 KVA transformer has 430 turns in the primary and 40 turns in the secondary. The primary is connected to 2790 V, 40Hz supply. Neglect losses, leakage drops and no load current in the primary. Based on this data solve following three questions.

Hint: Refer to the video at this QR code to solve this set of questions.

27. Find the full load secondary current?

A. 74.75 A

B. 87.85 A

C. 64.52 A

D. 77.06 A

28. What is the emf induced in the secondary?

A. 259.53 V

B. 246.56 V

C. 129.77 V

D. 235.39 V

29. What is maximum flux in the core?

A. 37.63 mWb

B. 36.53 mWb

C. 94.26 mWb

D. 129.60 mWb

30. A 6 kVA, 400/120 V transformer has equivalent resistance refered to primary, Req(HV) = 1.33 Ω and equivalent reactance referred to primay, Xeq(HV) = 3.36 Ω. A lagging load is being supplied by it resulting in the following meter readings (meters are placed on the HV side): I_1 = 9.6 A, V_1 = 400 V, P_1 = 2.4 kW For this condition calculate what a voltmeter would read if connected across the load terminals. Neglect the no-load current of the transformer.

A. 174.79 V

B. 69.37 V

C. 110.12 V

D. 117.82 V

31. A single-phase transformer has the maximum efficiency of 98%. The core losses are 205 W and the equivalent winding resistance as seen from the primary side is 0.45 Ω. The rated current on the primary side is 35 A. At what percentage of the rated input current does the maximum efficiency occur?

A. 60.749 %

B. 60.982 %

C. none of these choices

D. 61.375 %

OC and SC Test on a Transformer

A 190/390 V, 50 Hz transformer when tested gave the following results:
OC test, measurement on LV side:
55 W, 0.7 A, 190 V
SC test, measurement on HV side:
82 W, 12 A, 15 V
Based on the above data determine all the parameters of the equivalent circuit of the transformer and accordingly answer the following four questions.

Hint: Refer to the video at this QR code to solve this set of questions.

32. Determine R_{01}, the equivalent resistance of the transformer in Ω referred to the LV side.

A. 0.569

B. 0.264

C. 0.135

D. 656

33. Determine X_0, the magnetizing reactance of the transformer referring to the LV side.

A. 0.264

B. 298

C. 1.113

D. 656

34. Determine X_{02}, equivalent reactance of the transformer in Ω referred to the HV side.

A. 0.264

B. 0.569

C. 1.113

D. 298

35. Determine R_0, the resistance representing the core losses of the transformer referring to the LV side.

A. 656

B. 298

C. 0.135

D. 0.569

36. A 310 KVA, 1150/400 V transformer has primary resistance and secondary resistance of 0.038 Ω and 0.023 Ω. Calculate the copper loss of the transformer, when supplying $(4/7)^{th}$ fraction of full rated load.

A. data not sufficient

B. 968 W

C. 5412 W

D. 16576 W

Estimating OC and SC Test Readings

The parameters of a 4.5 KVA, 460/200 V 50 Hz transformer are:

Note: All parameters are referred to the primary side.

Equivalent resistance	=	0.24 Ω
Equivalent reactance	=	0.312 Ω
Core loss resistance	=	713 Ω
Magnetization reactance	=	435 Ω

If a student correctly performs open circuit (OC) test and short circuit (SC) test on the transformer then calculate what the meter readings will be for the above tests. Based on the above data solve following six questions.

Hint: Refer to the video at this QR code to solve this set of questions.

37. As the general practice and from practical convenience point of view, which side of the transformer should the meters be connected for performing the OC test and SC Test, respectively?

    A. HV side, LV side

    B. HV side, HV side

    C. LV side, LV side

    D. LV side, HV side

38. What is the input power taken from the supply during the OC test?

    A. 296.8 W

    B. 10.6 W

    C. 23.0 W

    D. 56.1 W

39. What is the input power taken from the supply during the SC test?

    A. 121.5 W

    B. 296.8 W

    C. 4.3 W

    D. 23.0 W

40. What is supply voltage to be applied during the SC test?

    A. 460 V

    B. 0 V

    C. 3.9 V

    D. 200 V

41. What is current taken from the supply during the OC test?

    A. 1.484 A

    B. 0.539 A

    C. 9.783 A

    D. 2.432 A

42. A 290/160 V transformer has an iron loss of 832 W when excited from high voltage side under no load condition. If the no load current is 9.89 A, then the no load power factor is

    A. 0.29 lag

    B. 0.71 lag

    C. 0.55 lag

    D. 0.53 lag

43. The open-circuit test result gives 220 V, 77 A, 4 kW measured on the low-voltage side of a transformer. The transformer is rated as 80 kVA, 1100/220 V, 45 Hz and single-phase with 1000 turns on high-voltage side. The core loss component of no load current is approximately.

    A. 0.02 A

    B. 9.09 A

    C. 18.18 A

    D. 55.00 A

44. Calculate the regulation of the transformer in which ohmic loss is 1% of the output and the reactance drop is 3% of the voltage when the power factor is 0.8 lag

A. 2.60 %

B. 2.35 %

C. 1.60 %

D. 3.10 %

45. An ideal transformer has a turns ratio of 14:135. The following connections are made:
Primary side: Voltage of 220 V is applied
Secondary side: a resistance of 11 kΩ is connected.
What is the input power taken by the primary side?

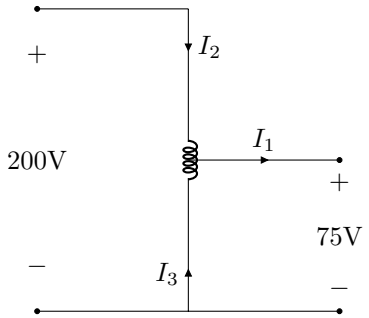
A. 409 W

B. 417 W

C. 42 W

D. 372 W

46. A single-phase auto-transformer has a voltage ratio 200/75 V and supplies a load of 20 kVA at 75 V. Assuming an ideal transformer, determine the current I_3 in the common section of the winding as shown in the circuit diagram.



A. 166.67 A

B. 167.67 A

C. 166.92 A

D. 170.00 A

47. A single-phase transformer with a voltage regulation of 2% has a secondary terminal voltage of 130 V at full load. Calculate its no-load secondary terminal voltage.

A. 112.60 V

B. 135.93 V

C. 132.60 V

D. 122.60 V

48. A 20 kVA, 1900/270 V, single phase transformer has the following resistance and reactance parameters on primary and secondary sides: $R_1 = 7\ \Omega$, $R_2 = 0.04\ \Omega$, $X_1 = 13\ \Omega$, $X_2 = 0.09\ \Omega$ Find the voltage regulation when transformer is supplying full-load 0.84 pf lagging.

A. 9.427 %

B. -0.152 %

C. -1.068 %

D. 1.340 %

49. Three single-phase transformers are connected to form a delta-star three-phase transformer of voltage rating of 200 V/13 kV. The transformer supplies at 13 kV a balanced three phase load of 45 kW at 0.73 pf lagging to a nearby plant. Neglect the transformer losses. What will be the current in each phase winding on the primary side?

A. 102.7 A

B. 178.0 A

C. 273.8 A

D. Data insufficient

50. The full-load copper loss of a transformer is 1500 W, while the iron losses at full load are 900 W. At half-load, the copper loss will be

A. 750 W

B. 188 W

C. 375 W

D. 1500 W

3 DC Machines

51. A DC shunt generator delivers 410 A at 210 V. The armature and shunt winding resistances are 0.055 Ω and 60 Ω respectively. Determine the EMF generated.

A. 232.550 V

B. 216.451 V

C. 232.743 V

D. 187.257 V

52. A 6 pole wave wound motor armature has 615 conductors and delivers 140 A. The brushes have been displaced through 2.1 angular degrees from geometrical axis. Calculate Demagnetising ampere turns per pole.

A. 251 AT/Pole

B. 572 AT/Pole

C. 168 AT/Pole

D. 259 AT/Pole

53. A 2 pole wave wound motor armature has 840 conductors and delivers 140 A. The brushes have been displaced through 1.4 angular degrees from geometrical axis. Calculate Cross-magnetising Ampere Turns.

A. 58661 AT

B. 59511 AT

C. 58111 AT

D. 58571 AT

54. A separately excited generator when running at 800 rpm supplieS 60 A to a resistive load at 100 V. What will be the load current when the speed drops to 380 rpm, if field current is unchanged. Given armature resistance is 0.4 Ω.

A. 30.500 A

B. 33.500 A

C. 28.500 A

D. 26.300 A

55. A separately excited DC motor has an armature resistance of 0.3 Ω. It runs from a 245 V DC supply drawing an armature current 24 A at 1280 rpm. For the same field current, the torque developed (in Nm) for an armature current 10 A will be

A. 19.17 Nm

B. 15.99 Nm

C. 17.05 Nm

D. 17.75 Nm

56. A DC shunt generator delivers 65 kW at 220 V and 300 rpm. The armature and field resistance are 0.025 Ω and 50 Ω respectively. The speed of the machine when running as a shunt motor and taking 65 kW input at 220 V will be

A. 303.919 rpm

B. 289.619 rpm

C. 280.519 rpm

D. 296.319 rpm

57. A 560 V DC shunt motor draws a line current of 1 A, on no load. If armature resistanc is 0.3 Ω and field resistance is 240 Ω, determine the efficiency of the machine running as a generator delivering a load current of 45 A at 560 V.

A. 88.000 %

B. 97.950 %

C. 97.350 %

D. 65.000 %

58. A DC generator has armature emf of 170 V when flux per pole is 10 mWb, and speed is 1250 rpm. Calculate the emf generated when speed is 1260 rpm and flux per pole is 26 mWb.

A. 445.536 V

B. 504.152 V

C. 476.724 V

D. 433.336 V

59. A break test is conducted on a DC motor. The spring balance reading are 4 kg and 26 kg. The diameter of drum is 40 cm. The speed of the motor under these loading is 890 rpm, when supplied at 220 V, taking current of 30 A from the mains. Find efficiency.

A. 59.955 %

B. 57.475 %

C. 51.685 %

D. 60.935 %

60. A 5 kW 440 V short shunt compound DC generator has a full load efficiency of 93.0 %. If the resistance of armature and interpole is 0.5 Ω and that of series and shunt winding are 0.3 Ω and 220 Ω respectively. Calculate the combined bearing friction loss, windage and core losses of the machine.

    A. 637 W

    B. 613 W

    C. 1368 W

    D. 646 W

61. A 8 pole DC generator has induced emf of 200 V when driven at a speed of 300 rpm.The armature is lap wound and has 10 conductors. The armature resistance is 0.25 Ω. The pole shoe has diameter of 21 cm, each pole substends an angle of 40 degrees at the center. The length of pole is 25 cm. Determine the flux density in the air gap.

    A. 0.218 Wb/m^2

    B. 0.478 Wb/m^2

    C. 0.400 Wb/m^2

    D. 0.768 Wb/m^2

62. A belt driven DC shunt generator runs at 1540 rpm delivering 8 kW, at 215 V bus. The belt breaks following which the machine operates as a motor drawing 1 kW power. The armature and field resistance are 0.32 Ω and 54 Ω respectively. The speed when working as a motor will be

    A. 1357.59 rpm

    B. 1583.59 rpm

    C. 1159.59 rpm

    D. 1449.59 rpm

63. A 3 kW, 180 V DC shunt motor has armature resistance of 0.5 Ω and shunt field resistance 100 Ω. At no load, the motor draws 5 A from 180 V supply and runs at 860 rpm. The rotational loss of the machine is

    A. 7.342 W

    B. 10.042 W

    C. 16.282 W

    D. 6.342 W

64. A 2 pole DC generator, having wave wound armature winding has 40 slots, and 25 conductors per slot. Flux per pole is 25 mWb. What is the emf generated when motor is driven at 510 rpm.

    A. 221.000 V

    B. 212.500 V

    C. 206.900 V

    D. 227.375 V

65. A 220 V DC shunt motor takes 2 A at no load. It draws 24 A when running at full load at 1590 rpm. The armature and shunt resistance are 0.53 Ω and 210 Ω, respectively. The no load speed in rpm is

    A. 1723.20 rpm

    B. 1679.20 rpm

    C. 1600.20 rpm

    D. 1665.80 rpm

66. A short shunt compound generator delivers a current of 400 A at 240 V. The armature, series and shunt field resistances are 0.04 Ω, 0.048 Ω and 60 Ω respectively. Determine the EMF generated. Allow a brush contact drop of 1 V per brush.

    A. 275.200 V

    B. 296.789 V

    C. 204.420 V

    D. 277.373 V

67. A 8 pole wave wound motor armature has 690 conductors and delivers 180 A. The brushes have been displaced through 4.45 angular degrees from geometrical axis. Find additional field current for neutralising demagnetising effect if there are 1040 turns in shunt field winding.

    A. 0.546 A

    B. 0.738 A

C. 0.627 A

D. 1.012 A

68. A 250 V series motor has an armature resistance of 0.45 Ω and series field resistance of 0.1 Ω. Calculate the current required to develop a torque of 70 Nm at 1160 rpm.

A. 44 A

B. 31 A

C. 45 A

D. 37 A

69. A 8 pole lap connected DC machine has an armature resistance of 0.55 Ω, and generate 80 volt on no load at rated speed. Determine the armature resistance, when same machine is re-wound using simplex wave connection.

A. 2.046 Ω

B. 1.800 Ω

C. 2.200 Ω

D. 0.850 Ω

70. A 12 kW, 250 V, DC shunt motor with an armature resistance of 0.7 Ω and field resistance 290 Ω takes 4.2 A, when running light at rated voltage and rated speed. What is machine efficiency as generator with output of 12 kW at rated voltage and speed.

A. 76.558 %

B. 77.415 %

C. 81.558 %

D. 86.358 %

4 Induction Motor

71. A 3-phase, 200 V, 65 Hz, 6 pole induction motor runs at 1209 rpm at full load. Calculate the full load slip of the motor.

A. 0.070

B. 0.075

C. 0.090

D. -0.070

72. A 3-phase, 210 V, 45 Hz, 8 pole induction motor has a full load slip of 0.06 %. Calculate the rotor speed of the motor in rpm.

A. 38

B. 634

C. 40

D. 596

73. The power input to the rotor of a 3-phase, 50 Hz, 4 pole induction motor is 14.5 kW, the rotor copper losses are 241.7 **W per phase**. Calculate the speed of rotor in rpm, ignoring the mechanical losses.

A. 75.0

B. 1500.0

C. 1425.0

D. 1353.8

74. A 3-phase, 4 pole, 230V, 55 Hz induction motor has a full load slip of 7 %. Calculate the frequency of emf induced in the rotor at full load in Hz.

A. 51.15

B. 27.50

C. 3.85

D. 110.00

75. A 3-phase, 65 Hz, 6 Pole induction motor has a rotor impedance of (0.02 + j0.19) ohm at stand still. If the full load torque is obtained at 1235.0 rpm, Calculate the ratio of starting torque to full load torque

A. 0.289

B. 0.269

C. 0.134

D. 0.249

76. A 3-phase, 230 V, 45 Hz induction motor runs has a synchronous speed of 900.0 rpm. Calculate number of poles of the motor.

A. 3

B. 12

C. 7

D. 6

77. A 3 ϕ induction motor is wound for 6 poles and is supplied from 45 Hz system. Calculate the synchronous speed in rpm.

A. 1800

B. 910

C. 900

D. 450

78. A 746 kW, 3 phase, 60 Hz, 8 pole induction motor has rotor resistance and reactance at stand still of 0.06 Ω and 0.32 Ω per phase. The full load torque is obtained at 801.0. Find the ratio of maximum torque to full load torque.

A. 1.126

B. 0.573

C. 1.166

D. 1.146

79. A 3-phase, 700 kW, 55 Hz, 4 Pole induction motor has a rotor impedance (0.017 + j0.07) ohm at standstill. Calculate the rotor resistance in Ω to be added to get maximum starting torque.

A. 0.159

B. 0.053

C. 0.261

D. 0.087

80. In a 3-phase, 45 Hz, 6 Pole induction motor, the rotor electromotive force is observed to make 1.80 complete alterations per second. Find the ratio of rotor copper loss to the mechanical power developed in the rotor. Calculate upto 4 decimal places.

A. 0.0833

B. 0.0417

C. 0.1304

D. 0.0435

* * * All the Best * * *