Basic Electrical Engineering - Exam

Student Name: Roll no: Code: GBWFVYVKVV

1 Transformers

1. A single phase transformer has 650 turns on the primary and 200 turns on the secondary. The no load current is 1 A at a power factor of 0.2 lag and the secondary current is 240 A at a power factor of 0.6 lag. Neglect R2 and X2. Calculate the input power factor.

   1. _____

2. The SC test conducted on a 50 KVA, 2200/360 V, 50 Hz 1-phase transformer yielded results of 210 V, 2800 W, and 22.7 A, when the readings were taken on the high voltage side. Find the equivalent reactance of transformer referred to the secondary side, X_{02}. Calculate upto 3 decimal places.

   2. _____

3. A 9 KVA transformer has a copper loss of 200 W and core loss of 50 W at full load. Find the efficiency (in percentage) of the transformer when the load current is 0.4 times the full load current with power factor of 0.4 lag.

   3. _____

4. In a single phase 40 KVA, 2900/210 V, 30 Hz transformer, the maximum flux allowable in the core is 10 mWb. Calculate the number of turns in secondary winding. Round off your answer to the nearest integer.

   4. _____

5. A single phase, 100 KVA, 2000/200 V, 50 Hz transformer has reactance drop of 9% and resistance drop of 4%. At what power factor of the load will regulation be zero.

   5. _____

6. The rating of a single phase, 40 Hz, transformer is 660 KVA. When operating at full load, the load current is 15 A which lags the load terminal voltage by a power factor of 0.1. Find the magnitude of reactive power consumed by the load in KVARs.

   6. _____

7. A transformer T with ratio of secondary turns to primary turns 0.89 has a weight of copper = 273 kg. The cost of copper required for another autotransformer A with 4 times the primary turns as that of primary of T but has the same ratio of secondary turns to primary turns (0.89) and having the same corresponding currents in primary and secondary circuits (in INR)? (Cost of copper per kg = 500 INR.)

   7. _____

8. A single phase 60 KVA, 3000/550 V, 120 Hz transformer has 166 turns in its primary coil and a maximum flux density of 1.7 Tesla. Calculate the cross-section area of the core in cm^2.

   8. _____

9. No load current of a transformer is 3 A at a power factor of 0.3 lagging when connected to a 400 V, 40 Hz power supply. Calculate the magnetising component of the no load current.

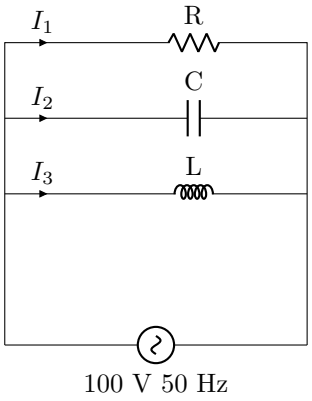
   9. _____

10. The applied voltage for a transformer primary winding is incresed by 30% while the frequency is decreased by 25%. By what percentage will the maximum flux density increase in the core? Calculate the percentage increase upto two decimal places.

2 AC Circuits

11. In the figure shown below, the currents I_1, I_2, I_3 are measured by ideal AC ammeters and their values are 9 A, 21 A, and 15 A, respectively. Find

the rms value of the current supplied by the AC source.

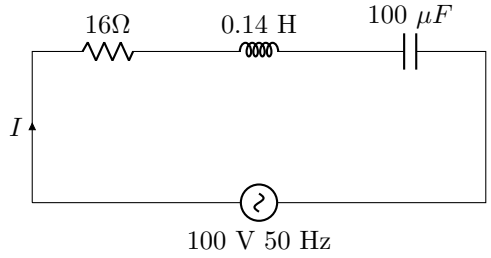


12. Two AC currents I_1, and I_2 meet at a junction point, from were another branch carries current I_3 away from the junction. It is known that, $I_1 = 26\angle 40°$ A, and $I_3 = 74\angle 35°$ A. Determine the phase angle of current I_2 in degrees. Calculate upto 2 decimals.

13. The voltage phasor of a circuit is $170\angle 80°$ V and the current phasor is $7\angle 115°$ A. Determine the active power supplied by the voltage source. Round off your answer to the nearest integer.

13. _____

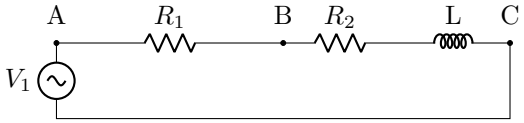
14. For the circuit shown below find the value of current I in polar form



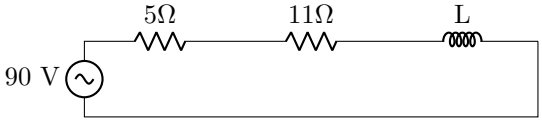
14. _____

15. A single phase, 300 V AC source is connected to a load with impedance of $60\angle 40°\Omega$. A capacitor is connected in parallel to the load. If the capacitor supplies 584 VARs of reactive power, the real power supplied by the source is. Round off your answer to nearest integer.

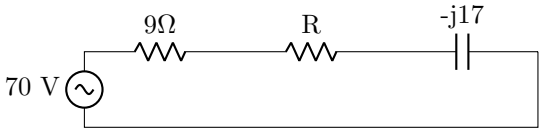
16. In the circuit shown below the magnitudes of voltages are: $V_1 = 200$ V, $V_{AB} = 133$ V, and $V_{BC} = 121$ V. Determine the power factor of the supply. Calculate upto 4 decimals. (Hint: Draw phasor diagram with V_1, V_{AB} and V_{BC}. Then use law of cosines to determine the power factor angle, which appears between phasors V_1 and V_{AB}.)



17. In the circuit shown below the power consumed by the 5 Ω resistor is 35 W. Since the circuit is inductive, the power factor will be lagging. Find the magnitude of power factor of the circuit. Calculate upto 4 decimal places.



18. In the circuit shown below find the value of variable resistor R in Ω, such that the power consumed by R is maximum. Calculate upto 4 decimal places.



19. Obtain the sum of following three AC voltages:

$$v_1 = 100\sin(wt + 55°)V$$

$$v_2 = 100\sin(wt - 55°)V$$

$$v_3 = 20\cos(wt)V$$

Then find the **rms** value of total voltage. Calculate upto 2 decimal places.

20. When a 100 V, 50 Hz AC supply is applied to an impedance element with a resistance and a pure inductor connected in series, the current is 1.2 A. The frequency of supply is then increased to 80 Hz keeping the voltage at the same value. The current now is observed to be reduced to 0.7 A. Determine the inductance of the coil in Henrys. Calculate upto 4 decimal places.

3 Induction Motors

21. A 3-phase, 200 V, 60 Hz, 2 pole induction motor runs at 3348 rpm at full load. Calculate the full load slip of the motor.

21. _____

22. A 3 ϕ induction motor is wound for 6 poles and is supplied from 60 Hz system. Calculate the synchronous speed in rpm.

22. _____

23. The power input to the rotor of a 3-phase, 50 Hz, 10 pole induction motor is 5.4 kW, the rotor copper losses are 126 **W per phase**. Calculate the speed of rotor in rpm, ignoring the mechanical losses.

23. _____

24. A 3-phase, 60 Hz, 6 Pole induction motor has a rotor impedance of (0.04 + j0.19) ohm at stand still. If the full load torque is obtained at 1092 rpm, Calculate the ratio of starting torque to full load torque

24. _____

25. A 746 kW, 3 phase, 60 Hz, 10 pole induction motor has rotor resistance and reactance at stand still of 0.13 Ω and 0.36 Ω per phase. The full load torque is obtained at 698. Find the ratio of maximum torque to full load torque.

25. _____

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

26. _____

27. A 3-phase, 200V, 60 Hz induction motor runs has a synchronous speed of 1200 rpm. Calculate number of poles of the motor.

27. _____

28. A 3-phase, 500 V, 110 Hz, 10 pole induction motor has a full load slip of 6 %. Calculate the rotor speed of the motor.

28. _____

29. A 3-phase, 6 pole, 400V, 80 Hz induction motor has a full load slip of 11 %. Calculate the frequency of emf induced in the rotor at full load.

29. _____

30. A 3-phase, 500 kW, 50 Hz, 4 Pole induction motor has a rotor impedance (0.02 + j0.16) ohm at standstill. Calculate the rotor resistance to be added to get maximum starting torque.

30. _____

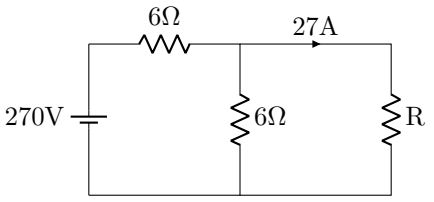
4 DC Circuits

31. Two bulbs B_1 rated 150 W, 110 V and B_2 rated 220 W, 130 V are connected in series. What is the total resistance offered by this combination? Calculate upto 3 decimals.

32. Two resistors 22 Ω and 15 Ω are in parallel. This combination is in turn connected in series with another resistance of value 6 Ω. Further this entire combination is connected in parallel to another resistance of 15 Ω. Find the effective resistance of the above circuit.

32. _____

33. In the figure below the value of R in Ohms is



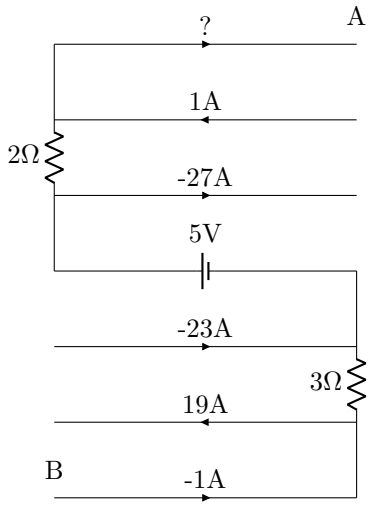
33. _____

34. The Thevenin equivalent of a network is 40 V in series with a resistance of 130 Ω whose load terminals are labeled as A and B. Further a resisistance of 82 Ω is connected across A and B. Determine the modified Thevenin's equivalent voltage in Volts of the entire circuit above, across the terminals A and B. Calculate upto two decimals.

34. _____

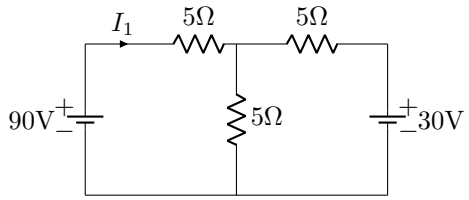
35. Three resistances 31 Ω, 15 Ω, and 52 Ω, are connected in delta form. The same needs to be transformed to star equivalent. Determine the value of resistance that will appear from the common node connecting the 15 Ω and 52 Ω resistances. Calculate upto two decimal places.

36. Determine the value of voltage V_{AB} in the following circuit.



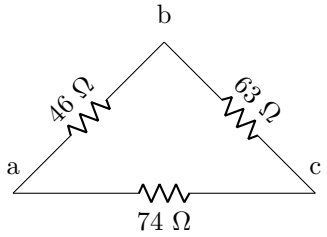
36. _____

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



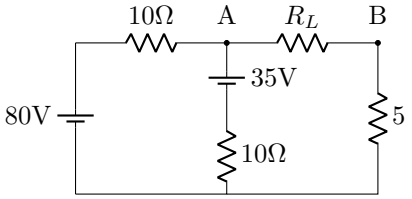
37. _____

38. Refering to the figure below, R_{max} denotes the maximum value of effective resistance measured between any two nodes out of three available nodes. Find R_{max} in Ohms.



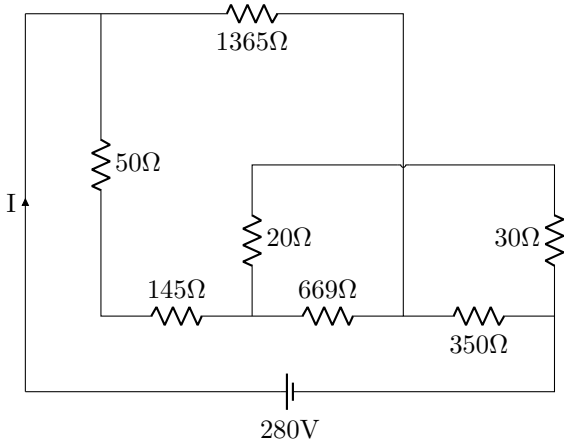
38. _____

39. Find the Norton's equivalent current magnitude when seen from the load terminals A and B. Calculate upto two decimal places.



39. _____

40. Find the current I in the given circuit. Note that there is a no-contact crossing between 30 Ω and 20 Ω resistors.



40. _____

* * * All the Best * * *