EEE Power Systems I & II - Collected Questions

Sorted by Topic and Year

July 25, 2025

Contents

I Power System I (EEE 3211) 2

1 Per-Unit System & Impedance Diagrams 2
1.1 Year 2021 . . . 2
1.2 Year 2020 . . . 2
1.3 Year 2019 . . . 2

2 Transmission Line Parameters & Performance 3
2.1 Year 2021 . . . 3
2.2 Year 2020 . . . 3

3 Load Flow Analysis 3
3.1 Year 2021 . . . 3
3.2 Year 2020 . . . 4

4 Symmetrical & Asymmetrical Faults 4
4.1 Year 2021 . . . 4
4.2 Year 2020 . . . 4
4.3 Year 2018 . . . 4
4.4 Year 2016 . . . 5

II Power System II (EEE 4141) 6

5 Power System Stability 6
5.1 Year 2021 . . . 6
5.2 Year 2020 . . . 6
5.3 Year 2018 . . . 6

6 Transmission Lines (Overhead) 6
6.1 Year 2017 . . . 6

7 Distribution Systems (AC & DC) 7
7.1 Year 2021 . . . 7

Part I
Power System I (EEE 3211)

1 Per-Unit System & Impedance Diagrams

1.1 Year 2021

Q1. **(a)** What is the per-unit system and single line diagram of a power system? Prove that per-unit impedance of a transformer is the same whether computed from primary or secondary side.

(b) Explain mathematically how an existing power system network's Y-bus matrix gets affected when transmission is added to the network.

(c) Draw an impedance diagram for the following network showing in per-unit on a 100MVA base. Choose 20kV as the voltage base for generator. Three phase power and line-line ratings are given.

Figure 1: Network for 2021, Q.1(c).

1.2 Year 2020

Q.5.(c) Find the fault current in p.u. and amperes for the following network when a 3LG fault of zero impedance occurs at (i) point A and (ii) point B. Choose a base power of 100 MVA.

Figure 2: Network for 2020, Q.5(c).

1.3 Year 2019

Q1. **(d)** Draw the impedance diagram for the power system which is shown in the following figure. The ratings of the generators, motors, and transformers are given.

Figure 3: Network for 2019, Q.1(d).

Q2. **(c)** Draw the impedance diagram and find the power consumption by the load for the electric power system as shown.

Figure 4: Network for 2019, Q.3(c).

2 Transmission Line Parameters & Performance

2.1 Year 2021

Q2. **(c)** Prove that, the inductance per loop meter of a single-phase two wire line is $L = 4 \times 10^{-7} \ln \frac{D}{r'}\ H/m$.

Q3. **(a)** Calculate the capacitance of a three phase line with unsymmetrical spacing which is shown in fig. 3a.

Figure 5: Line configuration for 2021, Q.3(a).

(b) For medium transmission lines, prove that A = D and AD - BC = 1. Where symbols have their usual meanings. Consider nominal T-method.

(c) A 100km long, three phase, 50Hz transmission line has given constants. If the line supplies a load of 20MW, calculate by nominal π-method: (i) Sending end power factor, (ii) Regulation and, (iii) Transmission efficiency.

2.2 Year 2020

Q2. **(c)** One circuit of a 1-ϕ transmission line is composed of three solid 0.30 cm radius wires. The return circuit is composed of two 0.60 cm radius wires. The arrangement is shown. Find the inductance.

Figure 6: Line configuration for 2020, Q.2(c).

3 Load Flow Analysis

3.1 Year 2021

Q2. **(a)** How do we control active power flow and reactive power flow by tap changer of a transformer in a power system network?

(b) A sample power system network is shown in fig 2b. Construct the bus admittance matrix. The per-unit reactances are presented on the same base.

Figure 7: Network for 2021, Q.2(b).

Q4. **(c)** For the following power system network... (i) Using Gauss-Seidal method, determine V_2 after two iterations. (ii) If after several iterations voltage at bus 2 converges to $V_2 = 0.90 - j0.10$, determine S_1 and real and reactive power losses in line.

Figure 8: Network for 2021, Q.4(c).

3.2 Year 2020

Q.3(c) The one-line diagram of a simple three-bus power system is shown... (i) compute the bus voltages using Newton-Raphson method with initial estimates... and (ii) compute the slack bus real and reactive power.

Figure 9: Network for 2020, Q.3(c).

Q.4(c) Following figure shows the single line diagram of a simple power system... (i) Using Gauss-Seidel method, determine v_2 and v_3. Perform one iteration only. (ii) If bus voltages converge, determine line flows and losses.

Figure 10: Network for 2020, Q.4(c).

4 Symmetrical & Asymmetrical Faults

4.1 Year 2021

Q5. **(c)** For the network shown... using "step-by-step Z_{bus} building algorithm", determine the bus impedance matrix. Assume a 3-phase fault occurs at bus 2, find (i) Fault current and (ii) The bus voltages during the fault.

Figure 11: Network for 2021, Q.5(c).

Q6. **(a)** When fault occur at the terminal of a generator, prove that, 1LG fault is more severe than 3LG fault if $X_n < \frac{1}{2}(X_1 - X_0)$.

(b) A 20MVA, 13.8kV generator has $X''_d = 0.25$ pu, $X_2 = 0.35$ pu and $X_0 = 0.10$ pu. ... Determine the subtransient currents and the line to line voltages at fault ... when a 2L fault occurs at the generator terminal.

4.2 Year 2020

Q.5(b) Draw the positive-, negative-, and zero-sequence network of the following power system.

Figure 12: Network for 2020, Q.5(b).

4.3 Year 2018

Q.7(c) Draw the zero sequence equivalent circuits for the following three phase transformer banks.

Figure 13: Transformer configurations for 2018, Q.7(c).

4.4 Year 2016

Q.5(c) The one line diagram of a simple four-bus power system is shown... A bolted three-phase fault occurs at bus 4. Using Thevenin's theorem obtain the impedances to the point of fault and the fault current in per-unit.

Figure 14: Network for 2016, Q.5(c).

Q.4(c) Draw the negative and zero sequence network for the following system.

Figure 15: Network for 2016, Q.4(c).

Part II
Power System II (EEE 4141)

5 Power System Stability

5.1 Year 2021

Q2. **(c)** A power system is shown below... Determine (i) the power angle equation and (ii) the swing equation during fault.

Figure 16: Diagram for 2021, Q.2(c).

5.2 Year 2020

Q1. **(b)** The single-line diagram of a power system is shown below...Compute the power angle equation and the swing equation.

Figure 17: Diagram for 2020, Q.1(b).

Q2. **(a)** Derive an expression of the critical clearing angle for the power system as shown...

Figure 18: Diagram for 2020, Q.2(a).

5.3 Year 2018

Q.7(c) A 50 Hz synchronous generator...is connected to an infinite bus through a purely reactive circuit as shown... Determine the critical clearing angle and the critical fault clearing time.

Figure 19: Diagram for 2018, Q.7(c).

6 Transmission Lines (Overhead)

6.1 Year 2017

Q.3(c) Find the inductance per phase per km of double circuit 3-phase line shown in the figure.

Figure 20: Diagram for 2017, Q.3(c).

7 Distribution Systems (AC & DC)

7.1 Year 2021

Q.7(b) A d.c. 2-wire distributor AB is 500 m long and is fed at both ends at 240 V. The distributor is loaded as shown in given figure... Calculate the point of minimum voltage.

Figure 21: Diagram for 2021, Q.7(b).