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MODULE TITLE : ELECTRICAL SUPPLY AND DISTRIBUTION SYSTEMS

TOPIC TITLE : SUPPLY SYSTEMS AND LOAD VOLTAGE LEVELS

TUTOR MARKED ASSIGNMENT 3

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..... ***HOME TELEPHONE*** .....

EMPLOYER .....

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ESD - 3 - TMA (v1)

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IMPORTANT

Before you start please read the following instructions carefully.

1. This assignment forms part of the formal assessment for this module. If you fail to reach the required standard for the assignment then you will be allowed to resubmit but a resubmission will only be eligible for a Pass grade, not a Merit or Distinction.

   You should therefore not submit the assignment until you are reasonably sure that you have completed it successfully. Seek your tutor's advice if unsure.

2. Ensure that you indicate the number of the question you are answering.

3. **Make a copy** of your answers before submitting the assignment.

4. **Complete all details on the front page of this TMA** and return it with the completed assignment including supporting calculations where appropriate. The preferred submission is via your TUOL(E) Blackboard account:

   https://eat.tees.ac.uk

5. Your tutor's comments on the assignment will be posted on Blackboard.

1. (i) State briefly how the equivalent circuit of a generator is similar to that of a short transmission line.

(ii) On what assumptions is the representation of the following simple load supply system (FIGURE 1) based?

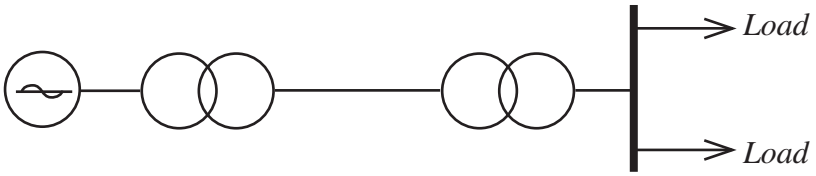


FIG. 1

(iii) In what way does it differ from the radial supply system shown in FIGURE 2?

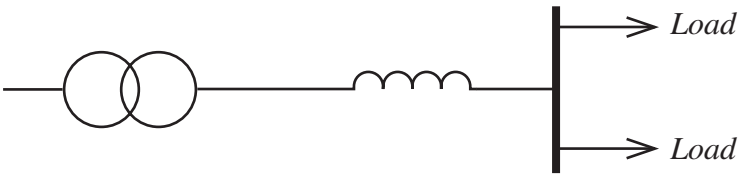
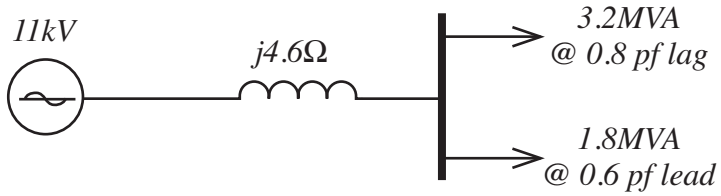


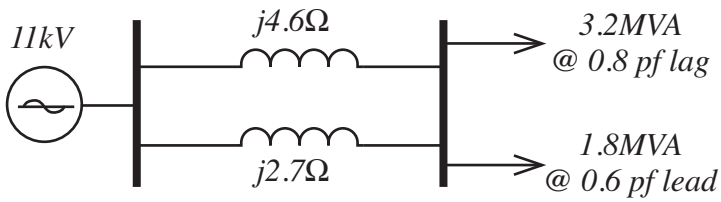
FIG. 2

(iv) In FIGURE 1, the first transformer steps up the voltage and the second steps down the voltage. State the reason or reasons why you think this is done.

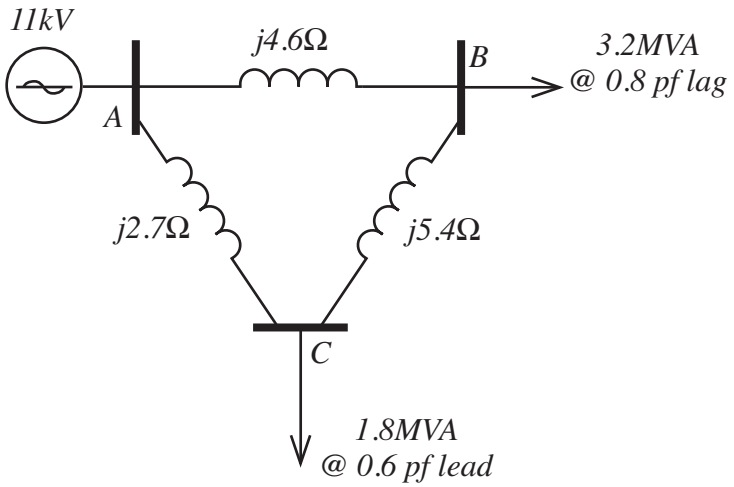
2. For the following distribution feeder systems shown in FIGURES 3(i), (ii) and (iii) determine the load voltage levels.



(i)



(ii)



(iii)

FIG. 3

3. (a) A short 3-phase 11 kV line delivers a load of 4.1 MW, 2.6 MVAr lag. If the series impedance of the line is (7.2 + j12.1) Ω/ph, calculate the sending end voltage and load angle.

(b) Develop the receiving end performance chart for the above line and load to a 3-phase power scale. (Use a scale of 10 mm = 1000 V and 30 mm = 4.1 MW.)

4. Using the chart you produced in Question 3, determine:

(a) the real and reactive power when

(i) the transmission angle remains unaltered and the sending end voltage is increased by 28%

(ii) the original sending-end voltage is reduced by 15% and the transmission angle increased by 9°. (Use the same scale as that for Question 3 (b))

(b) the real power limit for the sending voltage in (ii) above (i.e. when reduced by 15%).

5. The following phase schematic diagram (FIGURE 4) shows an 11 kV, 50 Hz, 3-phase, short line feeding a load. By calculation or constructing the phasor diagram (use a scale of 1 mm = 2 A) for the load current with V_R as reference, determine the capacitive current and

   - calculate the capacitive reactance/ph such that the load power factor is increased to 0.98 lag

   - calculate the percentage reduction in line current with this value of capacitive reactance in circuit.

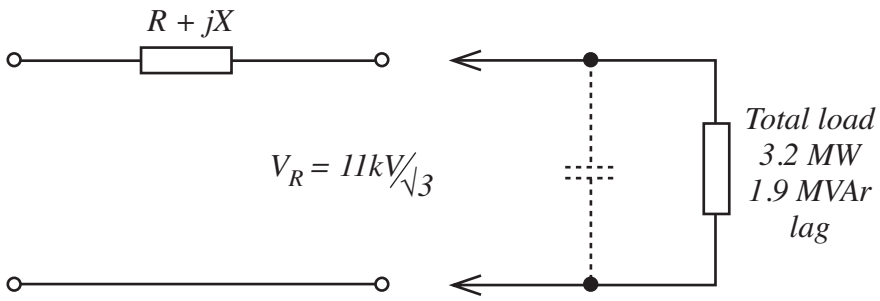


FIG. 4

6. Compare FIGURES 2 and 4 from lesson ESD - 2 - 2 (reproduced here) with those of FIGURES 1 and 8 from lesson ESD - 3 - 2 (also reproduced) and state briefly why they are similar.

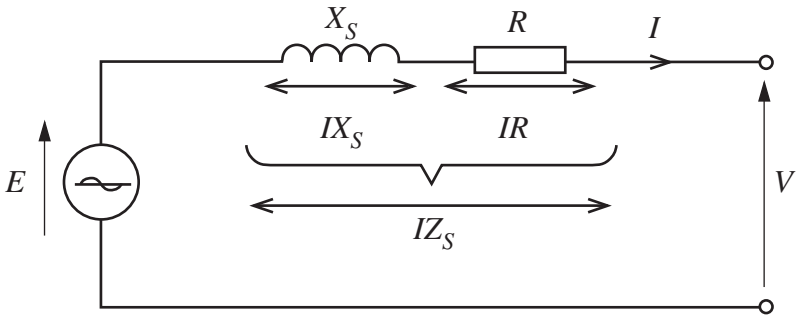


FIG. 2 from ESD - 2 - 2 (reproduced)

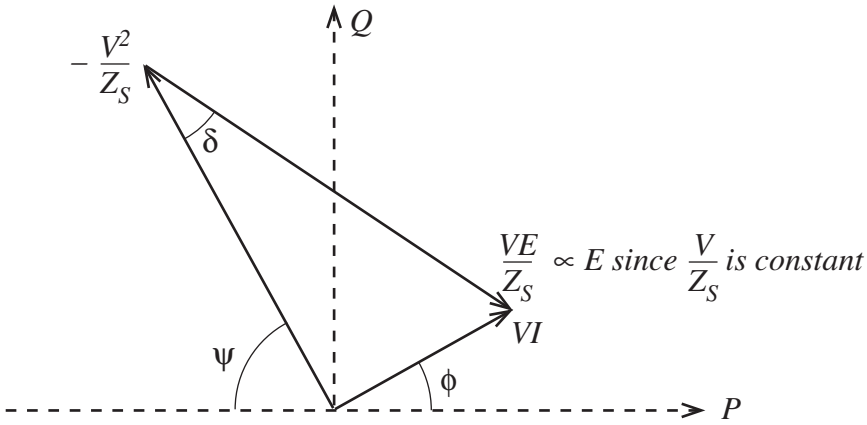


FIG. 4 from ESD - 2 - 2 (reproduced)

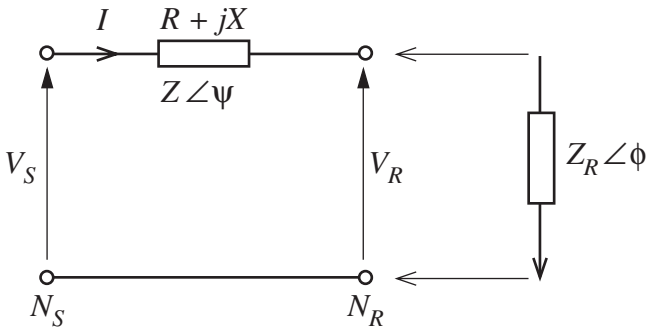


FIG. 1 from ESD - 3 - 2 (reproduced)

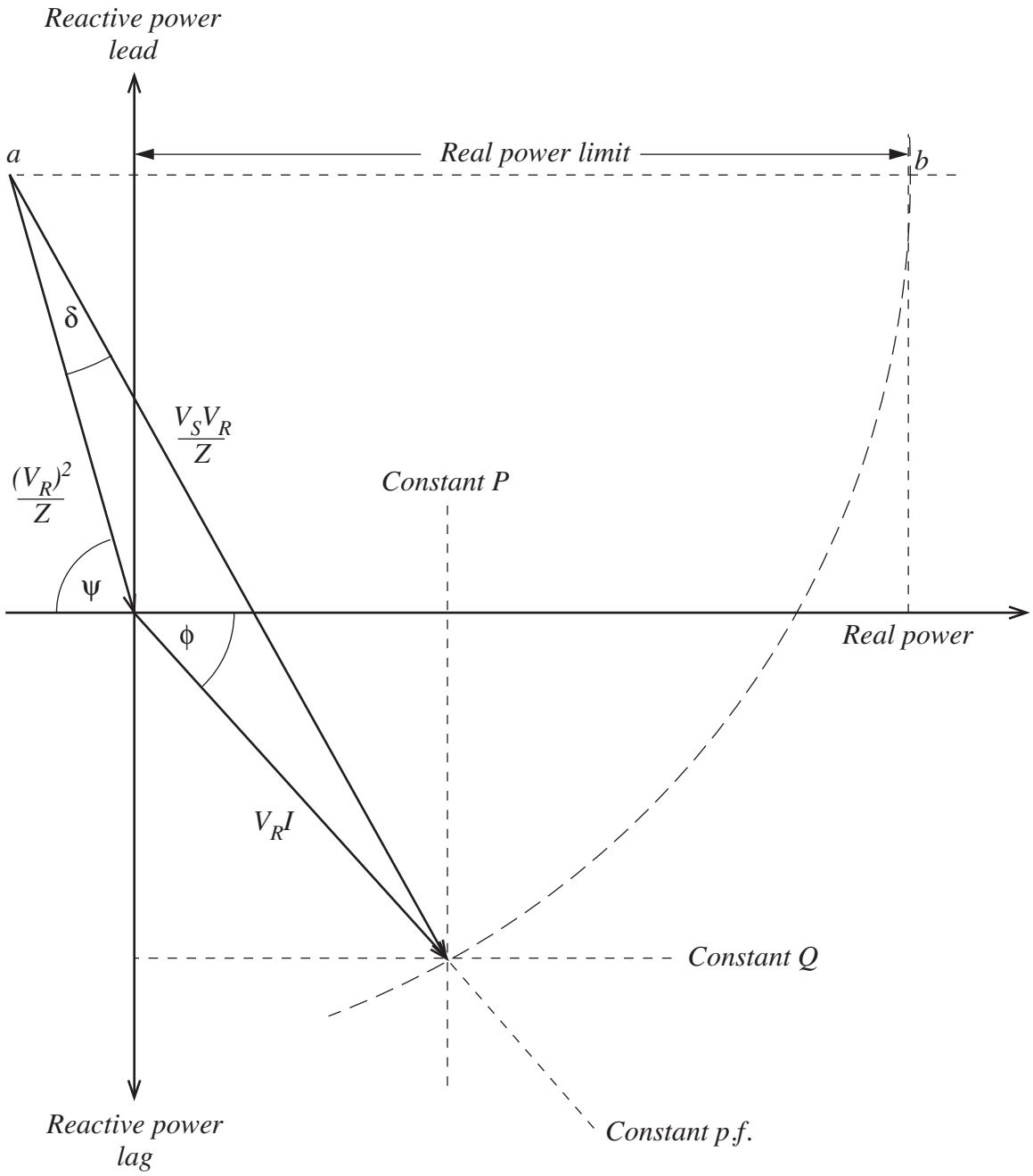


FIG. 8 from ESD - 3 - 2 (reproduced)

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