



ELIZADE UNIVERSITY, ILARA=MOKIN, ONDO STATE
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING

FIRST SEMESTER EXAMINATION 2020/2021 ACADEMIC SESSION

COURSE TITLE: ELECTRIC POWER SYSTEM ENGINEERING PRINCIPLES

COURSE CODE: EEE 415

EXAMINATION DATE: 29th MARCH, 2021

COURSE LECTURER: ENGR. OSHIN OLA A

HOD'S SIGNATURE

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:

1. ANSWER ANY 2 QUESTIONS FROM SECTION A. THEN ANSWER ANY THREE QUESTIONS FROM SECTION B
2. SEVERE PENALTIES APPLY FOR MISCONDUCT, CHEATING, POSSESSION OF UNAUTHORIZED MATERIALS DURING EXAM.
3. YOU ARE **NOT** ALLOWED TO BORROW ANY WRITING MATERIAL DURING THE EXAMINATION.

SECTION A

Question 1

- What is meant by the term corona effect in power system transmission lines? How can this effect be reduced (4marks)
- State three benefits of per-unit system in power system analysis (3 marks)
- A 30 MVA , 11 kV, 3 phase generator, shown in Fig Q1 has a sub transient reactance of 18%. The generator supplies a motor over a transmission line with transformers at both ends. The motor has rated input 8 MVA, 10 kV with sub-transient reactance 25%. The three phase transformers are both rated 25 MVA, 10.8/121 kV and 121/10.8 kV respectively and are connected in Y- Δ with leakage reactance 10% each. The series reactance of the line is 100 ohms. The per unit reactance of the transformer is 0.083 per unit. Given that the base MVA for the network be 30MVA and the base KV for the generator side 11 kV.

Calculate:

- Transformer 1 base voltage
- Per unit reactance of the generator
- Transmission line voltage base
- Determine the per unit reactance of the motor
- Determine the per unit reactance of the transmission line

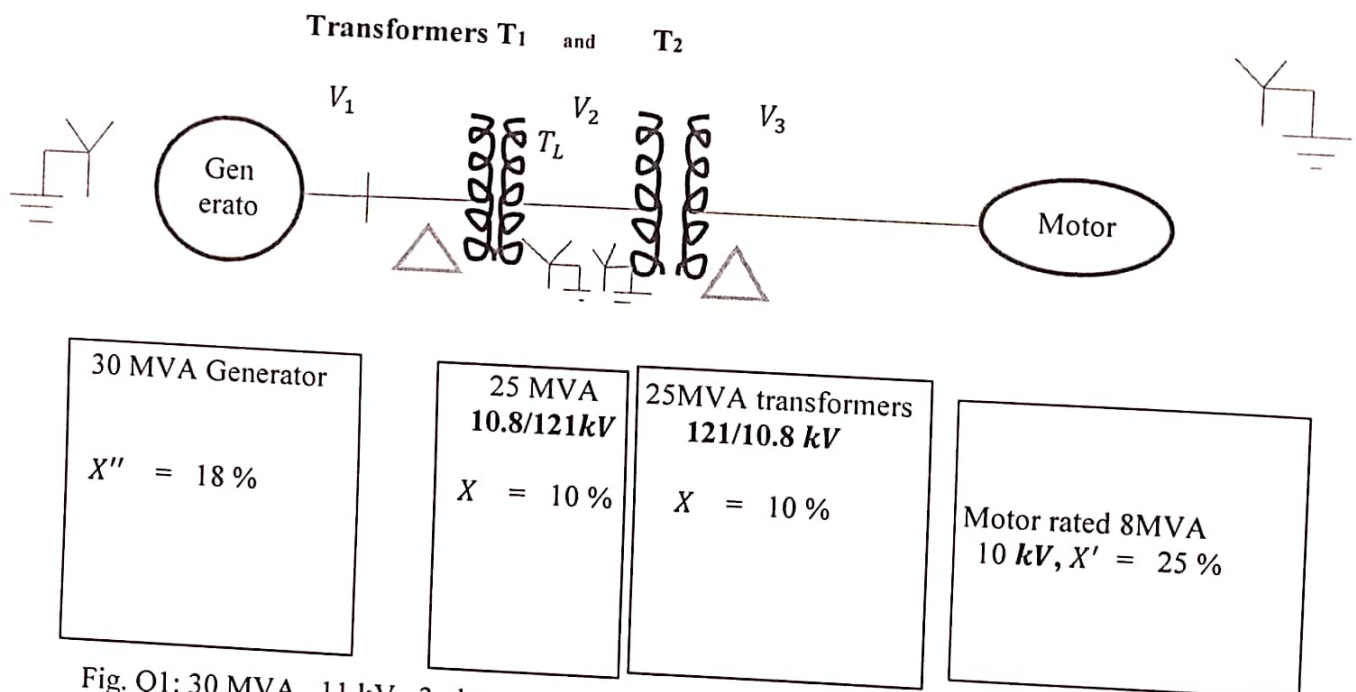
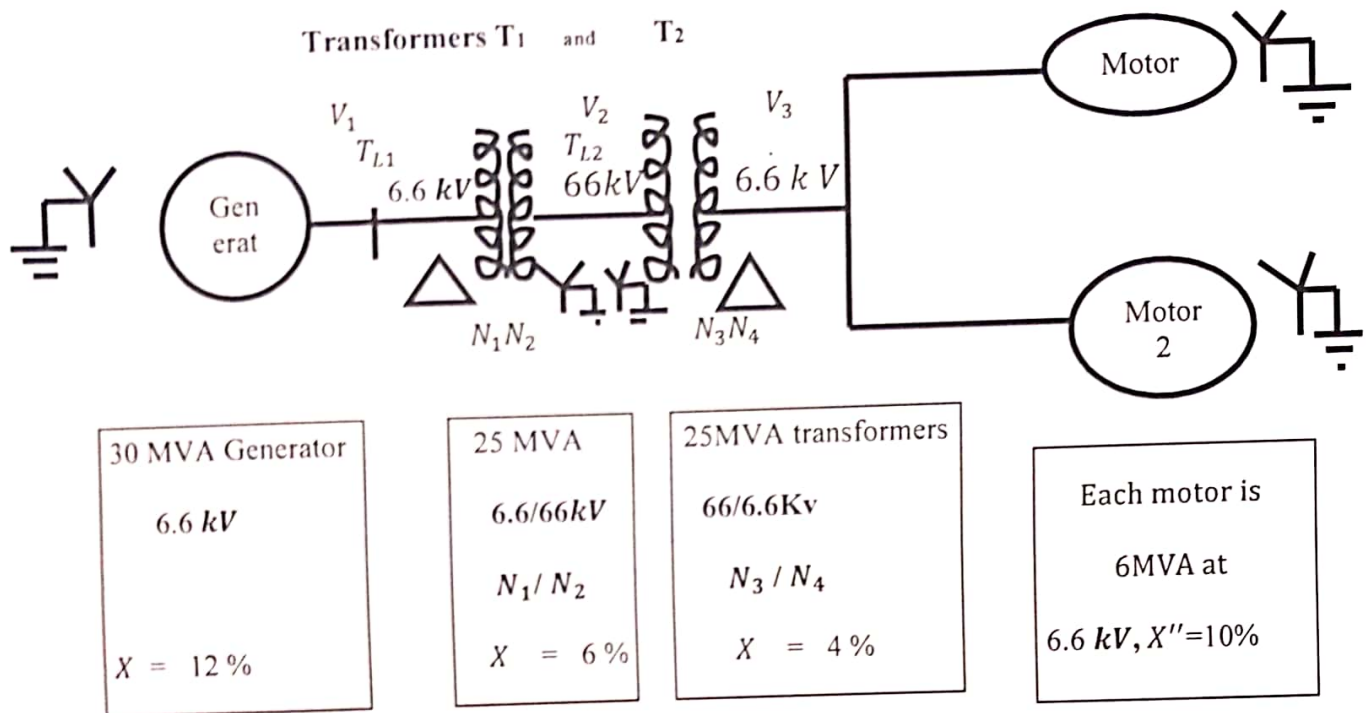


Fig. Q1: 30 MVA , 11 kV, 3 phase power supply system

(13 marks)

Question 2

- Distinguish between short, medium and long transmission lines (4.5 marks)
- What is skin effect? Why is it absent in the DC power system? (3 marks)
- The ratings of typical power system components are as shown in Fig Q2. The transmission line reactance X_{actual} is $j76\Omega$. and the base MVA is 32 MVA. Draw the per unit reactance diagram of the power system.



(12.5 marks)

QUESTION 3

- Briefly explain and state the importance of the following parameters in the design of a distribution system: Demand factor, load factor and diversity factor? (8 marks)
- A two wire D.C distribution BM is fed from both ends. At feeding point P, the voltage is maintained at 240 Volts and at end X, the voltage is maintained at 232 Volts. The total length of the distributor is 200 metre.
The resistance per km of each of the conductor is 0.25Ω .
The load are tapped from the supply as shown below:

- 28 A at 50m from P
- 30 A at 100m from P
- 44 A at 80m from P
- 50 A at 150m from P

Calculate

- i. the current in each section of the distributor (8 marks)
- ii. Find the minimum voltage and the point at which it occurs (4 marks)

SECTION B

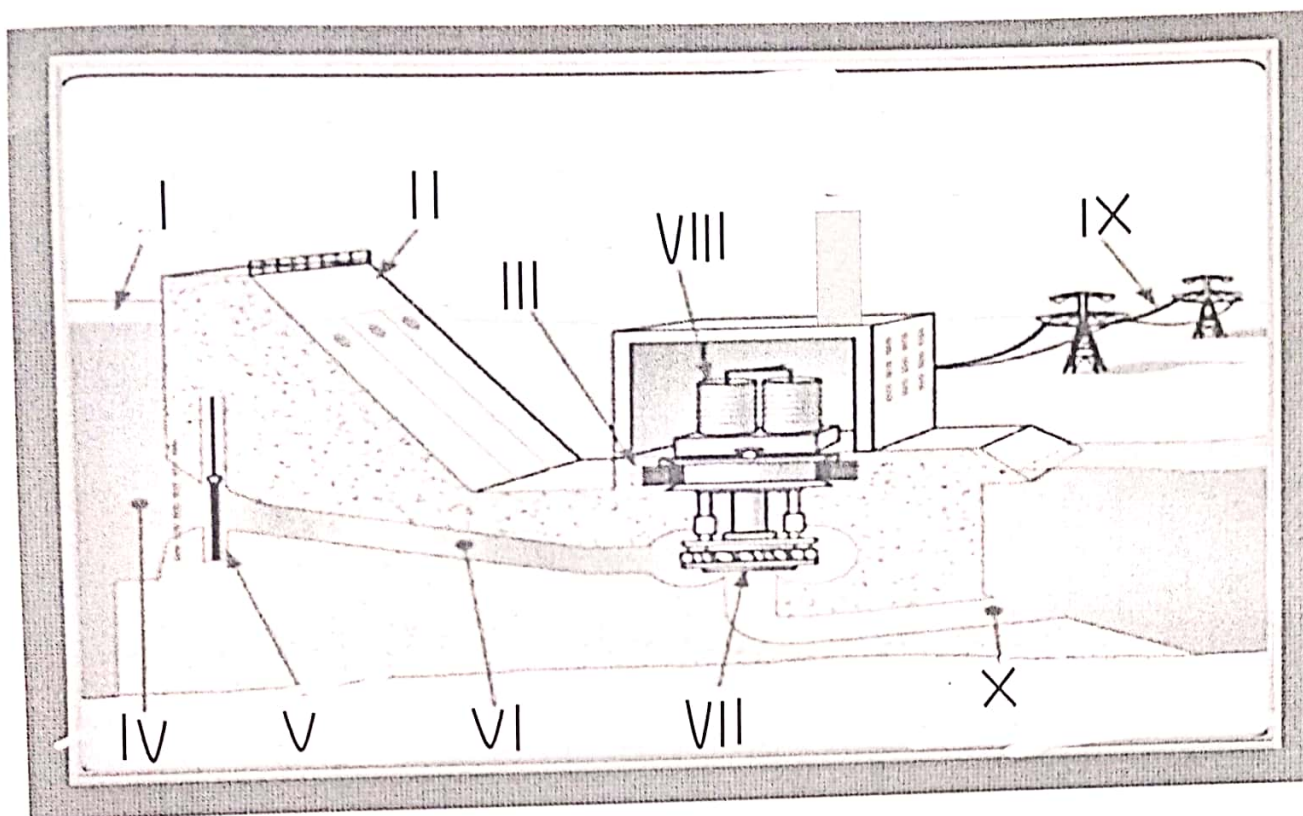
QUESTION 4

- a. Mention four major components of an overhead line (4 marks)
- b. List three methods of classifying distribution system (3 marks)
- c. Explain, using suitable diagrams the difference between radial and interconnected system under the connection schemes of distribution system
- d. A single phase overhead transmission line delivers 1200 kW at 33 kV at 0.8 p.f. lagging. The total resistance and inductive reactance of the line are 12Ω and 16Ω respectively. Draw a phasor diagram to represent the power system
Hence, determine the: (i) Sending end voltage
(ii.) Sending end power factor and
(iii.) Transmission efficiency (12 marks)

QUESTION 5

- a. List three components of a distribution system (3 marks)
- b. Using a suitable diagram, explain the difference between a feeder, distributor and service main (6 marks)
- c. The weekly discharge of a typical hydroelectric plant shown in Fig. Q 3 are as follows:

Days	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Discharge(m^3/sec)	532	475	864	900	675	918	550



- 5c i Copy the Hydro-electric power plant and label the parts shown
- ii State the function of each of the parts labelled. (5 marks)
- iii The plant has a gross head of 34 m, turbine head loss 2.8 m, penstock frictional loss 0.8 m and an overall efficiency of 74 %. It plant operates on 36 % load factor, determine (i) the average daily discharge (ii) pondage required and (iii) installed capacity of proposed plant. (6 marks. 2 marks each)

QUESTION 6

- a. Draw the layout of a typical A.C. power supply scheme using a single line diagram (4 marks)
- b. State two advantages of D.C over A.C in transmission of Electricity (2 marks)
- c. Using a suitable diagram, describe the construction of a typical 11/0.415 kV distribution Sub-station? (8 marks)
- d. The primary and secondary sides of a single phase 3 MVA, 6 kV / 3 kV, transformer have a leakage reactance of 2.5Ω each. Find
1. the p.u reactance of the transformer refer to primary side
 2. the p.u reactance of the transformer refer to secondary side (6 marks)

QUESTION 7

- a. What is meant by smart grid in Power System? State two importance of smart grid (3 marks)
- b. What is meant by cyber-security in power system automation? State its two advantages (3 marks)
- c. What is Broad-Over Power Line BPL? State two benefits of Power Line Communication (3 marks)
- d. What is distribution automation? State its two advantages (3 marks)
- e. A 3 phase 12,000 kVA, 11kV alternator shown Fig. Q 7 has a transient reactance of 8.4%. A three-phase short circuit fault occurs at its terminal.

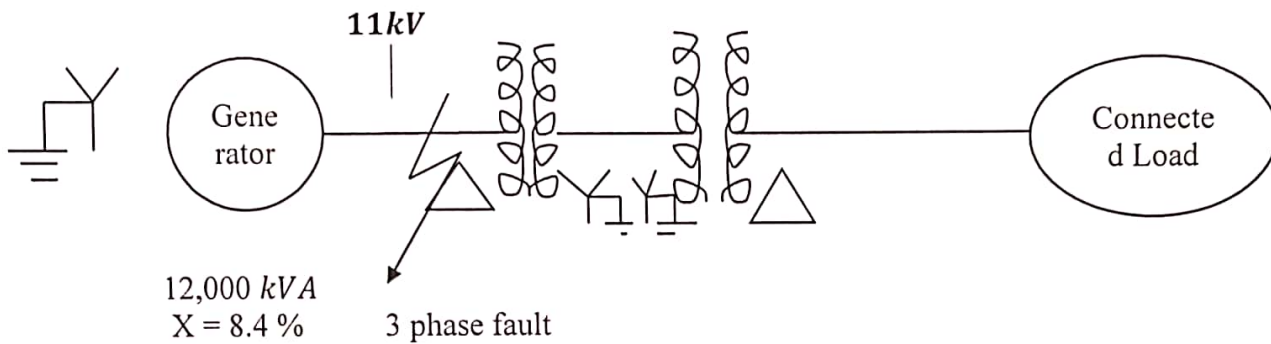


Fig. Q7

- Determine
- the fault current
 - fault MVA

(8 marks)