



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ELECTRICAL AND ELECTRONICS ENGINEERING)

EEE 303: POWER SYSTEMS I

DATE: 21/5/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS

Answer Question ONE and any other TWO Questions.

QUESTION ONE (30 MARKS)

- a) A single phase motor connected to 400V, 50Hz supply takes 31.7A at a power factor of 0.7 lagging. Calculate the capacitance required in parallel with the motor to raise power factor to 0.9 lagging (10 marks)
- b) A hydro-electric project from the following data:
- | | | | |
|------|--------------------|---|-----------------------------|
| i. | Catchment area | = | $5 \times 10^9 \text{ m}^2$ |
| ii. | Mean head, H | = | 30m |
| iii. | Annual rainfall, F | = | 1.25 m |
| iv. | Yield factor, K | = | 80% |
| v. | Overall efficiency | = | 70% |
- Calculate the average power in kW that can be generated. (10 marks)
- c) A single phase 20 kVA, 480/120, 60 Hz single-phase transformer has an impedance of $Z_{eq2} = 0.0525 \angle 78.13^\circ \text{ S}$ referred to the LV winding. Determine the per-unit transformer impedance referred to the LV winding and the HV winding. (10 marks)

QUESTION TWO (20 MARKS)

A hydro – electric power station has a reservoir of area 2.4 square kilometers and capacity of 5×10^6 cubic metres and effective head of 100m. The penstock, turbine and generator efficiencies are respectively 0.95, 0.9 and 0.85.

- Calculate the total energy in kWh which can be generated from the power station.
- If a load of 15MW has been supplied for 3 hours, find the fall in reservoir level

QUESTION THREE (20 MARKS)

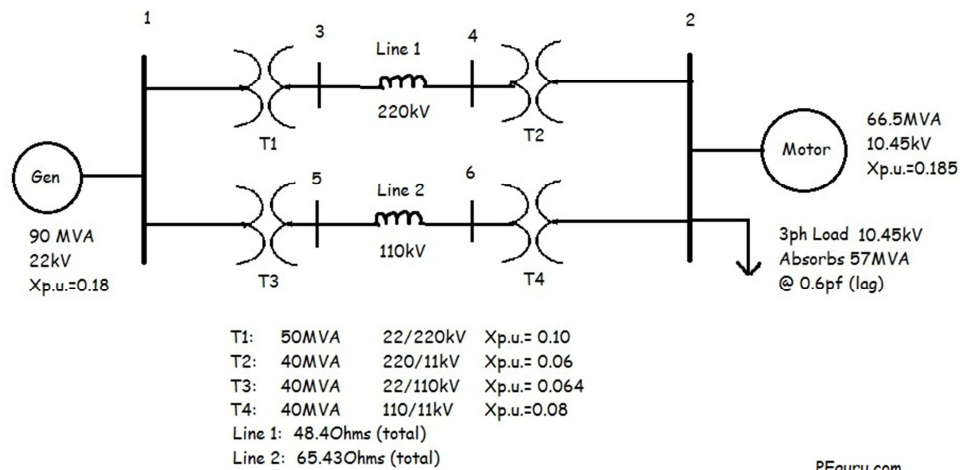
- State and explain the **five** disadvantages of Low power factor.
- A star connected 37.5kW, 440V, 50Hz induction motor operates on full load with an efficiency of 90% and at a p.f of 0.8 lagging. Three delta connected condensers are used to raise the p.f to 0.95. Find the rating of the condensers bank and the capacitance of each of capacitor.

QUESTION FOUR (20 MARKS)

A single phase ac system supplies a load of 200kW and if this system is converted to a 3-phase 3-wire system by running a third similar conductor, determine the three phase load that can now be supplied if the voltage between the conductors is the same. Assume the power factor and transmission efficiency to be the same in the two cases.

QUESTION FIVE (20 MARKS)

Consider the figure below and the details attached. Assume a system base of 100MVA



- Identify voltage base
- Calculate base voltages for line 1, line 2 and the 3-phase load
- Calculate the per unit impedance line 1, line 2, 3-phase load, T1,T2,T3,T4 and motor