



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATIONS FOR:

BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EEE: 4408 ELECTRICAL POWER SYSTEMS I

END-OF-SEMESTER EXAMINATIONS

SERIES: APRIL 2025

TIME: 2 HOURS

DATE: April 2025

Instructions to Candidates

It would be best if you had the following for this examination

-Answer Booklet, examination pass, and student ID

This paper consists of FIVE questions. Attempt **Question ONE plus any other TWO Questions**

Do not write on the question paper.

Question ONE 30 -MARKS (COMPULSORY)

- a) Using a block diagram, describe the components of gas turbine power plants (8 marks)
- b) A 65,000 kW steam power station uses coal of a calorific value of 15,000 kcal per kg. If the coal consumption per kWh is 0.5 kg and the load factor of the station is 40%, calculate
 - i. The overall efficiency
 - ii. Coal consumption per day (8 marks)
- c) Explain THREE essential factors that influence the choice of site for a hydroelectric plant (6 marks)
- d) Calculate the continuous power available from a hydroelectric plant with an available head of 300 meters, a catchment area of 150 sq. km, annual rainfall of 1.25 m, and a yield factor of 50%. Assume penstock, turbine, and generator efficiencies to be 96%, 86%, and 97%, respectively. If the load factor is 40%, what should be the rating of the generators installed (8 marks)

Question TWO

- a) State any FOUR importance of the daily load curve (4 marks)
- b) A 100 MW power station delivers 100 MW for 2 hours, 50 MW for 8 hours, and is shut down for the rest of each day. It is also shut down for maintenance for 60 days each year. Calculate its annual load factor. (4 marks)
- c) A power station has to meet the following demand:
- Group A: 200 kW between 8 A.M. and 6 P.M.
 - Group B: 100 kW between 6 A.M. and 10 A.M.
 - Group C: 50 kW between 6 A.M. and 10 A.M.
 - Group D: 100 kW between 10 A.M. and 6 P.M. and then between 6 P.M. and 6 A.M.

Plot the daily load curve and determine

- i. Diversity factor
- ii. Units generated per day
- iii. Load factor. (12 marks)

Question THREE

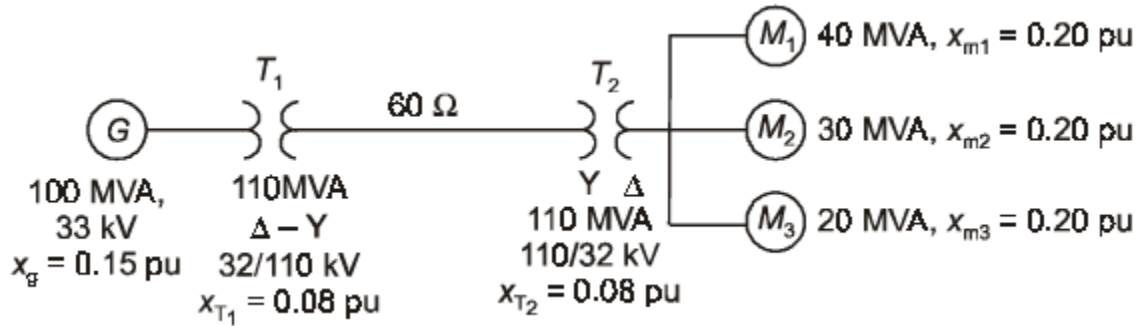
- a) Describe how the following equipment can be used to improve the power factor. (12 marks)
- i. Static capacitors
 - ii. Synchronous condenser
 - iii. Phase advancers
- b) A single-phase motor connected to a 400 V, 50 Hz supply takes 31.7A at a power factor of 0.7 lagging. Calculate the capacitance required in parallel with the motor to raise the power factor to 0.9 lagging (8 marks)

Question FOUR

- a) Describe any four characteristics of a tariff . (8 marks)
- b) The maximum demand of a consumer is 20 A at 220 V, and his total energy consumption is 8760 kWh. If the energy is charged at the rate of 20 paise per unit for 500 hours of use of the maximum demand per annum, plus 10 paise per unit for additional units, calculate :
- i. Annual bill
 - ii. Equivalent flat rate. (12 marks)

Question FIVE

- a) Explain four advantages of interconnected systems (8 marks)
- b) A 100 MVA, 33 kV, three-phase generator has a reactance of 15%. The generator is connected to motors through a transmission line and transformers, as shown in the diagram below. The motors have rated inputs of 40 MVA, 30 MVA, and 20 MVA at 30 kV with 20% reactance each. Draw the per-unit circuit diagram



(12 marks)