



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

UNIVERSITY EXAMINATIONS FOR:

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EEE 4321: ELECTRICAL ENGINEERING II

END-OF-SEMESTER EXAMINATION

SERIES: JULY 2025

TIME: 2 HOURS

DATE: July 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) Discuss any THREE dynamic characteristics of the measuring instruments (6 marks)
- b) A voltmeter reads 40 V on its 50 V range, while a meter reads 50 mA on its 125 mA range when used in the circuit. Both instruments are guaranteed to be accurate within $\pm 2\%$ at the full scale deflection. Determine the limiting error of the power calculated. (4 marks)
- c) Discuss any THREE errors in moving iron instruments (6 marks)
- d) A 0-250 V voltmeter has a guaranteed accuracy of 2% of full-scale reading. The voltage measured by the voltmeter is 150 volts. Determine the limiting error in percentage (4 marks)
- e) Using block diagrams, describe the operation of data logger (4 marks)
- f) Compare analogue and digital meters under the following;
 - i. Accuracy
 - ii. Input impedance
 - iii. Processing speed (6 marks)

Question TWO

- a) Describe the construction of D.C generators (5 marks)
- b) A D.C. generator has a generated e.m.f. of 210 V when running at 700 rev/min and the flux per pole is 120 mWb. Determine the generated e.m.f.
 - i. At 1050 rev/min, assuming the flux remains constant
 - ii. If the flux is reduced by one-sixth at constant speed
 - iii. At a speed of 1155 rev/min and a flux of 132 mWb: (9 marks)
- c) An eight-pole lap-wound d.c. motor has a 200V supply. The armature has 800 conductors and a resistance of 0.8. If the useful flux per pole is 40 mWb and the armature current is 30A, calculate
 - i. The speed and
 - ii. The torque developed. (6 marks)

Question THREE

- a) Discuss the losses in a single-phase transformer (5 marks)
- b) Derive the e.m.f. Equation for the single-phase transformers (6 marks)
- c) A single-phase transformer has a voltage ratio of 6:1 and a high voltage. winding is supplied at 540V. The secondary winding provides a full load current of 30 A at a power factor of 0.8 lagging. Neglecting losses, find
 - i. The rating of the transformer,
 - ii. The power supplied to the load,
 - iii. The primary current. (9 marks)

Question FOUR

- a) Explain the effects of back e.m.f in dc motors (4 marks)
- b) Draw the circuit of the following types of dc machine
 - i. Short shunt compound
 - ii. Long shunt compound (4 marks)

- c) A 250V series motor draws a current of 40A. The armature resistance is $0.15\ \Omega$, and the field resistance is $0.05\ \Omega$. Determine the maximum efficiency of the motor. (6 marks)
- d) A 200V, d.c. Shunt-wound motor has an armature resistance of $0.4\ \Omega$ and, at a certain load has an armature current of 30A and runs at 1350rev/min. If the load on the shaft of the motor is increased so that the armature current increases to 45A, determine the speed of the motor, assuming the flux remains constant. (6 marks)

Question FIVE

- a) State any TWO advantages of an induction motor (2 marks)
- b) Explain the principle of operation of a phase induction motor (6 marks)
- c) The power input to the rotor of a 400 V, 50-Hz, 6-pole, 3- ϕ induction motor is 75 kW. The rotor electromotive force is observed to make 100 complete alterations per minute. Calculate:
- i. slip
 - ii. rotor speed
 - iii. rotor copper losses per phase
 - iv. Mechanical power developed. (12 marks)