



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

CERTIFICATE IN ELECTRICAL AND ELECTRONIC ENGINEERING

EPC 216: ELECTRICAL ENGINEERING PRINCIPLES IV

DATE: 9/5/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS:

Answer Question One and Any Other Two Question

SECTION A; COMPULSORY QUESTION

QUESTION ONE (30 MARKS)

- a) Define the following terms with regard to a d.c series L – R circuit;
- Rise time
 - Settling time . (4 marks)
- b) Derive using differential equations the expression of the resultant current in a d.c series L – R circuit suddenly connected to a supply voltage V . 7 marks)
- c) The winding of an electromagnet , with an inductance value of 3 H and a resistance of 15 Ω , is connected to a 120 V d.c supply . Calculate the following;
- the induced emf after 0.1 sec
 - The time for the current to rise to 85% of its final value
 - The current after 0.3sec. (8 marks)
- d) A balanced star – connected load of (8 + j6) Ω per phase is connected to a balanced 3 – phase , 400 V supply. Calculate ;
- The line current
 - Power factor
 - Power
 - Total volt – amperes . (8 marks)

- e) State any three disadvantages of power factor improvement using synchronous condensers. (3 marks)

SECTION B – ATTEMPT ANY TWO QUESTIONS

QUESTION TWO (20 MARKS)

- a) Define the term “Time constant” with regard to a d.c series L – R circuit. (2 marks)
- b) State any three advantages of a 3 – phase system over a 1 – phase system. (3 marks)
- c) A 20 μF capacitor is connected in series with a 50 $\text{k}\Omega$ resistor and the circuit is then connected to a 20 V d.c supply. Determine the following;
- The value of current 1 sec after connection
 - The value of capacitor voltage 2sec after connection
 - The time after connection when the resistor voltage is 15 V. (6 marks)
- d) Explain the internal working of a camera flash as an application of a d.c series C – R circuit. (4 marks)
- e) A 415V, 3 – phase a.c motor has an output power of 12.75 KW and operates at a power factor of 0.77 lagging and with an efficiency of 85% .
If the motor is delta – connected, calculate;
- The input power
 - The line current
 - The phase current. (5 marks)

QUESTION THREE (20 MARKS)

- a) Define the following terms
- Power factor
 - Load factor. (4 marks)
- b) A 5 μF capacitor is connected in series with a 20 $\text{k}\Omega$ resistor and the circuit is connected to a 10V d.c supply . Determine
- the initial value of current flowing
 - the value of the current 0.4 sec after connection
 - the value of the capacitor voltage 30msec after connection
 - The time after connection when the resistor voltage is 4V. (8 marks)
- c) Three identical star – connected coils are supplied with 440 V , 3 – phase , 50 Hz supply where a 1– phase wattmeter with the current coil connected in R – line and pressure coil across the R – phase and neutral , reads 6 KW. An ammeter connected in the R – phase reads 30 A.

Assuming RYB phase sequence, calculate;

- i. Resistance of the coil
- ii. Reactance of the coil
- iii. The power factor of the load
- iv. Reactive power of the 3 – phase load. (8 marks)

QUESTION FOUR (20 MARKS)

- a) A 50KW , 415V , 3 – phase motor operates on full load at a Power factor 0.75 lagging with an efficiency of 85% . If the Power factor is improved to 0.95 lagging , calculate ;
- i. The reduction in KVA demand
 - ii. The current taken from the supply. (7 marks)
- b) State the following
- i. Any three undesirable effects of a low power factor in a 3 – phase system.
 - ii. Any four advantages of power factor improvement in a 3 – phase system. (7 marks)
- c) Describe the methods of power factor improvement using the following equipment;
- i. Synchronous Condensers
 - ii. Static Capacitors. (6 marks)

QUESTION FIVE (20 MARKS)

- a) i With the aid of a connection and phasor diagrams describe the two wattmeter method of measuring power in a balanced 3 – phase Inductive load. (6 marks)
- ii State any three advantages of power factor improvement using static capacitors . (3 marks)
- b) Derive the expression for the capacitor discharging current in a d.c series C – R circuit. (5 marks)
- c) A 40 V d.c supply is connected across a coil of inductance 25 mH and resistance 5Ω . Calculate the following ;
- i. the value of current after 10 mSec
 - ii. The p.d across the resistor after 5 mSec
 - iii. The value of the voltage across the inductance after 2 mSec.
 - iv. The time when the current reaches 3 A. (6 marks)