



MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRICAL ENGINEERING

UNIVERSITY ORDINARY EXAMINATION

2018/2019 ACADEMIC YEAR

**FIRST YEAR SECOND SEMESTER EXAMINATION FOR, DIPLOMA
ELECTRICAL AND ELECTRONICS ENGINEERING**

EEE 053 - ELECTRICAL CIRCUIT THEORY AND ANALYSIS

DURATION: 2 HOURS

DATE: 20/12/2018

TIME: 9 – 11 A.M.

Instructions to candidates:

1. Answer question One and Any Other Two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

- a. Define the following terms;
- Amplitude
 - Transformer
 - Armature
 - Commutator (4 Marks)
- b. Show that on series resonance frequency (4 Marks)
- $$f_r = \frac{1}{2\pi \sqrt{cl}}$$
- c. State any THREE properties of ideal transformer (3 Marks)
- d. Describe using phaser diagram how capacitor can be a power factor improvement device (3 Marks)
- e. A supply voltage has a mean value of 150v. Determine;
- Its maximum value (2 Marks)
 - Its rms value (2 Marks)
- f. With the diagram, explain the operation the operation of full wave rectifier (6 Marks)
- g. State THREE advantages of three phase power supply system (3 Marks)
- h. Three loads, each of resistance 30Ω are connected in star to a 415v, 3 ϕ supply. Calculate;
- System phase voltage
 - Phase current (3 Marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

- a. State any TWO;
- Applications of auto-transformer (2 Marks)
 - Losses of transformers (2 Marks)
- b. An ideal 25kva transformer has 500 turns on the primary winding and 40 turns on the secondary winding. The primary is connected to 3000v, 50Hz supply. Calculate;
- Primary and secondary current on full load (3 Marks)
 - Secondary e.m.f (2 Marks)
 - Maximum core flux (2 Marks)

- c. With the aid of a diagram, explain construction of D.C machines (6 Marks)
- d. Derive the generated e.m.f (E_g) equation for a D.C generator (3 Marks)

QUESTION THREE (20 MARKS)

- a. State TWO ways in which e.m.f is generated in alternating voltage circuit (2 Marks)
- b. An alternating voltage is given by;
 $V=75 \sin(200 \pi t - 0.25)$ volts

Calculate:

- i. Periodic time (2 Marks)
 - ii. Peak to Peak (1 Mark)
 - iii. r.m.s value (2 Marks)
 - iv. The frequency (1 Mark)
 - v. Phase angle relative to $V=75 \sin 200 \pi t$ (2 Marks)
- c. Explain THREE ways of measuring power in three phase system (6 Marks)
- d. Three coils each having resistance 3Ω and inductive reactance is connected in delta to a 415v, 3 phase supply. Calculate;
- i. Line voltage (1 Mark)
 - ii. Phase voltage (1 Mark)
 - iii. Line current (1 Mark)
 - iv. Phase current (1 Mark)

QUESTION FOUR (20 MARKS)

- a. Define the term Q-factor in a.c series circuit (2 Marks)
- b. Show that Q-factor = $\frac{1}{R} \sqrt{\left(\frac{L}{C}\right)}$ at resonance frequency (f_r) in a.c. series circuit (3 Marks)
- c. A coil of resistance 5Ω and inductance 120 mH in series with 100UF capacitor is connected to a 300v, 50 Hz supply. Calculate:
- i. The current flowing in the circuit (4 Marks)
 - ii. The phase difference between the supply voltage and current (1 Mark)
 - iii. Voltage across the coil (2 Marks)
 - iv. Voltage across the capacitor (1 Mark)
- d. A pure inductance of 120mH is connected in parallel with a 25UF capacitor and the network is connected to a 100v, 50Hz supply. Calculate;

- i. Branch currents (3 Marks)
- ii. The supply current and its phase angle (2 Marks)
- iii. The circuit impedance (1 Mark)
- iv. The power consumed (1 Mark)