



TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering and Technology

Department of Electrical and Electronic Engineering

UNIVERSITY EXAMINATION FOR:

Diploma in Electrical Engineering

EEP2105: CIRCUIT THEORY II

END OF SEMESTER EXAMINATION

SERIES: MARCH 2025

TIME: 2 HOURS

DATE: MARCH 2025

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** Questions; Attempt **QUESTION ONE** and any other **TWO** Questions.

Do not write on the question paper.

QUESTION ONE (COMPULSORY)

1. (a) Explain the following terms as used in A.C theory.

- i. R.M.S value
- ii. Frequency
- iii. Instantaneous values.
- iv. Mean value (8 marks)

(b) (i) Briefly explain any **TWO** advantages of generating alternating currents as opposed to direct currents

(ii) With aid of a diagram, explain the principle of operation of an a.c generator. (12 marks)

2. (a) The voltage in an a.c. circuit at any time t seconds is given by;

$$V = 75 \sin(50\pi t - 0.523) \text{ Volts.}$$

Determine the;

- i. peak-to-peak value
- ii. periodic time
- iii. r.m.s value
- iv. phase angle in degrees.
- v. frequency

(10 marks)

- (b) Three identical coils, each of resistance 10Ω and inductance 42 mH are connected in star to a 415 V , 50 Hz , three-phase supply. Determine the;

- i. Phase impedance, Z_p
- ii. phase voltage, V_p
- iii. Phase current, I_p
- iv. Power factor
- v. the total power dissipated.

(10 marks)

3. (a) With aid of a well labelled diagram, explain the principle of operation of a transformer.

(8 marks)

- (b) A 12 kVA , single-phase transformer has a turns ratio of $11:1$ and is supplied from a 2.6 kV supply. Neglecting losses, determine;

- i. the full load secondary current
- ii. the minimum value of load resistance which can be connected across the secondary winding without the kVA rating being exceeded.
- iii. the primary current.

(6 marks)

- (c) Using a well labelled diagram, briefly describe how Short-circuit test is carried out in transformers.

(6 marks)

4. (a) (i) State any three essential devices that an analogue electrical indicating instruments require.

- (ii) Highlight three advantages of electronic measuring instruments over analogue indicating measuring instruments.

(6 marks)

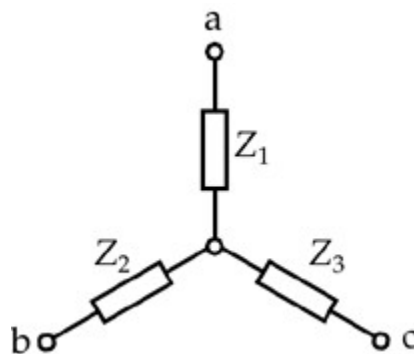
(b) Differentiate between series resonance and Q-factor. (4 marks)

(c) A coil of negligible resistance and inductance 100 mH is connected in series with a capacitance of $2\mu\text{F}$ and a resistance of $10\ \Omega$ across a 50 V, variable frequency supply. Determine;

- the resonant frequency
- the current at resonance
- the voltages across the coil and the capacitor at resonance
- the Q-factor of the circuit. (10 marks)

5. (a) The figure below shows three impedances Z_1, Z_2 and Z_3 in star connection. Given that impedances $Z_1=5\Omega, Z_2=6\Omega$ and $Z_3=10\Omega$, determine and draw the delta-connected equivalent network. (9 marks)

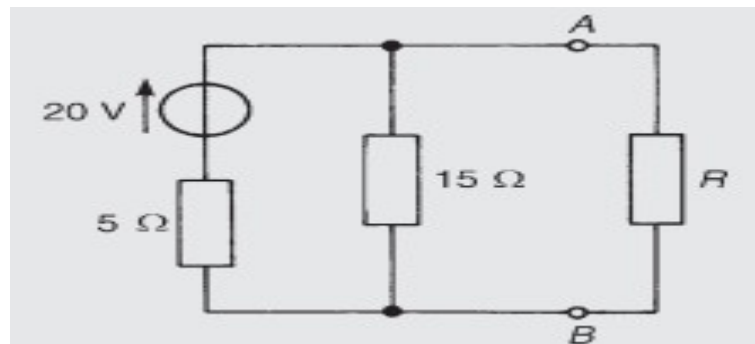
Fig. I



(b) (i) State the Maximum power transfer theorem.

(ii) Determine the value of the load resistance R shown in Figure II shown below that gives maximum power dissipation and calculate the value of this power

Fig. I



(11 marks)

