



28

KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

**FOR THE DEGREE OF B.SC (RENEWABLE ENERGY AND BIOFUELS
TECHNOLOGY)**

COURSE CODE: REN 223

COURSE TITLE: BASIC ELECTRICAL TECHNOLOGY

DATE: 11/05/2022

TIME: 9:00AM-11:00AM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

Answer question ONE and any TWO of the remaining

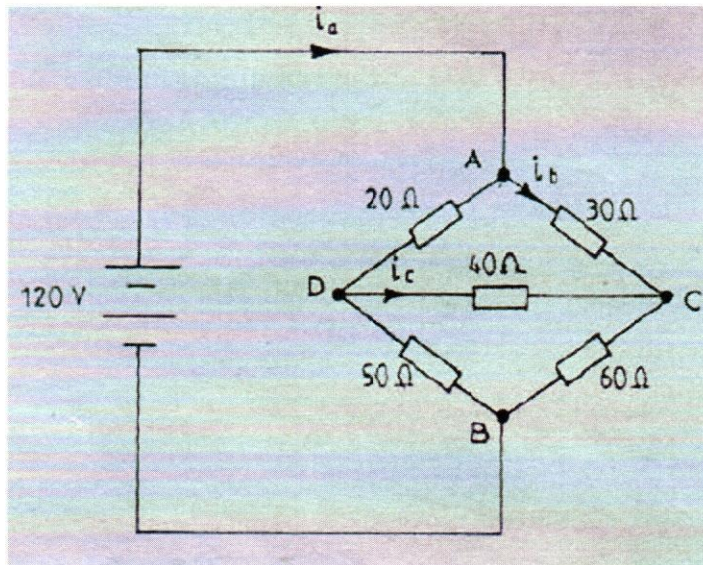
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Question One (Compulsory)

- a) State Kirchhoff's laws. (4 marks)
- b) Define the following terms as used in single-phase A.C circuits. (4 marks)
- i) Cycle
 - ii) Periodic time
- c) State four conditions observed at resonance in A.C series circuits. (4 marks)
- d) Explain the term 'Quality factor' as used in parallel A.C circuits. (2 marks)
- e) State two advantages of the interconnection of power stations for A.C power distribution. (2 marks)
- f) State two advantages and applications of auto-transformers. (4 marks)
- g) Highlight the purpose of laminating a transformer core. (2 marks)
- h) State any five basic parts of a DC machine. (5 marks)
- i) State the principle losses in DC machines. (3 marks)

Question Two

- a) The figure below shows a D.C bridge circuit. Determine the branch currents i_a , i_b and i_c . (12 marks)



- b) The instantaneous value of A.C voltage supply is given by $V = 110 \sin(100\pi t + 0.2\pi)$
Determine the; (8 marks)
- Amplitude
 - r.m.s value of the voltage
 - phase angle
 - supply frequency

Question Three

- a) A coil of resistance 5Ω and inductance 120mH in series with a $100\mu\text{F}$ capacitor, is connected to a 300V , 50 Hz supply. Calculate; (12 marks)
- the current flowing
 - the phase difference between the supply voltage and current
 - the voltage across the coil
 - the voltage across the capacitor.
- b) Derive the expression for the Q-factor of an R-L-C series AC circuit. (8 marks)

Question Four

- a) Three impedances each of resistance 10Ω and inductive reactance 15Ω are connected in delta across a three phase, 415V A.C supply. Determine the; (8 marks)
- Phase current
 - Line current
 - Active power.
- b) A 5 kVA single-phase transformer has a turns ratio of $10:1$ and is fed from a 2.5 kV supply. Neglecting losses, determine; (12 marks)
- the full-load secondary current
 - the minimum load resistance which can be connected across the secondary winding to give full load kVA
 - the primary current at full load kVA.

Question Five

a) A 4-pole armature of a D.C machine has 1000 conductors and a flux per pole of 20mWb.

Determine the e.m.f generated when running at 600 rev/min when the armature is:

i) Wave-wound

ii) Lap-wound

(10 marks)

b) An 8-pole lap-wound D.C motor has a 200V supply. The armature has 800 conductors and a resistance of 0.8Ω . If the useful flux per pole is 40mWb and the armature current is 30A, calculate:

i) The speed

ii) Torque developed.

(10 marks)