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KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**SECOND YEAR SECOND SEMESTER
SUPPLEMENTARY EXAMINATIONS**

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

COURSE CODE: REN 223

COURSE TITLE: BASIC ELECTRICAL TECHNOLOGY

DATE: ²⁷25/07/2022

TIME: 8:00AM-10:00AM

INSTRUCTIONS TO CANDIDATES

TIME: 2 Hours

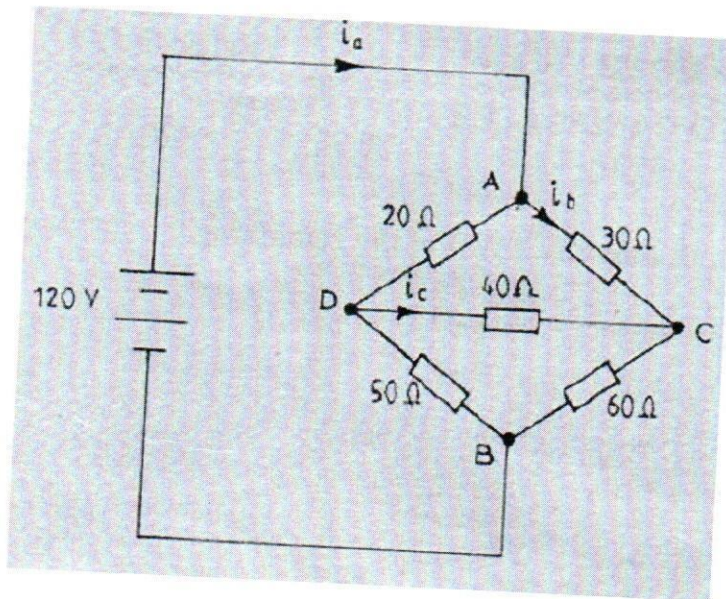
Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating
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) Name three types of motor enclosures. (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

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$$V = 110 \sin(100\pi t + 0.2\pi)$$

Determine the:

- i) Amplitude
- ii) r.m.s value of the voltage
- iii) phase angle
- iv) supply frequency. (8 marks)

Question Three

- a) A series A.C. circuit resonates at a frequency of 60Hz. It consists of a resistor of 15Ω , and an inductor of 0.6H and a capacitor of unknown value. The supply voltage is 240V, determine the: (12 marks)
- i) Supply current
 - ii) Value of the capacitor
 - iii) Q-factor
 - iv) 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)
- i) Phase current
 - ii) Line current
 - iii) Active power.
- b) A 5kVA single-phase transformer has a turns ration of 46:1 and is fed from a 11kV, 50Hz supply. Neglecting losses, determine the: (12 marks)
- i) Secondary voltage on open circuit
 - ii) Full-load secondary current
 - iii) Minimum load resistance
 - iv) Full load primary current.

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Question Five

- a) A six-pole lap-wound motor is connected to a 250V d.c supply. The armature has 500 conductors and a resistance of 1Ω . The flux per pole is 20mWb. Calculate:
- i) the speed
 - ii) the torque developed when the armature current is 40A. (10 marks)
- b) A 320V shunt motor takes a total current of 80A and runs at 1000 rev/min. If the iron, friction and windage losses amount to 1.5kW, the shunt field resistance is 40Ω and the armature resistance is 0.2Ω , determine the overall efficiency of the motor. (10 marks)