GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination

JUNE 2021 **INTERMEDIATE LEVEL**

Specialty Name (Specialty Acronym)	**ELECTRICAL POWER SYSTEMS (EPS)**
Subject Title	**ELECTRICAL AND ELECTRONIC CIRCUITS**
Subject Code No.	**5240**
Paper No.	**2**

Three Hours

This Paper has Two Sections: A and B and has a weighting of 35% of the whole subject.

Section A has THREE Questions. Each Question carries **30 marks.** ***ANSWER ANY TWO***

Section B has THREE Questions. Each Question carries **20 marks.** ***ANSWER ANY TWO***

Show all steps in your calculations giving your answer at each stage and indicating the units and symbols used

All sketches must be neat and clear

You are allowed to use a non – programmable calculator and mathematical sets

SECTION A: ELECTRICAL CIRCUIT

1)

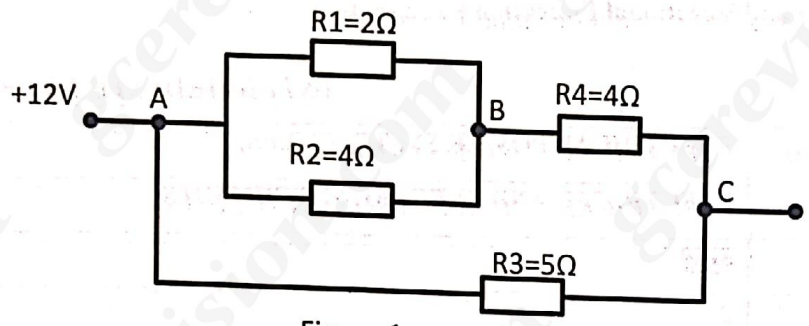

Figure 1

Consider the circuit of figure 1

a) Determine the total resistance when R3 is removed (open circuited) **(5 marks)**

b) Considering now that R3 is connected back in the circuit as shown in Figure1;

i) Calculate the equivalent resistance of the circuit **(3 marks)**

ii) Calculate the total current of the circuit **(4 marks)**

iii) Deduce the voltage drop across R1 **(3 marks)**

iv) What is the voltage drop between the points B and C? **(5 marks)**

v) Determine the current through R3 **(5 marks)**

vi) Calculate the power dissipated in the resistor R2 **(5 marks)**

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2) A coil draws a current of 20A when connected to a 100V DC source. When connected to an AC voltage of 240V, 50Hz, it draws a current of 15A.

a) Calculate

i) The impedance of the circuit **(4 marks)**

ii) The inductance of the inductor **(4 marks)**

iii) The voltage across the inductor and the resistor **(4 marks)**

iv) The power factor of the circuit **(4 marks)**

v) The phase angle of the circuit **(4 marks)**

vi) The active, reactive and apparent powers **(4 marks)**

b) Define the following and give their units

i) Impedance **(2 marks)**

ii) Inductive reactance **(2 marks)**

iii) Capacitive reactance **(2 marks)**

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3) Two batteries having E1 = 15V, $r_1 = 5\Omega$, E2 = 10V, $r_2 = 5\Omega$ supplies a load of 20Ω.

a) Draw the circuit diagram **(4 marks)**

b) Calculate the Norton current **(7 marks)**

c) Calculate the Norton equivalent resistance **(4 marks)**

d) Draw the Norton equivalent circuit **(5 marks)**

e) Calculate the current flowing in the 20Ω resistor **(4 marks)**

f) Deduce the energy consumed by the 20Ω resistor in half a minute **(6 marks)**

SECTION B: ELECTRONIC CIRCUIT

4) a) With the aid of a circuit diagram, explain the functioning of a Bridge rectifier circuit **(7 marks)**

b) State one disadvantage of a bridge rectifier over a full wave rectifier **(4 marks)**

c) Assuming a resistive load, draw the voltages across the supply and the load of a bridge rectifier **(6 marks)**

d) What is the role of a capacitor usually connected across the load in a rectifier circuit? **(3 marks)**

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5) a) Write in full the abbreviation BCD as used in machine language **(3 marks)**

b) Convert the following binary numbers to base 10

i) 01100111_2 **(2 marks)**

ii) 1001011_2 **(2 marks)**

c) Convert the decimal number 80_{10} into binary **(4 marks)**

d) Carryout the following conversions

i) 324_5 to base 10 **(3 marks)**

ii) 432_6 to base 10 **(3 marks)**

iii) 432_3 to base 10 **(3 marks)**

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6) a) Define a semiconductor **(2 marks)**

b) Cite two examples of semiconductor materials **(2 marks)**

c) What is a diode? **(2 marks)**

d) Draw the symbol of a junction diode, identify its terminals and give an area of application **(4 marks)**

e) Draw the symbols of each of the following electronic components

i) Light emitting diode (LED) **(2 marks)**

ii) Photodiode **(2 marks)**

iii) Phototransistor **(2 marks)**

iv) Zener diode **(2 marks)**

v) Bipolar Junction transistor **(2 marks)**