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Index No.....School.....

Date.....Signature.....

**448/1**  
**ELECTRICITY**  
*(Theory)*  
Paper 1  
**Time: 2 ½ hours**  
December 2021

## **BUNAMFAN CLUSTER EXAMINATION 2021**

**448/1**  
**ELECTRICITY**  
*(Theory)*  
Paper 1  
**Time: 2 ½ hours**  
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### **INSTRUCTIONS TO CANDIDATES**

**Candidates should have the following for this examination**

1. Mathematical tables or non-programmable calculators maybe used
2. This paper has **TWO** sections: **A** and **B**
3. Answer **ALL** the questions in section **A** and **ANY FOUR** questions from section **B**.
4. All dimensions are in millimeters unless stated otherwise.
5. This paper consists of **11** Printed pages.
6. Candidates should check the question paper to ensure that all the Papers are printed as indicated and no questions are missing

*This paper consists of 9 Printed pages.  
Candidates should check the question paper to ensure that all the  
Papers are printed as indicated and no questions are missing*

**SECTION A (48 MARKS)**

*Answer **all** the questions in this section.*

1. (a) State **three** safety precautions to be observed when using electric power tools. (1 ½ marks)

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- (b) State **three** requirements for proper storage of electrical measuring instruments. (1 ½ marks)

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- (c) Arrange the following job titles in ascending order of seniority: craftsman, engineer, artisan and technician. (2 marks)

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2. (a) Name **two** electrical equipment at the consumer's intake point in a domestic installation.

(1 mark)

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- (b) Explain each of the following electric circuit conditions. (2 marks)

(i) Short circuit

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(ii) Overload

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3. State the effect of each of the following on current in an electric circuit. (2 marks)

(i) Resistance

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(ii) Inductance

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4. (a) Give **two** reasons why aluminum is preferred to copper for overhead power line cables. (2 marks)

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(b) In a 12V dc system a 40W solar panel is exposed to the sun for 6 hours daily. Calculate the number of days it will take to fully charge a 60 Ampere-hour battery. (3 marks)

5. (a) Describe the energy conversion sequence in a hydro-electric power station. (2 marks)

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(b) An alloy wire whose diameter is 1.0mm and resistivity is  $75\mu\Omega\text{m}$  is used to make a  $150\Omega$  resistor. Calculate the length of the wire. (4 marks)

6. (a) Name **any two** metals used to make alloy magnets. (1 mark)

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(b) Explain how a permanent magnet can be demagnetized electrically. (2 marks)

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7. (a) Explain why electric power is transmitted at high voltages. (2 marks)

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(b) Explain the three functions of a switch gear at a domestic consumer's intake point. (3 marks)

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8. (a) Name one material used to make each of the following parts of electric machines: (2 marks)

- (i) Commutator segments .....
- (ii) Slip rings .....
- (iii) Brushes .....
- (iv) Armature core .....

9. With respect to dc motors, explain the risk involved in each of the following malpractices:

(i) Switching the motor to directly to full supply voltage. (3 marks)

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(ii) Running series motor without a load

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(iii) Operating a shunt motor while its field winding is open.

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10. A moving coil instrument of internal resistance of  $100\ \Omega$  requires a current of  $0.5\text{mA}$  to give full-scale deflection. If the instrument is modified to a voltmeter. Calculate the value of the multiplier for the instrument to measure up to  $100\text{V}$ . (3 marks)

11. The figure 1 below shows an arrangement of capacitors connected to a 10V d.c supply.

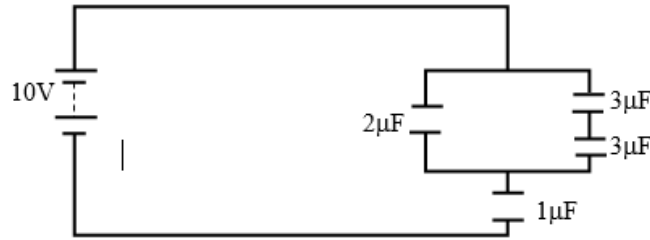


Figure 1

Determine

- i. The combined capacitance (2 marks)
- ii. The total charge in the circuit (1 mark)
- iii. The total energy stored in the circuit. (2 mark)

**SECTION B (52 MARKS)**

Answer any **four** questions from this section.

12. (a) Explain why a series motor develops high torque when subjected to a heavier load.

(5 marks)

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(b) A 240V/120V, 1.2kVA transformer delivers power to a load. Calculate the:

- (i) Transformation ratio; (1 mark)

(ii) Rated secondary current;

(2 marks)

(iii) Primary impedance at the rated load;

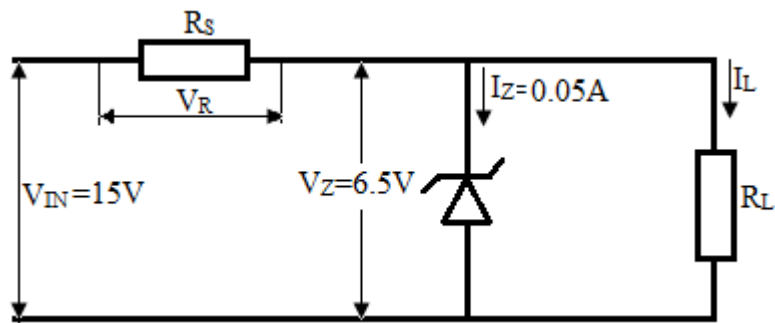
(3 marks)

(v) Number of turns in secondary winding if the primary winding induces 0.2V per turn.

(2 marks)

13. (a) Sketch the voltage-current characteristic curve of a rectifier diode and label:
- (i) The axis
  - (ii)  $V_F$
  - (iii)  $V_R$

(b) **Figure 2** shows a Zener diode regulator circuit.



**Figure 2**

- i. Given that the power dissipated by  $R_S = 2.125W$ , calculate the value of
  - I.  $R_S$
  - II.  $R_L$
  - III. Power dissipated by  $R_L$
- ii. If  $V_{IN}$  is decreased to 11V, state what changes occurs in. (9 marks)
  - I.  $V_R$
  - II.  $I_Z$

14. (a) Using a well sketched diagram show the symbols of the following logic gates. (2 marks)

I. AND gate

II. NOR gate

(b) Show the truth tables of the gates indicated below. (4 marks)

I. NAND

II. OR

(c) (i) State any **three** considerations one has to make before settling for a certain business idea. (3 marks)

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(ii) Explain the purpose of each of the following features in the circuit in (b) (i) above.

I. Choke (2 marks)

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II. Fluorescent powder. (2 marks)

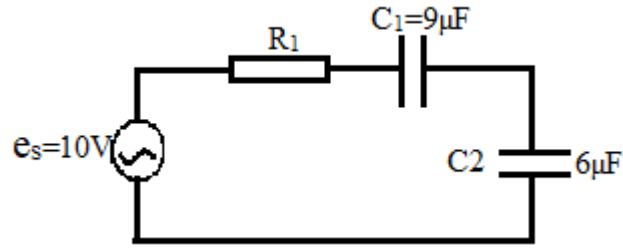
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(a) **Figure 3** shows an ac RC circuit.

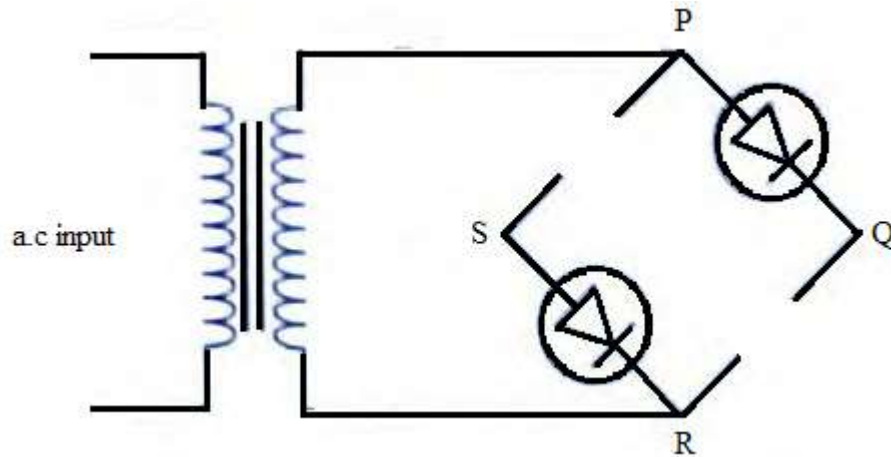


**Figure 3**

(i) Calculate the equivalent capacitance in the circuit. (2 marks)

(ii) If at a frequency  $f$ , the reactive capacitance of the circuit is  $6.0\text{k}\Omega$ , calculate the magnitude of the current in the circuit. (5 marks)

(b) **Figure 4** shows an incomplete circuit of a full wave rectifier.



**Figure 4**

i. Draw in the figure two more diodes to complete the circuit. (2 marks)

ii. Show on the circuit two points across which the rectified output should be obtained. (2 marks)

iii. State with reason the type of transformer shown above. (2 marks)

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15. (a) Differentiate between an Ohmic and non-ohmic conductor giving **one** example in each case. (2 marks)

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(b) Figure 5 shows a circuit with resistors and voltmeter connected to a battery.

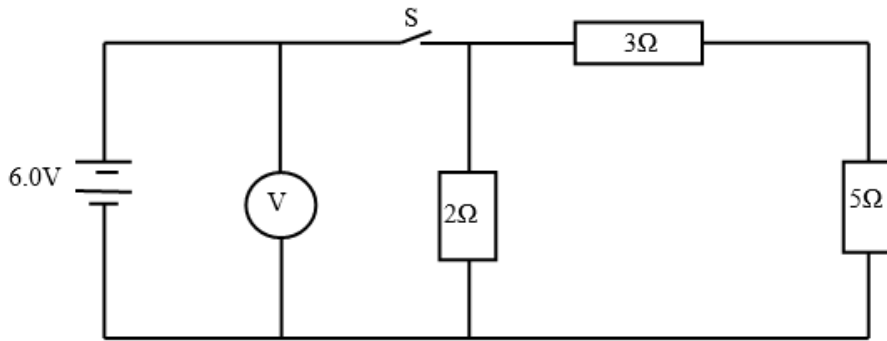


Figure 5

(i) If each cell has an internal resistance of  $0.7\Omega$ , determine the total resistance in the circuit. (3 marks)

(ii) What amount of current flows through the  $3\Omega$  resistor when the switch is closed? (3 marks)

(iii) What is the reading of the voltmeter when the switch S is

(I) Open (1 mark)

(II) Closed (1 mark)

(iv) Account for the difference between the answers in (I) and (II) above. (1 mark)

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(c) State one environmental effect of setting up a diesel run power station. (1 mark)

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