

Final Exam
TBEE: BASIC ELECTRICAL AND ELECTRONIC ENGINEERING
Spring 2026

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration: 2 hours
Instructor's Name: Ranjit Vasudevan
Exam Date: 10/05/2026
Program: PE

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Student Information

Name: ID:
Signature:

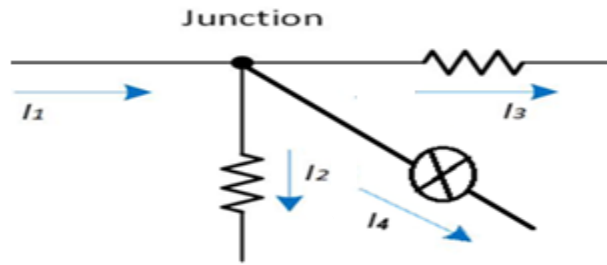
Invigilator

Initials: ☐ Student ID checked
Time received:

Question 1**[8 marks]****Circle the correct option. Each correct answer carries 1 mark.**

- i. In a process control junction, the total incoming current is 12 A. If two outgoing currents are 5 A and 4 A, the third outgoing current flowing through the lamp will be _____.

- (a) 2 A
(b) 3 A
(c) 21 A
(d) 11 A



- ii. If the peak voltage of an AC voltage is 110 V, then its RMS value is _____

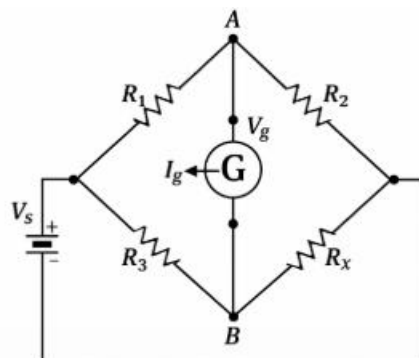
- (a) 7.78 V
(b) 77.78 V
(c) 155.54 V
(d) 15.55 V

- iii. Half wave rectifier circuit efficiency is :

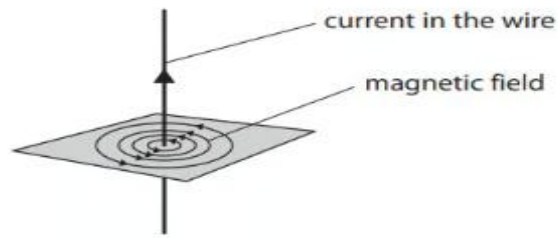
- (a) 42 %
(b) 84 %
(c) 50 %
(d) 22 %

- iv. A Wheatstone bridge circuit is used in a control system unit. For the current $I_g = 0$, Choose the correct condition for a balanced bridge circuit.

- (a) $\frac{R_1}{R_2 + R_x} = \frac{R_3}{R_x + R_2}$
(b) $\frac{R_1}{R_x} = \frac{R_3}{R_2}$
(c) $\frac{R_2}{R_3} = \frac{R_x}{R_1}$
(d) $\frac{R_1}{R_3} = \frac{R_2}{R_x}$



- v. Figure below shows the magnetic field produced by a straight current carrying conductor.



(The Physics Classroom, n.d.)

Which row of the table is correct when the strength of the magnetic field is greatest.

	Distance from the wire	Current
(a)	small	small
(b)	small	large
(c)	large	small
(d)	large	large

- vi. Which of the following materials will be suitable for making the core of a transformer?

- (a) copper (b) aluminium
(c) plastic (d) soft Iron

- vii. Increasing rate of change of magnetic flux in generator will_____:

- (a) decreases induced emf (b) increases induced emf
(c) no change (d) stop current

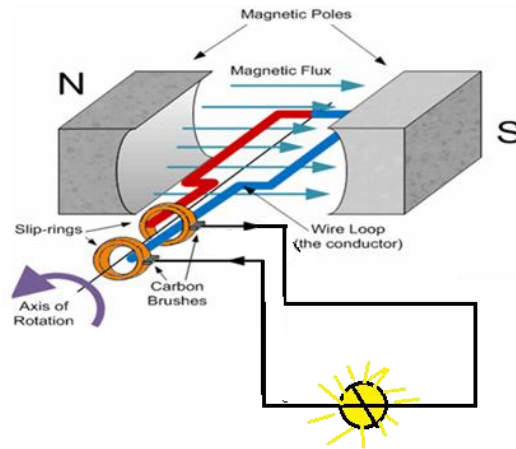
- viii. A semiconductor sensor operates at high temperature inside a reactor.

What happens to conductivity?

- (a) Remains constant (b) Decreases
(c) Increases (d) Become zero

Question 2**[8 marks]**

In a process plant, an electrical generator is used to supply backup power during shutdown conditions. The generator operates by converting mechanical energy into electrical energy.



(Storr, 2026)

- (a) Identify the basic principle on which this generator operates and briefly explain it.

(3 marks)

- (b) The frequency of the current generated by the generator is 50 Hz.

Calculate the periodic time of the current.

(2 marks)

- (c) Draw the current–time graph for an alternating current if the peak current is $I_0 = \pm 10 \text{ A}$

(2 marks)

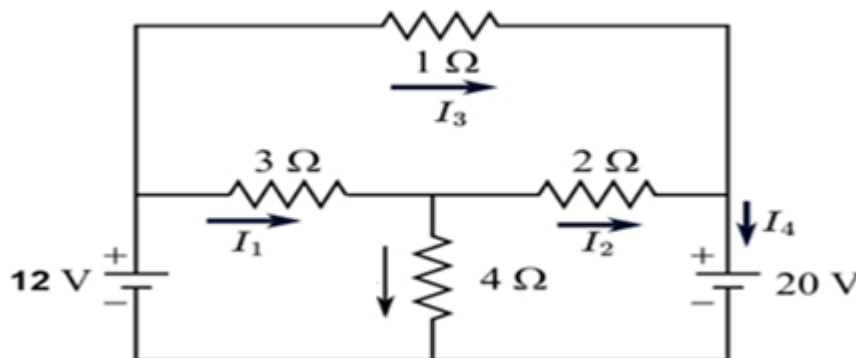
- (d) Suggest one method to make the frequency of the generated current zero.

(1 mark)

Question 3

[8 marks]

A distributed control system (DCS) supplies power to multiple control valves in a process plant. A fault is suspected in one branch.



(Study.com, 2026)

- (a) Determine current through each branch using Kirchoff's Current Law(KCL) and Kirchoff's Voltage Law(KVL).

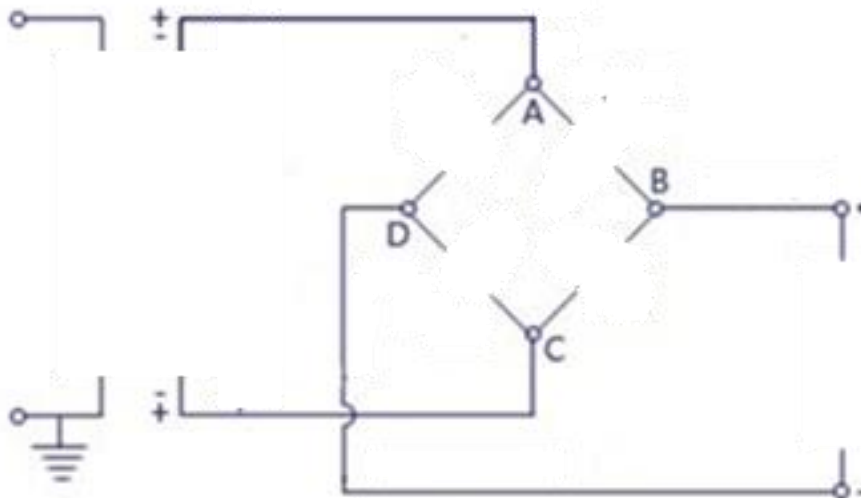
(6 marks)

(b) Calculate the voltage across the $4\ \Omega$ resistor.

(2 marks)

Question 4**[8 marks]**

In a process plant, a control instrumentation system requires a stable DC power supply derived from an AC source using a rectifier circuit. The partially completed diagram of a bridge rectifier is shown below.

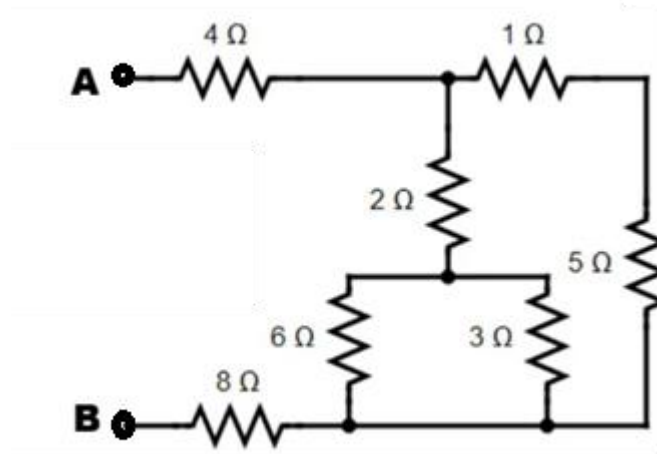


- (a) Complete the given circuit diagram by: (3 marks)
- Correctly connecting the four diodes (D_1 , D_2 , D_3 , D_4) to complete the bridge rectifier circuit.
 - Draw the load resistor (R_L).
 - Draw a step-down transformer.
 - Label the input AC source and output DC terminals.
- (b) Explain the working of the bridge rectifier with reference to how AC input wave is converted into DC output wave. Then draw the input and output wave forms. (4 marks)

- (c) The DC output from the rectifier is fluctuating. Suggest one common method to make the DC output smooth. (1 mark)

Question 5**[8 marks]**

A process control circuit in a plant consists of multiple resistors connected as shown in the figure below. The circuit is used to regulate the current supplied to different control components.



(ChatGPT, 2026)

(a) Calculate the total resistance across terminal AB.

(4 marks)

- (b) If a 12 V cell is connected across terminals A and B, determine the current flowing through the $8\ \Omega$ and $2\ \Omega$ resistors.

(4 marks)

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	1,2	Remember, Apply, Analysis	8	
2	1,2,4	Remember, Apply, Analysis	8	
3	2	Apply	8	
4	1,4	Remember, Analyse	8	
5	2	Apply	8	

References

Storr, Wayne. "Sinusoidal Waveform or Sine Wave in an AC Circuit." *Basic Electronics Tutorials*, 24 June 2013, www.electronics-tutorials.ws/ac/circuits/sinusoidal-waveform.html?utm_source=chatgpt.com.

Study.com, 2026, homework.study.com/cimages/multimages/16/hsgsthier4602553916302099106.jpg. Accessed 20 Apr. 2026.