ACADEMIC YEAR 2023 - 2024

Program	Year	Semester	Paper
PE	**1**	**2**	**MAIN**

MODULE NAME:	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

MODULE CODE:	**TBEEE**	**EXAM DATE:**	**19 – 5 – 2024**
INSTRUCTOR's NAME:	**Ranjit V**	**DURATION:**	**2 hrs**

Questions to be answered on:	Allowed tools:	Number of pages
✓ Space provided on the question paper	Pen, Pencil & Calculator	(Incl. cover page): **11**

Points of attention:

- For each question, the maximum earned points are mentioned between brackets at the end of each question.
- Write very clearly! Answers that are not readable are not marked and don't get points!
- Make sure your answers are written to the point.
- All answers should be written **in English.**
- Write all the answers in **blue or black pen only.**
- Use the **pencil** only for **diagrams & graphs.**
- Show all the calculation steps in the given space.
- When finished submit the question paper, the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

FINAL MARKS

STUDENT NAME:	**40**
STUDENT ID:	**10**

Number of answer scripts:…….……….……

Invigilator:………………..…………….…

Student's signature: .…………….…….……

Time of receipt:……………….……..…

## INSTRUCTIONS

- *Express the **CORRECT** SI units for all the dimensional quantities or **½ MARK** will be **deducted** from each **answer***

ANSWER ALL THE QUESTIONS IN THE SPACE PROVIDED

1. A DC electric circuit consists of a network of resistors designed for a power controller, as shown in the figure below:

A
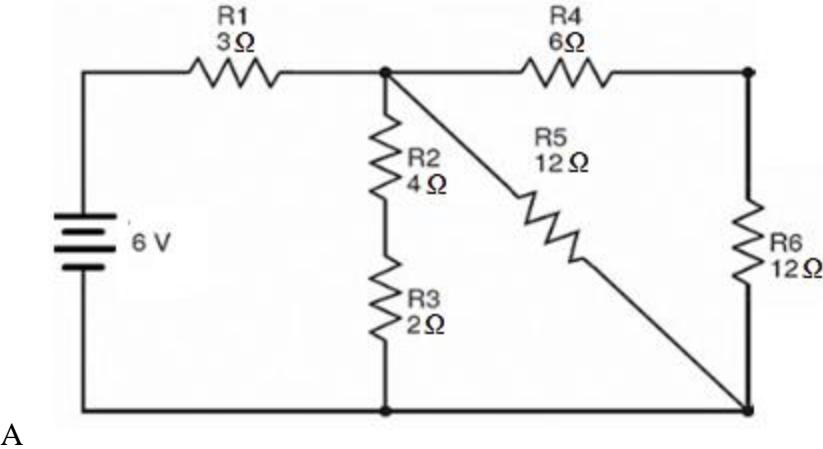
(Teja, 2024)

a) Calculate the total current in the circuit. (4 marks)

b) Calculate the voltage drop across R_4 and R_2 resistors.   (3 marks)

2.   A student rotates the handle H of an alternating current (AC) generator as shown in the figure below:
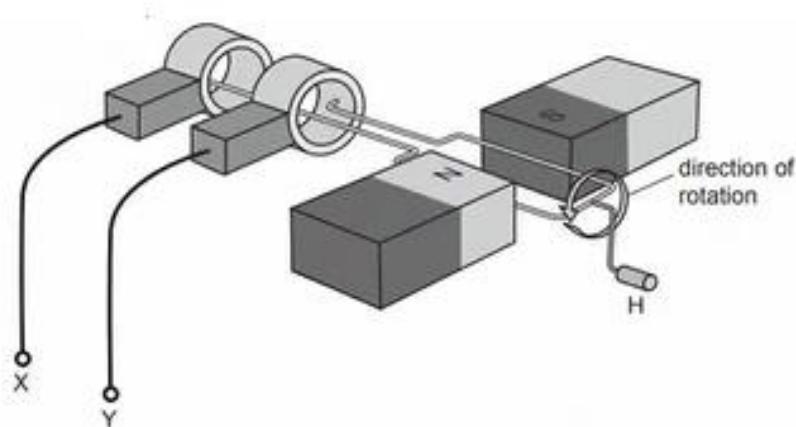
(ElProCus - Electronic Projects for Engineering Students, 2020)

a) On the graph below, plot the graph to show how the electromotive force (e.m.f) between the wires X and Y will change with time when the coil completes two complete rotations. (2 marks)
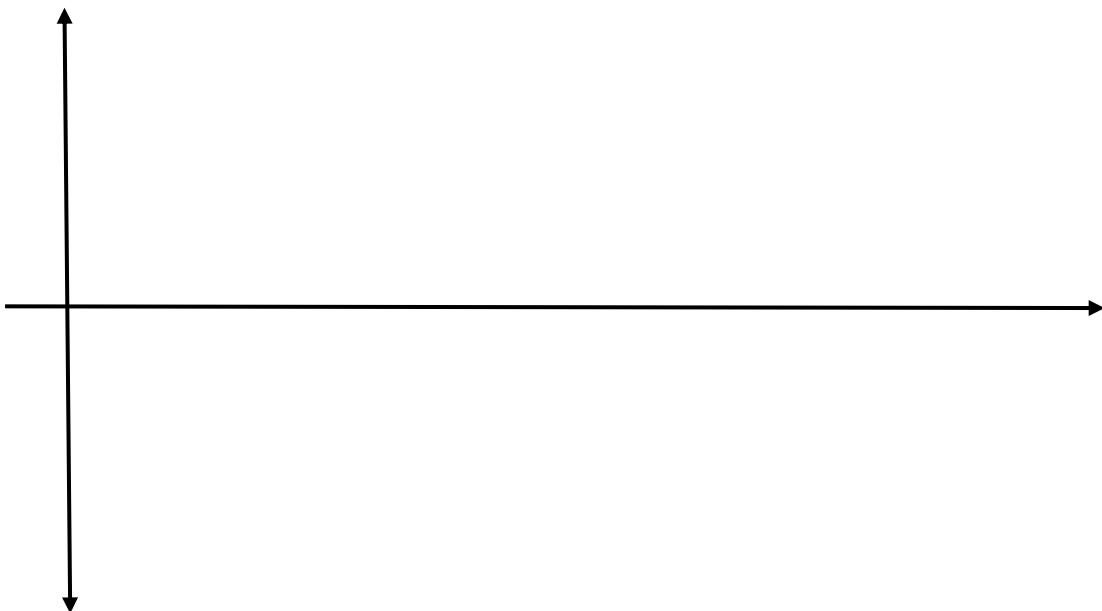
b) On the above graph, mark and label a point P for the e.m.f, when the coil is horizontal, as shown in the above figure. (1 mark)

c) If the student rotates the handle H much faster now, redraw the graph below showing how the e.m.f will change. (1 mark)
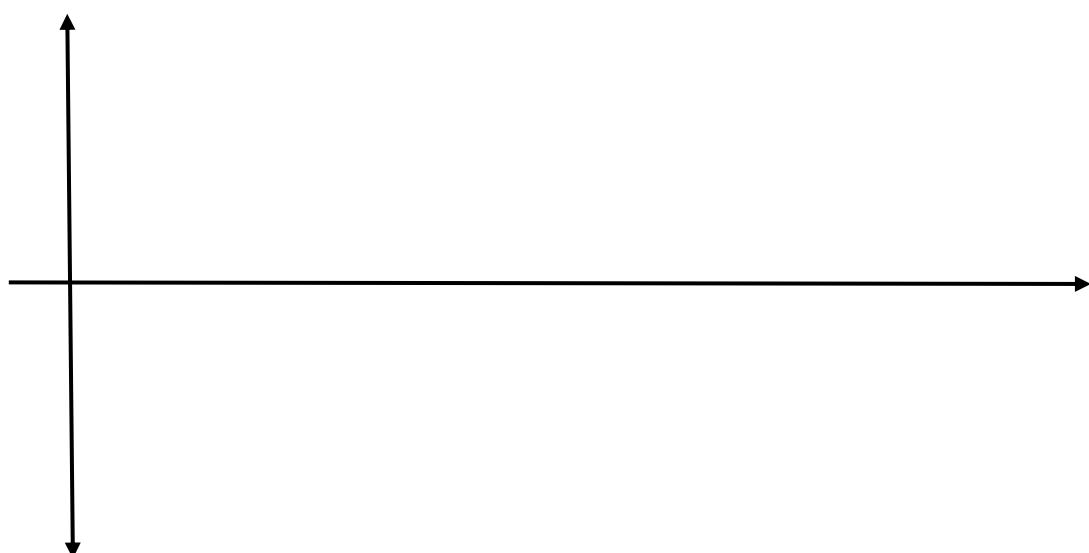
d) Now, if the wires X and Y of the AC generator are connected to the primary windings of a transformer, as shown in the figure below.
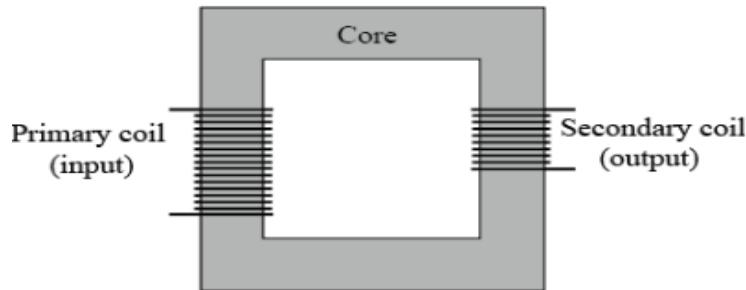
Describe how the output voltage and current will change at the secondary coil. Also, draw the graph showing the output voltage and current changes. (3 marks)

e) An X-ray machine requires a supply of 110 kV. The mains input electricity supply is 230V. A transformer supplies the correct voltage to the X-ray machine. The primary coil of the transformer has 50 turns. Calculate the number of turns on the secondary coil. (2 marks)

3. An adapter of a laptop consists of a rectifier electronic circuit which converts AC to a DC.

   a) Draw a circuit diagram of a half-wave rectifier and describe how it works in not more than 50 words.

(5 marks)

   b) Suggest any other rectifier circuit better than a half-wave rectifier. Justify your answer with a suitable reason.

(2 marks)

4. A controller circuit is designed with a series and parallel combinations of resistors and cells as shown in the figure below:
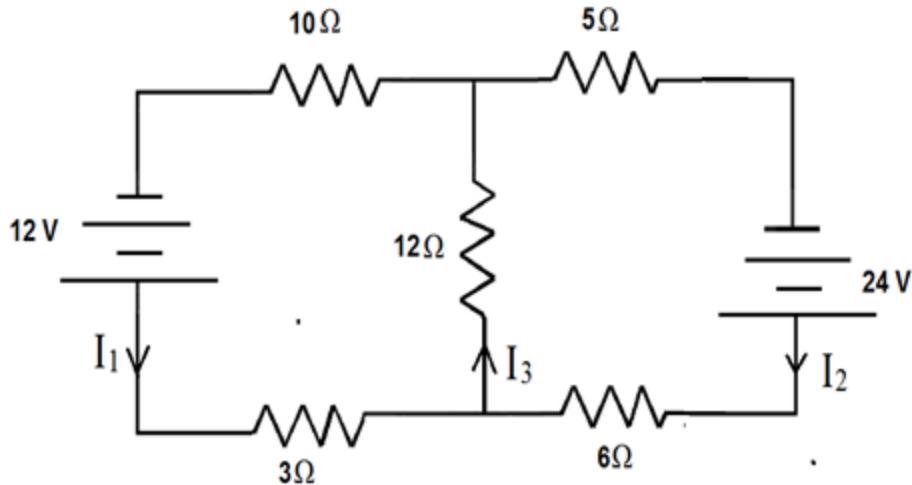
(Department of Physics & Astronomy, 2017)

Solve the circuit by finding the unknown currents I_1, I_2 and I_3 in the circuit arms by applying Kirchhoff's current and voltage laws (KCL and KVL). (7 marks)

5. Circle the correct option for the following questions as given below: [10 marks]

i) P-type semiconductor can be made by doping silicon with :

    a) Phosphorus   b) Indium

    c) Antimony   d) Arsenic

ii) By changing which of the factors, a semiconductor's conductivity can be increased

    a) Size   b) Nature of the material

    c) Temperature   d) None of the above

iii) At room temperature, the semiconductor with an equal number of holes and electrons is

    a) extrinsic semiconductor   b) intrinsic semiconductor

    c) pure conductor   d) insulator

iv) The valency of Si or Ge element is

    a) 3   b) 1

    c) 2   d) 4

v) An electric current is passed through a coil of wire.

coil of wire
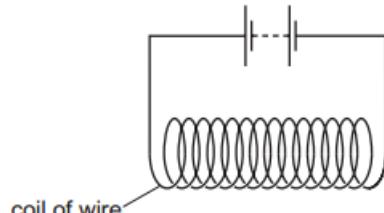
Which diagram shows the shape of the magnetic field produced in the middle of the coil?

vi) The number of magnetic field lines passing through a surface area normally is called

    a) magnetic field   b) magnetic flux

    c) electric field   d) electric flux

vii) A device used to convert mechanical energy to electrical energy is called as

    a) electrical motor   b) ammeter

    c) galvanometer   d) generator

viii) The rate of change of magnetic flux $(\frac{d\varphi}{dt})$ through a 50-turns coil is 0.05 Wb/s. The induced e.m.f between the ends of the coil is

    a) 2.5 V   b) 10 V

    c) 25 V   d) - 2.5 V

ix) In a P-type semiconductor, choose the relationship between the number of holes (n_h) and the number of electrons (n_e)

    a) $n_h \gg n_e$ b) $n_e \gg n_h$

    c) $n_h = n_e$ d) All of the above

x) The SI unit of electromotive force (e.m.f) is

    a) N (newton)   b) W (watt)

    c) V (volt)   d) A (ampere)

Reference

ElProCus - Electronic Projects for Engineering Students. (2020). AC Generator : Working Principle, Construction & Its Applications. [online] Available at: https://www.elprocus.com/what-is-an-ac-generator-construction-its-working-principle/.

Department of Physics & Astronomy, (2017). *Kirchhoff's Laws*. Appalachian State University. Retrived from https://physics.appstate.edu/laboratory/quick-guides/kirchhoffs-laws

byjus.com. (n.d.). Transformers [online] Available at: https://byjus.com/question-answer/i-draw-a-labelled-diagram-of-a-step-down-transformer-state-the-principle-of-its/.

Teja, R. (2024). *Resistors in Series and Parallel Combinations*. [online] ElectronicsHub USA. Available at: https://www.electronicshub.org/resistors-in-series-and-parallel-combinations. [Accessed 12 Apr. 2024].

Q #		MLO Addressed	Complexity Level	Mark	Remark
1	i	MLO 2	Apply	4	
	ii	MLO 2	Apply	3	
2	a)	MLO 3	Analyse	2	
	b)	MLO 3	Analyse	1	
	c)	MLO 3	Analyse	1	
	d)	MLO 4	Evaluate	3	
	e)	MLO 1	Apply	2	
3	a)	MLO 3	Analyse	5	
	b)	MLO 4	Evaluate	2	
4		MLO 2	Apply	7	
5	a)	MLO 1	Knowledge & Understanding	10	