AL/2024/16/E-I

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2024
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2024
General Certificate of Education (Adv. Level) Examination, 2024

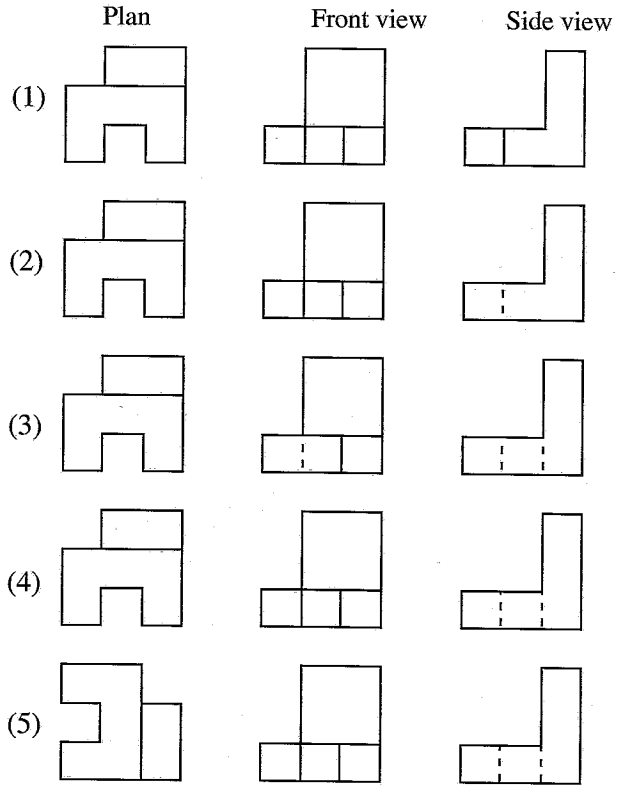
විදුලිය, ඉලෙක්ට්‍රොනික හා තොරතුරු තාක්ෂණවේදය I மின், இலத்திரன், தகவல் தொழினுட்பவியல் I **Electrical, Electronic and Information Technology I**	**16 E I**	පැය දෙකයි இரண்டு மணித்தியாலம் ***Two hours***

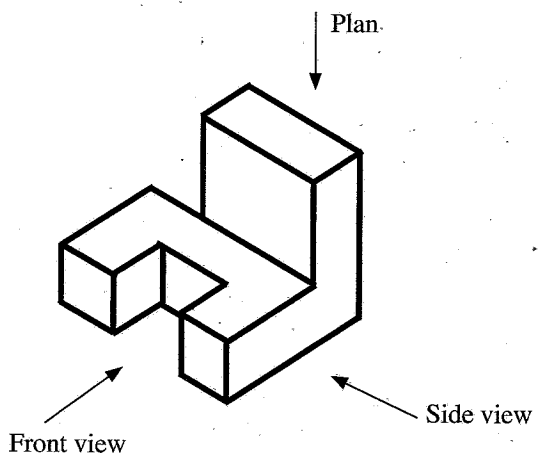
Instructions:

* *Answer* ***all*** *the questions.*
* *Write your* ***Index Number*** *in the space provided in the answer sheet.*
* *Instructions are given on the back of the answer sheet. Follow them carefully.*
* *In each of the questions* **1** *to* **50**, *pick one of the alternatives from* (1), (2), (3), (4), (5) *which is* ***correct*** *or* ***most appropriate*** *and* ***mark your response on the answer sheet with a cross*** (×) *in accordance with the instructions given in the back of the answer sheet.*
* *Use of calculators is not allowed.*

1. Which of the following chair designs best promotes ergonomic posture for a prolonged computer user?
   (1) Chair with a straight backrest and no armrests
   (2) Chair with lumbar support and adjustable armrests
   (3) Chair with no backrest and no armrests
   (4) Chair with a reclining backrest but no seat height adjustment
   (5) Chair with a hard, flat seat and fixed armrests

2. Which answer shows the correct third angle projection views of the given isometric view?





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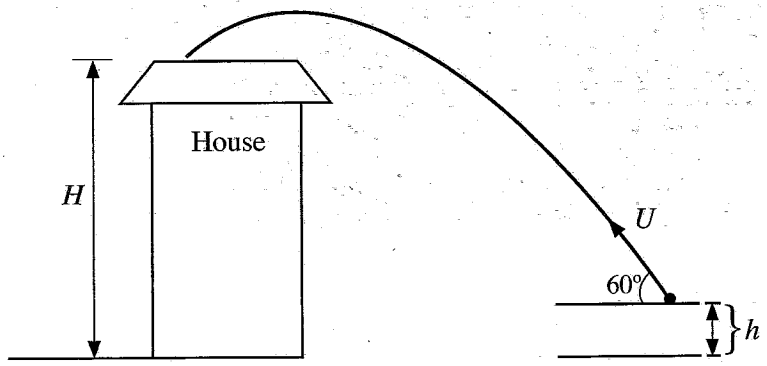
3. A person throw a ball from h height above the ground. Its initial velocity U is as shown in the figure. The ball fell onto a roof of a nearby house. The height from ground to roof is H. The time taken for the motion is t. (gravitational acceleration - g)



Which option shows the correct height (H) of the house from ground to roof?

(1) $H = 2\ h + U\ t \sin 60$

(2) $H = U\ t \cos 60$

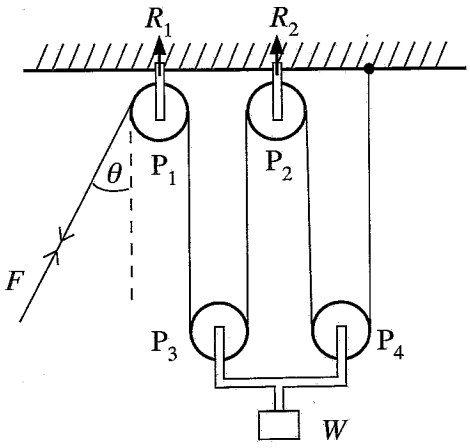
(3) $H = U\ t \sin 60 + \frac{1}{2} gt^2$

(4) $H = U\ t \cos 60 - \frac{1}{2} gt^2$

(5) $H = h + U\ t \sin 60 - \frac{1}{2} gt^2$

● Answer the questions No. **4** and **5** using below figure.

A frictionless pulley system is shown in the figure. Assume the cable is non- elastic. Neglect the weight of pulleys and the cable. F is the minimum force to keep the system equilibrium.



4. The correct statement about the above pulley system is

(1) $F = \frac{W}{4}$. (2) $F = W$. (3) $7F = \frac{1}{2}W$.

(4) $F = 4W$. (5) $3F = 2W$.

5. R_1 and R_2 are reaction forces from the pulleys P_1 and P_2. R_1 and R_2 respectively are,

(1) $2F \cos\theta$, $2F$.

(2) $F \cos\theta$, F .

(3) $F + F \cos\theta$, $2F$.

(4) F, $2F \cos\theta$.

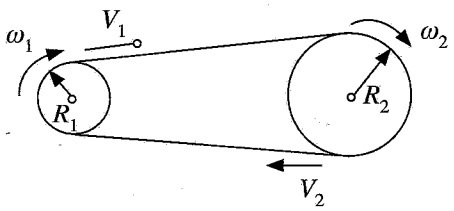
(5) $F \sin\theta$, $2F$.

[See page three

6. Which answer gives the correct unit of below physical quantities?

	luminous intensity	Solid angle	Frequency
(1)	S	C	W
(2)	cd	Sr	Hz
(3)	Sr	rad	S
(4)	cd	S	Hz
(5)	Sr	rad	cd

7.



A belt drive is given in the figure. If the belt weight is **not** considered, which statement is correct?

(1) $V_1 = V_2$, $\frac{R_1}{R_2} = \frac{\omega_2}{\omega_1}$

(2) $V_1 > V_2$, $\frac{R_1}{R_2} = \frac{\omega_1}{\omega_2}$

(3) $V_1 = V_2$, $R_1R_2 = \omega_1\omega_2$

(4) $V_1 < V_2$, $\frac{1}{R_1R_2} = \omega_1\omega_2$

(5) $V_1 < V_2$, $R_1\omega_2 = R_2\omega_1$

8. Select the correct statement relevant to the building regulations of Sri Lanka.

(1) There is no minimum site area requirement for the construction of a house in a land.

(2) In general, the maximum plot coverage by a house in a land is 33.3%.

(3) The minimum rear open space distance that should be provided for a single storey house is 3m.

(4) Construction boundary wall shall only be permitted along the building line of a land.

(5) The minimum height of bed rooms and living rooms shall be maintained as 2.7 m unless those are mechanically ventilated.

9. What is **not** an attribute of a successful entrepreneur?

(1) Flexibility (2) Self awareness (3) Dedication
(4) Leadership (5) Risk free approach

10. Consider the following statements.

A - Sulphuric acid is primarily used to make phosphoric acid in industrial applications.
B - Sodium hydroxide is one of the top five most common industrial chemicals.
C - Ammonia is only artificially produced and not found naturally in the environment.
D - Ethylene is commonly used in the food industry for quick-cooling processes.

Out of the above, what are true regarding chemicals used in industries?

(1) *A* and *B* only.
(2) *A* and *D* only.
(3) *B* and *D* only.
(4) *A*, *B* and *C* only.
(5) *A*, *B*, *C* and *D* all.

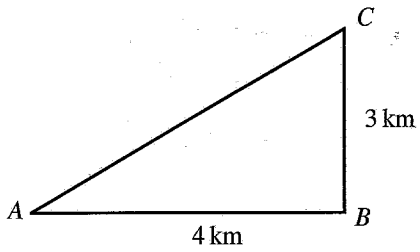
[*See page four*

11. A father has divided his land with an extent of 5 hectares and 100 m^2 among his two sons. The elder got an extent of 2 hectares and 50 m^2. What is the extent of land given to the younger son in acres and perches?

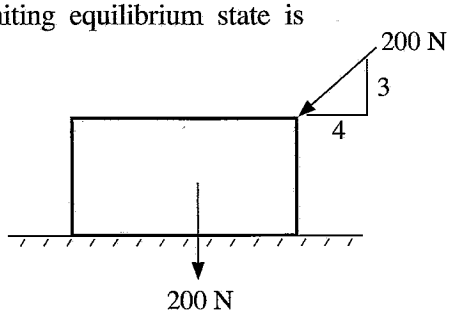
(1) 6 acres and 10 perches. (2) 7 acres and 68 perches.
(3) 8 acres and 65 perches. (4) 9 acres and 72 perches.
(5) 10 acres and 13 perches.

12. The figure shows right triangle *ABC*. Calculate the length of *AC* in miles.

(1) 2.9 miles (2) 3 miles (3) 3.1 miles
(4) 3.2 miles (5) 3.3 miles



13. A uniform crate has a weight of 200 N (approximately equal to 20 kg) and it is pushed with a force of 200 N (refer figure). Coefficient of static friction between the crate and ground is 0.25. The friction force at the limiting equilibrium state is



(1) 20 N. (2) 24 N. (3) 80 N. (4) 95 N. (5) 160 N.

14. A concrete mix of 1:3:6 (20 mm) is recommended to concreting in

(1) slabs. (2) beams. (3) columns.
(4) foundations. (5) lean concrete work.

15. Consider the following statements regarding trusses.

A - Trusses are used in building roofs and bridges.
B - Steel and timber are used in truss construction.
C - When the truss span is larger, truss height also higher.
D - Bottom chord of a truss is subjected to tensile forces.

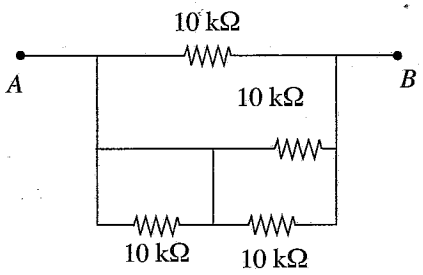
Which of the above statements are true?

(1) *A*, *B* and *C* only
(2) *A*, *B* and *D* only
(3) *A*, *C* and *D* only
(4) *D*, *B* and *C* only
(5) *A*, *B*, *C* and *D* only

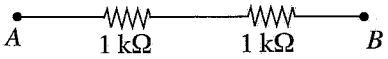
[*See page five*

16. A group of students is observing about a resistor bank with highest resistance between *A* and *B*. Select the suitable resistor network.

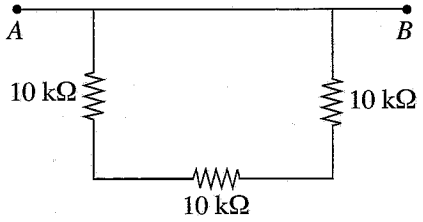
(1)



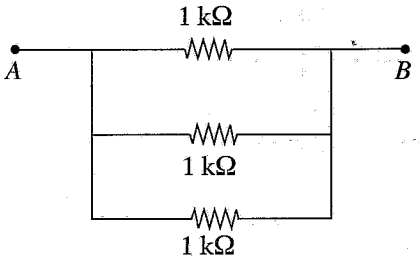
(2)



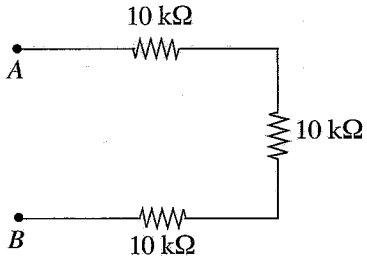
(3)



(4)



(5)



17. A resistor of 10 Ω is connected to a DC source. Its power dissipation is 250 W. What is the voltage of the source?

(1) 5 V (2) 25 V (3) 50 V (4) 100 V (5) 500 V

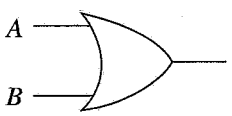
18. What is the item which is **not** included in a domestic electrical installation?

(1) bulb (2) socket outlet (3) switch
(4) two way switch (5) oscilloscope

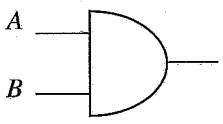
19. Select the logic gate for the following truth table.

Inputs		Outputs
A	*B*	
0	1	1
1	0	1
1	1	1
0	0	0

(1)



(2)



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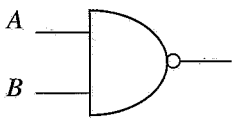
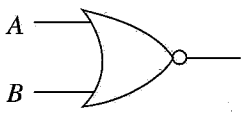
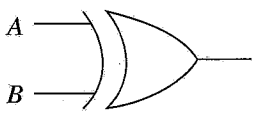


(4)



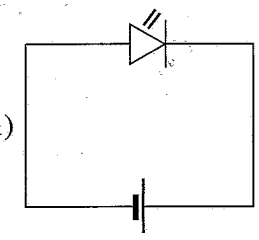
(5)



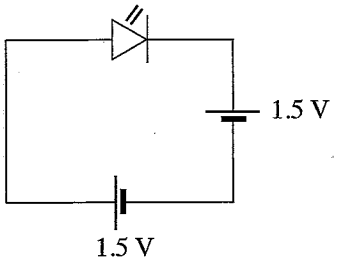
[*See page six*

20. From the following circuits which one demonstrate the LED is on?

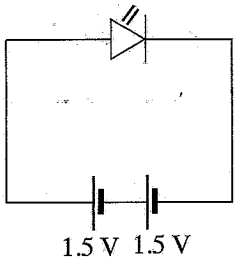
(1)



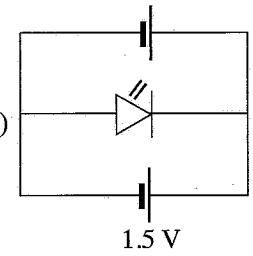
(2)



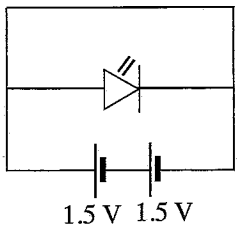
(3)



(4)



(5)

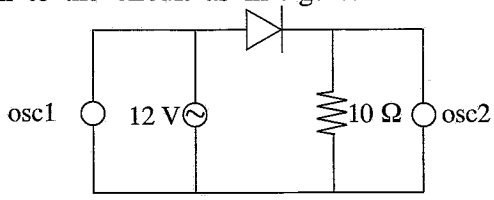


21. What are the SI units used for electrical power and energy respectively?

(1) W , J (2) V , A (3) W , A

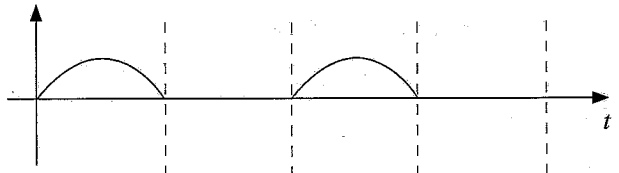
(4) kg m s^{-1} , N m s^{-2} (5) V , m s^{-1}

- Considering following rectifier circuit and answer the questions **22** and **23**. Two oscilloscopes (osc1 and osc2) are connected in to the circuit as in figure.

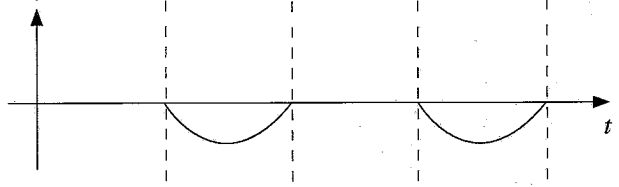


22. What is the correct waveform of the first oscilloscope osc1?

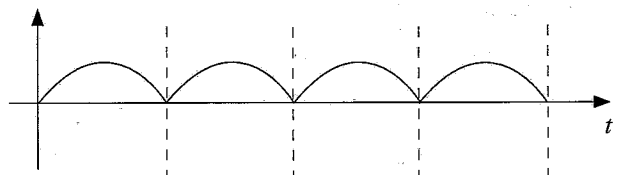
(1)



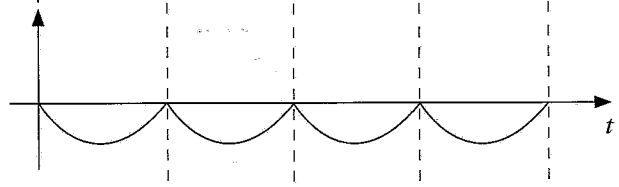
(2)



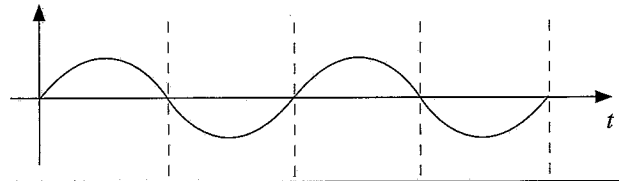
(3)



(4)

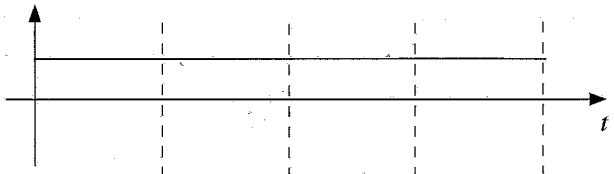


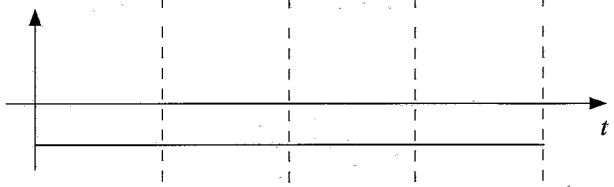
(5)

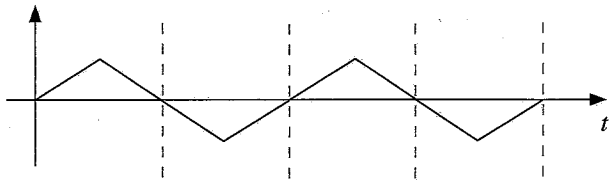


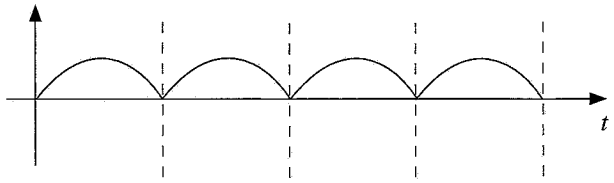
[See page seven

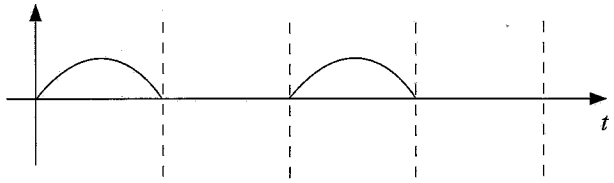
23. What is the correct waveform of the second oscilloscope osc2?

(1) 

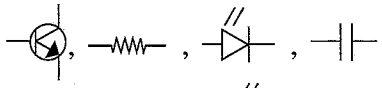
(2) 

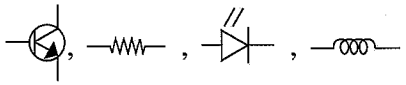
(3) 

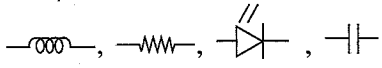
(4) 

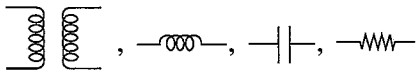
(5) 

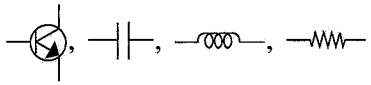
24. Student group is working on identifying transistor, resistor, light emitting diode and capacitor in a circuit. What is the answer with the correct item symbols in order?

(1) 

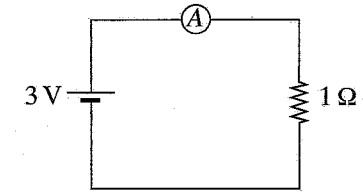
(2) 

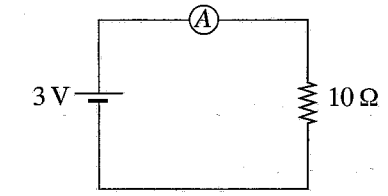
(3) 

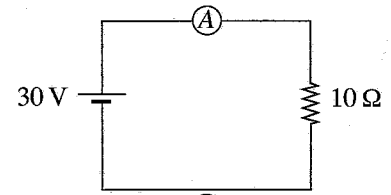
(4) 

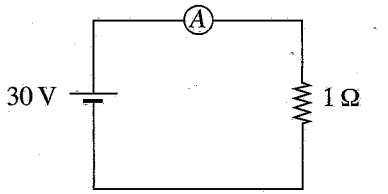
(5) 

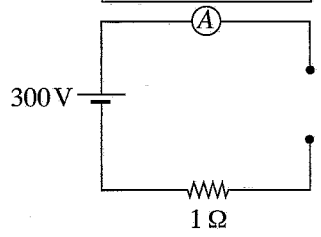
25. Out of the following figures, which shows the correct highest ammeter reading?

(1) 

(2) 

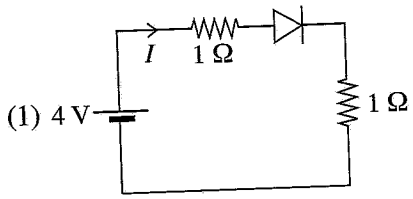
(3) 

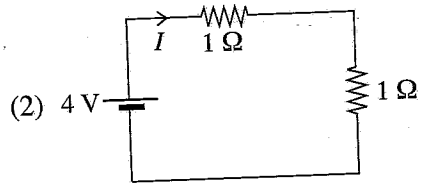
(4) 

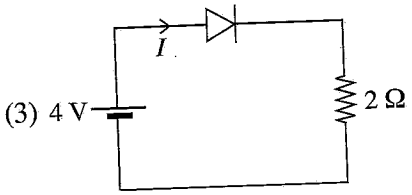
(5) 

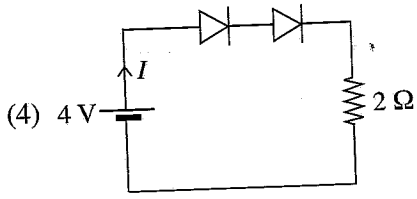
[See page eight

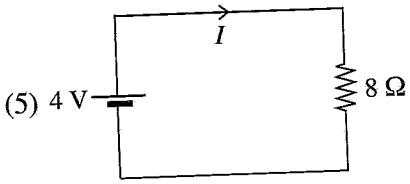
26. Following circuits are prepared by students. What is the circuit with lowest circuit current I, when Diode is **not** ideal?

(1) 

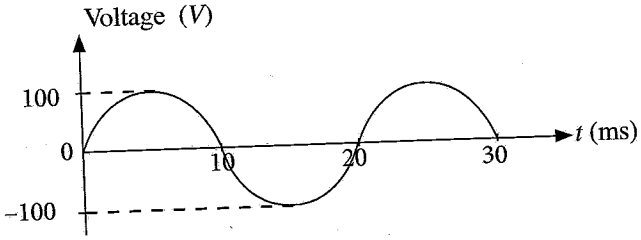
(2) 

(3) 

(4) 

(5) 

- Answer following questions **27** and **28** by considering AC waveform.



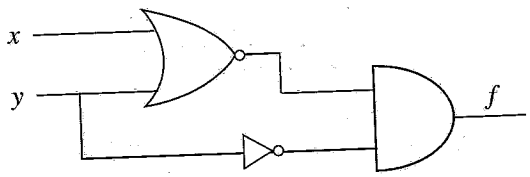
27. According to the above graph, what is the root mean square value of the voltage?

(1) 0.707 V (2) 7.07 V (3) 70.7 V (4) 100 $\sqrt{2}$ V (5) 200 V

28. What is the frequency of above waveform?

(1) 5 Hz (2) 10 Hz (3) 25 Hz
(4) 50 Hz (5) 100 Hz

29. A simple digital circuit is shown below. What is the correct Boolean expression for the output f?

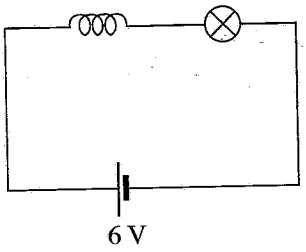


(1) $(\overline{x+y})\cdot\overline{y}$
(2) $\overline{xy}+\overline{y}$
(3) $\overline{\overline{xy}+\overline{y}}$
(4) $xy+\overline{y}$
(5) $(x+y)+\overline{y}$

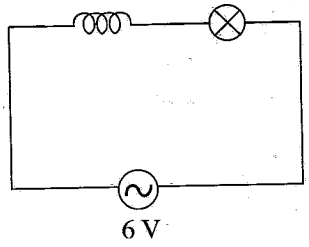
[See page nine

30. Out of the following circuits, what is the circuit that bulb is **not** continuously working?

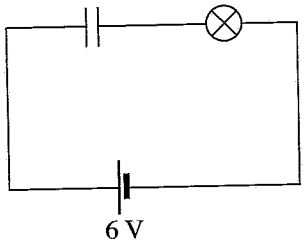
(1)



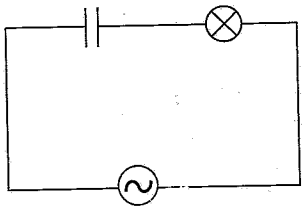
(2)



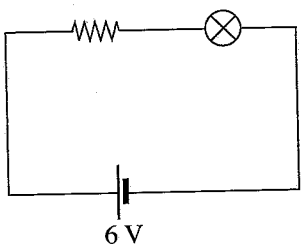
(3)



(4)



(5)



31. A 100 m long conductor with a cross section of 0.1 mm^2 has a resistance of 50 Ω. What is the resistivity of the conductor material?

(1) 1×10^{-8} Ωm (2) 2×10^{-8} Ωm (3) 5×10^{-8} Ωm
(4) 2×10^{8} Ωm (5) 5×10^{8} Ωm

32. Out of the below components, which item is **not** used in computer networks?

(1) network switch (2) hub (3) network cable
(4) server (5) ammeter

33. Consider the following statements regarding power factor ($\cos\phi$) of a load which is connected to an Alternative Current (AC) supply.

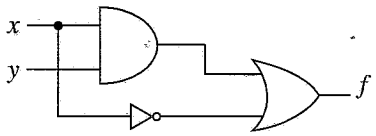
A - The active power consumption of the load is $VI\sin\phi$ (V, I and $\cos\phi$ are supply voltage, current and power factor respectively.)
B - Power factor can be improved by adding capacitor banks.
C - Reactive power is zero when power factor is 1.

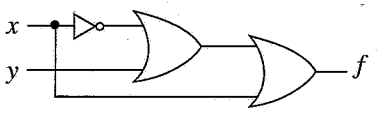
From the above, the correct statements is/are

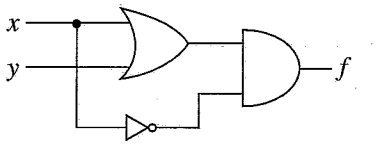
(1) *A* only. (2) *A* and *B* only. (3) *A* and *C* only.
(4) *B* and *C* only. (5) *A*, *B* and *C* all.

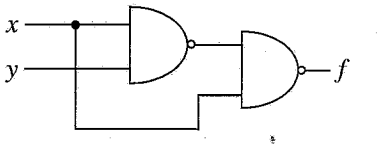
[*See page ten*

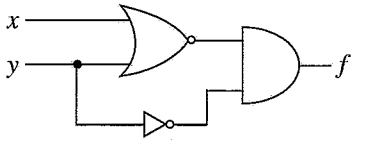
34. What is the correct digital circuit that implements the Boolean function $f=(x+y)\cdot\bar{x}$?

(1) 

(2) 

(3) 

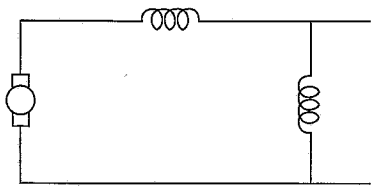
(4) 

(5) 

35. The voltage used in electric power distribution systems is

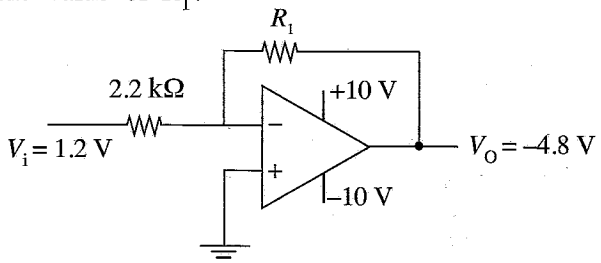
(1) 33 kV. (2) 132 kV. (3) 230 kV. (4) 300 kV. (5) 345 kV.

36. Following figure shows the connection of field winding and armature winding of a Direct Current (DC) motor. Select the correct type of the motor.



(1) DC series motor
(2) DC shunt motor
(3) DC compound motor
(4) Permanent magnet motor
(5) Squirrel cage motor

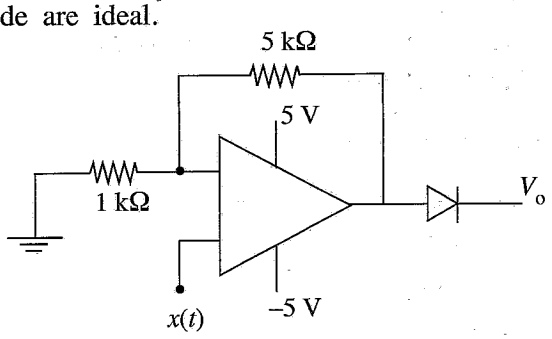
37. The input and output voltages of the below operational amplifier circuit is 1.2 V and –4.8 V, respectively. What is the value of R_1?

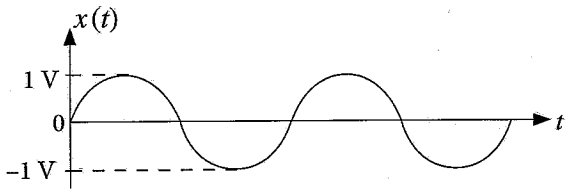


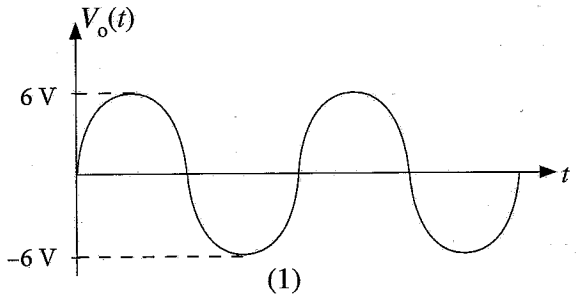
(1) 2.2 kΩ (2) 4.8 kΩ (3) 8.8 Ω (4) 8.8 kΩ (5) 525 Ω

[See page eleven

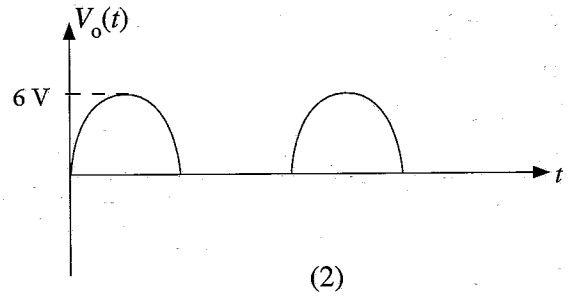
38. Consider the operational amplifier circuit shown below. A sinusoidal wave $x(t)$ is applied as the input of the signal. What is the correct waveform of the output signal? Assume that both operational amplifier and the diode are ideal.



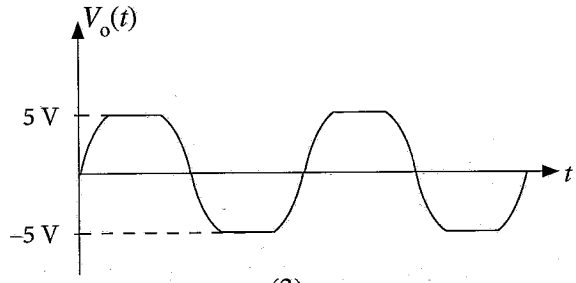




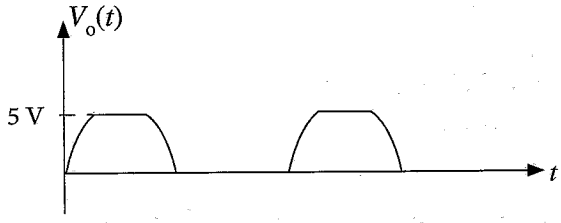
(1)



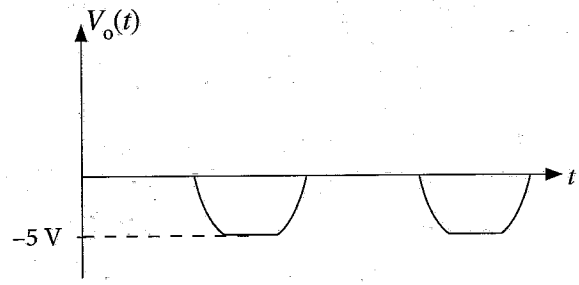
(2)



(3)



(4)



(5)

39. What is the correct expression regarding an ideal operational amplifier?

(1) The input impedance is zero.

(2) The output impedance is zero.

(3) The open-loop gain is 10^5.

(4) The bandwidth is 1 GHz.

(5) The output voltage can be infinite.

[*See page twelve*

40. Why are wires with larger cross section areas typically used for current transmission wires over long distances?

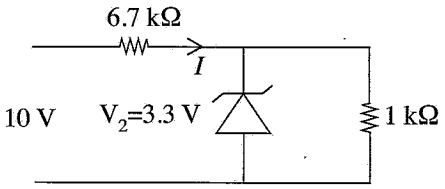
(1) To increase the current flow through the wire.
(2) To reduce resistance and minimize power loss due to heating.
(3) To prevent voltage drop at higher frequencies.
(4) To decrease the weight of the transmission wires.
(5) To increase the voltage handled by the wire.

41. What is the **wrong** expression regarding a BJT transistor?

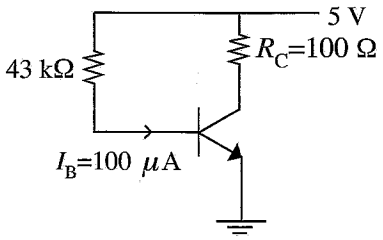
(1) A BJT transistor can act as a switch.
(2) A BJT transistor can act as an amplifier.
(3) When a BJT transistor operates in the active region, V_{CE} is always zero.
(4) $I_C = \beta I_B$ when a BJT transistor operates in the active region.
(5) $I_C < \beta I_B$ when a BJT transistor operates in the saturated region.

42. What is the current I flowing through the 6.7 kΩ resistor.

(1) 1 μA
(2) 1 mA
(3) 3.3 mA
(4) 6.7 mA
(5) 10 μA



43. Consider the simple, transistor circuit shown below.



If $I_B = 100\ \mu A$, $R_C = 100\ \Omega$ and $\beta = 100$, what is V_{CE}? Assume that the transistor operates in the active region.

(1) 0 V (2) 1 V (3) 2.5 V (4) 4 V (5) 5 V

44. Two point charges, $q_1 = +3\mu C$ and $q_2 = -5\mu C$, are placed 10 cm apart in a vacuum. A third charge, $q_3 = +2\mu C$, is placed 5 cm from q_1 and 5 cm from q_2 along the line joining them. What is the net electrostatic force acting on q_3? [Ke = 9×10^9 N m^2/C^{-2}]

(1) 28.8 N (2) 54 N (3) 57.6 N (4) 108 N (5) 156 N

45. A 200 W rated resistor has a potential difference of 30 V applied across it. The total charge is 90 C, through the resistor in 15 seconds. How much energy is dissipated by the resistor during this time?

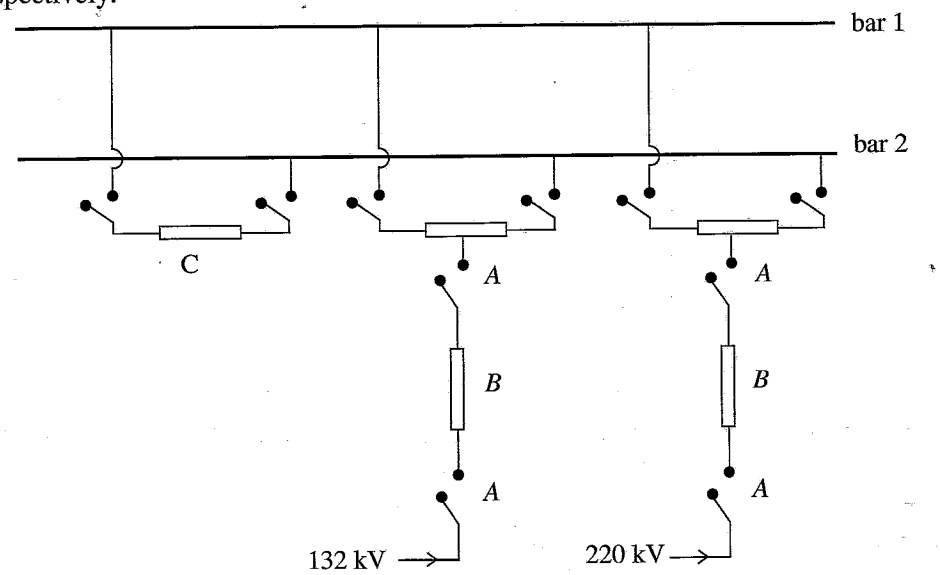
(1) 0 (2) 1.8×10^3J (3) 2.7×10^3J (4) 3.6×10^3J (5) 4.5×10^3J

46. What is the primary difference between a Miniature Circuit Breaker (MCB) and a Residual Current Circuit Breaker (RCCB)?

(1) MCBs protect against overloads and short circuits, while RCCBs protect against earth faults by detecting current leakage.
(2) MCBs only detect voltage surges, while RCCBs also provide protection against overcurrent.
(3) MCBs can be reset manually, while RCCBs can only be replaced once tripped.
(4) MCBs are used only in residential applications, while RCCBs are used exclusively in industrial settings.
(5) MCBs have a higher tripping current than RCCBs, making them less sensitive to electrical faults.

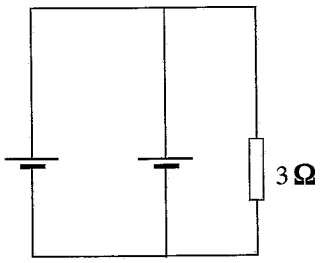
[*See page thirteen*

47. Single line diagram of a double bus bars in a grid substation is given below. Identify items *A*, *B* and *C* respectively.



(1) Isolator, Circuit breaker, Tie breaker
(2) Circuit breaker, Isolator, Tie breaker
(3) Isolator, Circuit breaker, Transformer
(4) Isolator, Transformer, Circuit breaker
(5) Isolator, Transformer, Bus bar

48. Two identical batteries, each with eletromotive force (emf) of 2 V and an internal resistance of 1.5 Ω, are connected in parallel. A resistor of 3 Ω is also connected in parallel with this combination.

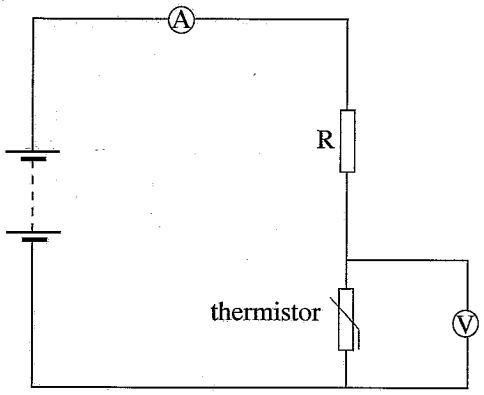


What is the current flowing through the 3 Ω resistor?
(1) 0.37 A (2) 0.53 A (3) 0.75 A (4) 1 A (5) 4 A

49. Two resistors R_1 and R_2 are connected in series with a voltage source of 12 V (which does not have an internal resistance) and the power loss was, 9 W. When they are connected in parallel to the same voltage source, the power loss was, 48 W. What is the largest resistance can obtain by R_1 or R_2?
(1) 3 kΩ (2) 4 Ω (3) 12 Ω (4) 16 Ω (5) 144 Ω

[*See page fourteen*

50. The diagram shows a temperature sensitive circuit. (The thermistor resistance increases when the temperature decreases)



Which of the following correctly indicate the change of the ammeter reading and the voltmeter reading, when the temperature of the thermistor is reduced?

	Ammeter reading	**Voltmeter reading**
(1)	increases	constant
(2)	increases	decreases
(3)	constant	decreases
(4)	decreases	increases
(5)	constant	increases

* * *

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2024
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2024
General Certificate of Education (Adv. Level) Examination, 2024

විදුලිය, ඉලෙක්ට්‍රොනික හා තොරතුරු තාක්ෂණවේදය II மின், இலத்திரன் தகவல் தொழினுட்பவியல் II **Electrical, Electronic and Information Technology II**	**16 E II**	*පැය තුනයි* *மூன்று மணித்தியாலம்* ***Three hours***

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

අමතර කියවීම් කාලය - මිනිත්තු 10 යි
மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள்
Additional Reading Time - 10 minutes

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

Index No. : .....

Important :

- *This question paper consists of* **11** *pages.*
- *This question paper comprises* ***Parts*** **A**, **B** *and* **C**. *The time allotted for* ***all parts*** *is* ***three hours***. *(Use of calculators is* ***not*** *allowed.)*

Part A - Structured Essay (08 pages)

- *Answer* ***all*** *the questions on this paper* ***itself***.
- *Write your answers in the space provided for each question. Note that the space provided is sufficient for your answers and that extensive answers are not expected.*

Part B and C - Essay (03 pages)

- *Select* ***two*** *questions from each of the parts* **B** *and* **C** *and answer* ***four*** *questions only. Use the papers supplied for this purpose.*
- *At the end of the time allotted for this paper, tie the* ***three parts*** *together so that* ***Part*** **A** *is on the top of* ***Part*** **B** ***and*** **C** *before handing over to the supervisor.*
- *You are permitted to remove only* ***Parts*** **B** ***and*** **C** *of the question paper from the Examination Hall.*

For Examiner's Use Only

Part	Q. No.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
C	8	
	9	
	10	
Total		

Total

In Numbers	
In Words	

Code Numbers

Marking Examiner 1	
Marking Examiner 2	
Checked by	
Supervised by	

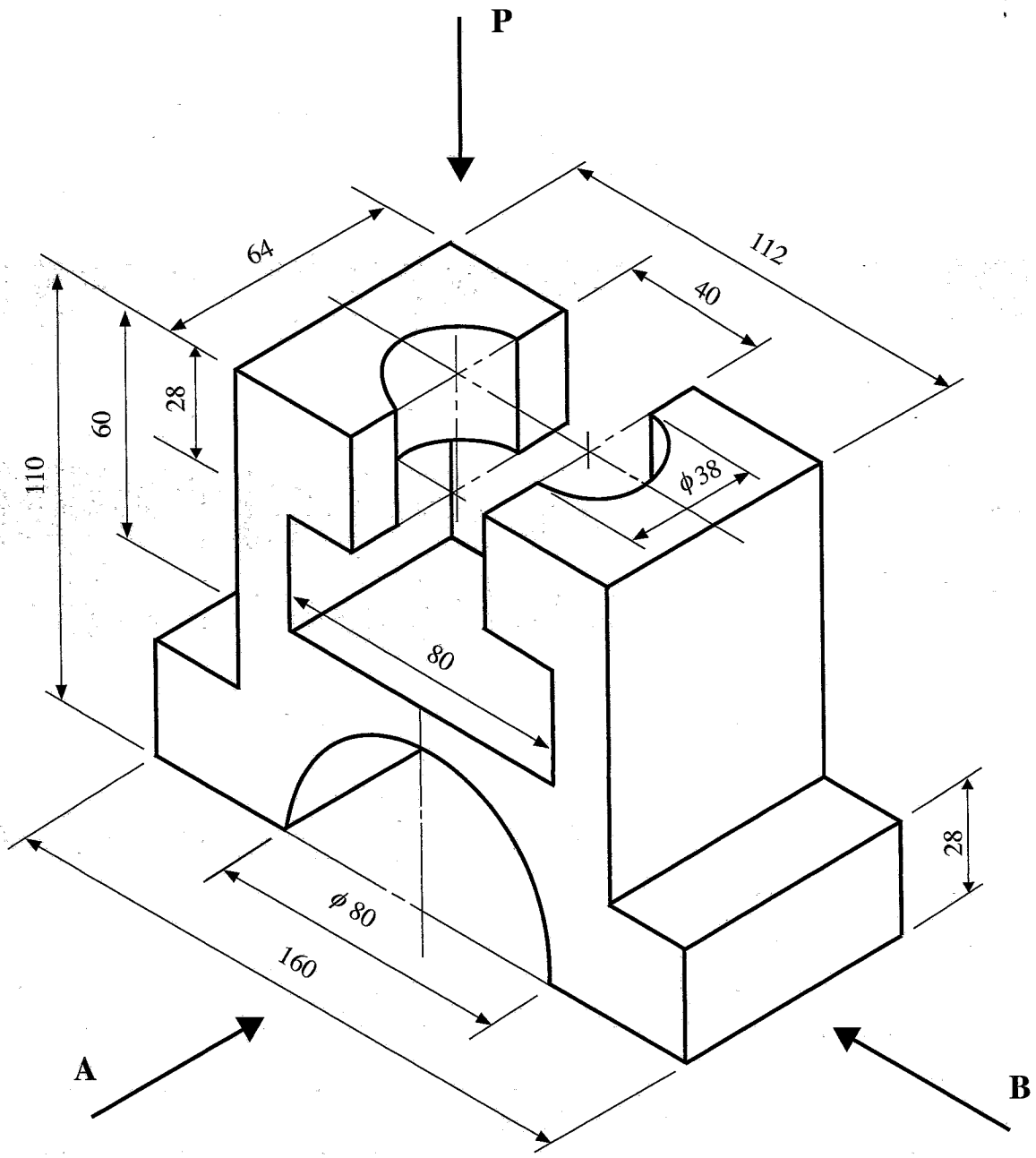
[see page two

PART A — Structured Essay

*Answer **all four** questions on this **paper itself**.*
*(Each question carries **10** marks)*

Do not write in this column

1. Draw the third-angle orthogonal projection views of the isometric view given in the figure using an appropriate scale. Indicate all relevant dimensions. Use the graph papers given on pages 3 and 4. All dimensions are in millimetres. The figure is not drawn in to scale.



(a) Front elevation looking from **A**

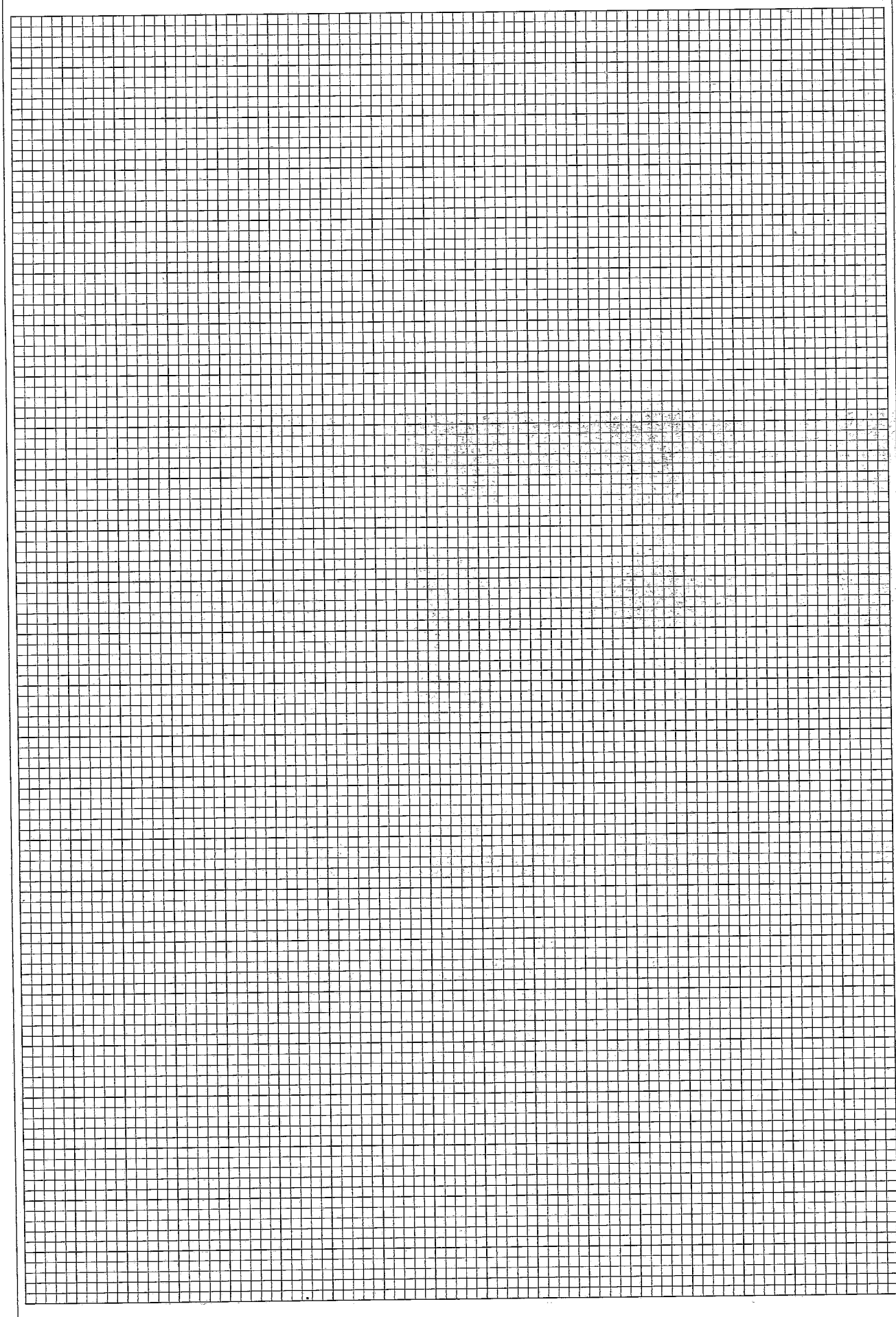
(b) End elevation looking from **B**

(c) The plan view of **P**

[see page three

0122

[see page four



[see page five

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2. There is a proposal to convert electronics laboratory of *ABC* school to a smart learning environment. Assume that you are appointed as the relevant technical officer for this project.

(a) (i) Forty laptop computers are to be purchased. Write suitable specification for the laptops.

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(ii) List **three** software for a laptop.

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(b) The school is planning to provide internet access to each laptop. List **two** suitable methods for this purpose.

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(c) There is a plan to describe the laboratory work by a teacher using examples, connections and operations through modern tools.

(i) State **one** hardware item for this purpose.

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(ii) Suggest **one** approach for interactively editing laboratory reports with the student groups.

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(d) Facilities will be available to conduct interactive sessions by external experts in realtime remotely. The experts will conduct sessions from their places and students will be in smart learning environment.

(i) State **two** hardware items required for facilitating this.

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(ii) State **one** possible software tool for above (d) (i).

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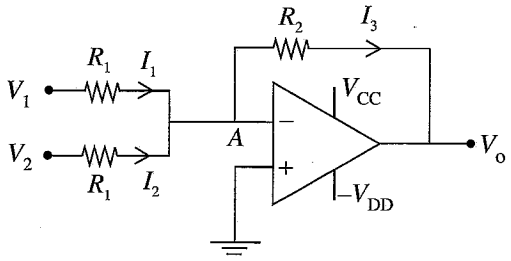
3. An operational amplifier circuit containing two voltage inputs V_1 and V_2 is shown below. Here, V_o is the output. Assume that the operational amplifier is ideal and V_{CC} and V_{DD} values are much greater than V_1 and V_2 values.



(a) With proper justification determine the voltage at the point A.

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(b) Express the currents I_1, I_2 and I_3 in terms of V_1, V_2, V_o, R_1 and R_2.

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(c) By using the expressions for currents I_1, I_2 and I_3, derive an expression for V_o in terms of V_1, V_2, R_1 and R_2.

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(d) If R_1 = 10 kΩ, R_2 = 25 kΩ, V_1 = –2 V and V_2 = –3 V, determine V_o.

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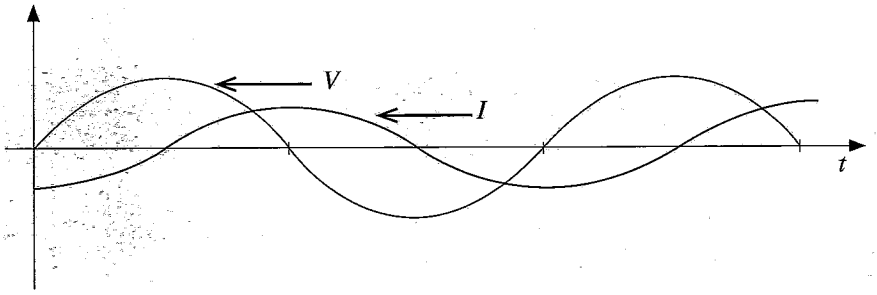
4. A group of students is starting an experiment to identify the behaviour of following electrical items and their combinations. Assume following items are available.

- Adjustable DC voltage source
- Adjustable AC voltage source
- resistors
- capacitors
- inductors
- voltmeters, ammeters and multichannel oscilloscope

(a) Students observed the following voltage and current waveform across a load using an oscilloscope.



(i) Sketch the complete circuit diagram for above (a).

(ii) Indicate the oscilloscope voltage probe and current probe connections in answer of section (i).

(iii) State the type of circuit and whether the load is inductive or capacitive.

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(iv) State a method to reduce the phase difference between voltage and current waveforms. Do not write in this column

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(v) Redraw the circuit by considering the modification suggested in part (iv).

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கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2024
General Certificate of Education (Adv. Level) Examination, 2024

විදුලිය, ඉලෙක්ට්‍රොනික හා තොරතුරු තාක්ෂණවේදය II
மின், இலத்திரன் தகவல் தொழினுட்பவியல் II
Electrical, Electronic and Information Technology II

16 E II

Essay

* *Select* ***two*** *questions from each of the* ***Parts*** **B** *and* **C** *and answer* ***four*** *questions only.*
(Each question carries ***15*** *marks.)*

Part B

5. Use of advanced technologies such as robotics has become popular in the modern agriculture. Drones are used to distribute pesticides, weddicides and fertilizer and also monitoring plant health and variety of other tasks.

(a) State **two** other modern technologies that are used presently in agriculture.

(b) Briefly explain **three** advantages of using modern technologies in agriculture.

(c) Explain **two** barriers to use such advanced technologies in the Sri Lankan context.

(d) Propose **two** suggestions to overcome above barriers mentioned in (c).

6. Sri Lanka has been experiencing many severe floods in the recent history that have caused significant damages to infrastructures, communities and the economy. These floods are influenced by both natural and human-made factors, highlighting the country's vulnerability to extreme weather events.

(a) State **two** natural and **two** human activities that contributed to the recent floods in Sri Lanka.

(b) Explain the social, economic and environmental impacts occurred due to recent floods in Sri Lanka.

(c) Describe **two** measures implemented by the relevant authorities in response to those floods with effectiveness of these measures and highlighting challenges faced in their implementation.

(d) Propose a long-term strategy to mitigate the impact of future floods in Sri Lanka and explain its potential benefits.

7. The available energy sources and their effective use are critical in achieving sustainable development.

(a) List **five** energy sources that are currently used in Sri Lanka.

(b) Briefly describe pros and cons of **three** energy sources from above (a).

(c) Critically evaluate how we could use energy sources by considering **two** examples. Use relevant sketches of machines and setups related to operation. Clearly label the components.

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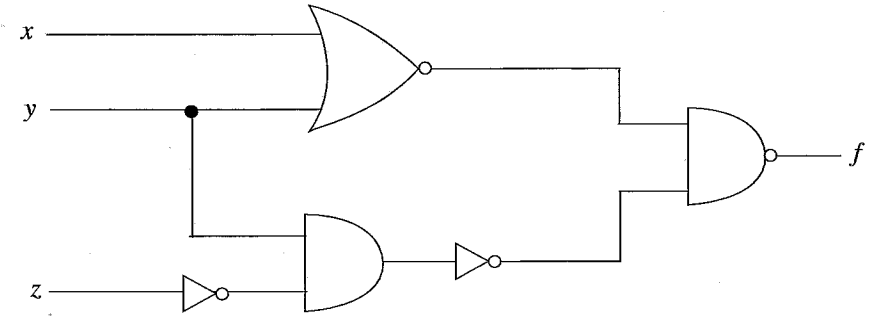
Part C

8. (a) A combinational logic circuit consisting of NOT, AND, NAND and NOR gates is shown below. Here, x, y and z are the inputs and f is the output.

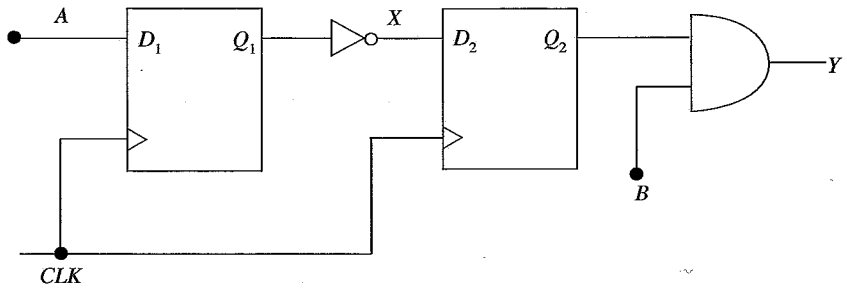


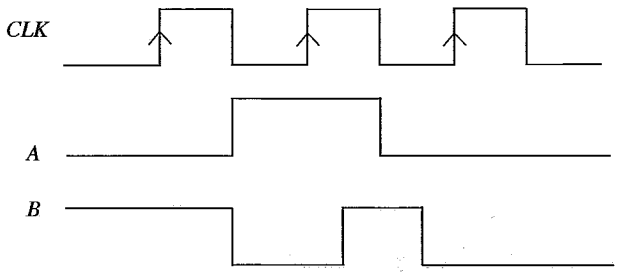
(i) Derive the Boolean expression for the output (f) of the circuit.

(ii) Construct the truth table corresponding to the Boolean expression obtained in above part (i).

(iii) Briefly explain whether the above circuit can be implemented using only NOT, NAND and NOR gates (without the AND gate).

(b) A simple sequential logic circuit consisting of two D-flip-flops is shown below. Both flip-flops are positive-edge triggered and are initially at logic '0'. Draw the signals X and Y for the input signals A and B and the signal CLK given below.





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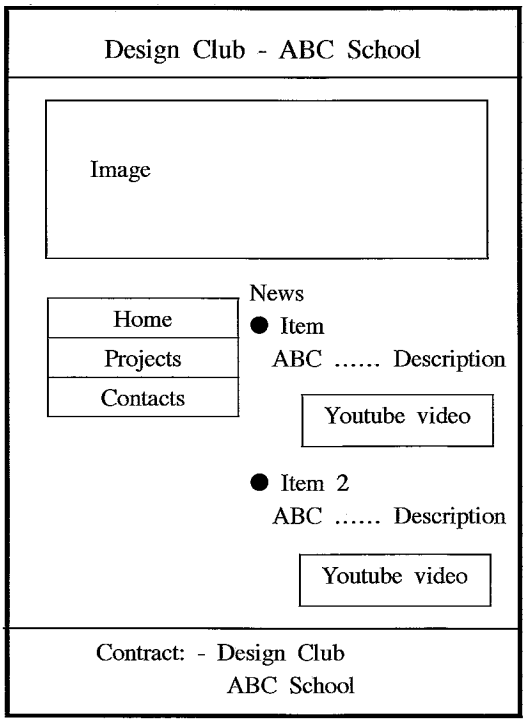
9. You are requested to design a website for 'Design club' of your school using HTML codes. The design for the web page is given below.



(a) Write the programme with HTML tags.

(b) You are requested to link relevant social media pages to News items. Write the additional HTML tags for this purpose.

(c) There is another request to link new web based artificial intelligence tools such as 'chatGPT', 'Hugging Face', etc. Prepare a design of a separate web page including introduction to these tools, introductory videos, links. Note that exact web links and names are not required.

10. (a) Briefly describe about the two main components, stator and rotor in an induction motor.

(b) Induction motos can be found to be used in many household applications such as fans and refrigerators. What are the advantages of using them in such applications?

(c) Name and briefly describe **three** types of starting mechanisms in single phase induction motor.

(d) Given below are the details about a single phase induction motor when it is serving a load.

Input Voltage: 230 V (single-phase)
Input Current: 8 A
Efficiency: 85%
Power Factor: 0.8
Motor Speed: 1440 rpm
Rated Power: 1.5 kW
Number of poles: 4
Supply frequency: 50 Hz

(i) Calculate the input power of the motor.

(ii) Calculate the output power of the motor.

(iii) Calculate the power loss that is happening in the motor.

(iv) Calculate the synchronous speed and the percentage slip.

(v) If the power factor improves to 0.9, calculate the new input power and output power.

(vi) What is the torque provided by the rotor at power factor 0.9?

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