AL/2020/16/E-I (NEW/OLD)

නව/පැරණි නිර්දේශය – புதிய/பழைய பாடத்திட்டம் – New/Old Syllabus

NEW/OLD

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2020
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2020
General Certificate of Education (Adv. Level) Examination, 2020

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

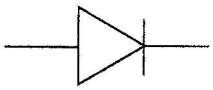
16 E I

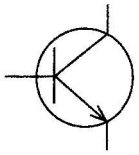
පැය දෙකයි
இரண்டு மணித்தியாலம்
Two hours

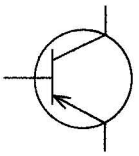
Instructions:

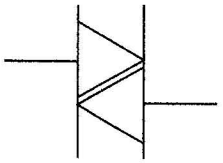
* *Answer **all** the questions.*
* *Write your **Index Number** in the space provided in the answer sheet.*
* *Instructions are given on the back of the answer sheet. Follow them carefully.*
* *In each of the questions **1** to **50**, pick one of the alternatives from (1), (2), (3), (4), (5) which 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.*

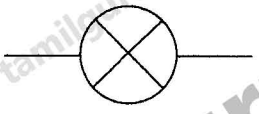
1. Select the symbol which denotes the NPN transistor.

(1) 

(2) 

(3) 

(4) 

(5) 

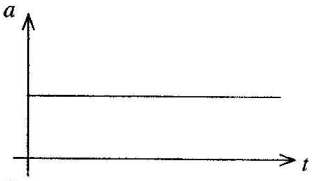
2. What is the nominal frequency of the domestic electricity supply in Sri Lanka?

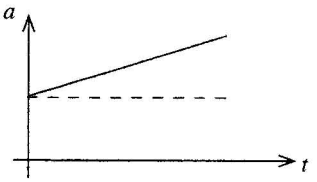
(1) 49.5 Hz (2) 50 Hz (3) 50.5 Hz (4) 55 Hz (5) 60 Hz

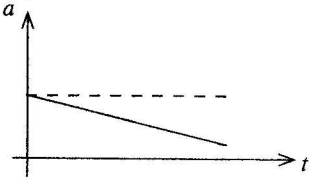
3. Mercury has a Specific Gravity of 13.6. The pressure exerted at the bottom of a 700 mm long mercury column is equal to (consider $g = 9.81\ m\ s^{-2}$)

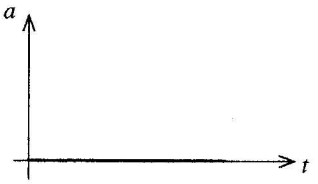
(1) 1 atm. (2) 100 kN. (3) 100 kPa. (4) 93391 Pa. (5) 101396 Pa.

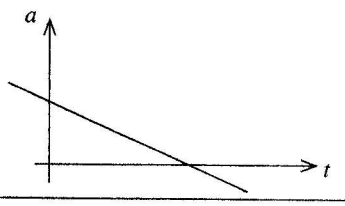
4. A ball is dropped from the top of a tall building. Which of the following acceleration-time graph shows the motion of the ball in air? (Assume that there is no air resistance.)

(1) 

(2) 

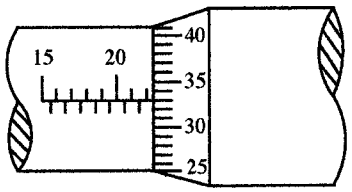
(3) 

(4) 

(5) 

[See page two

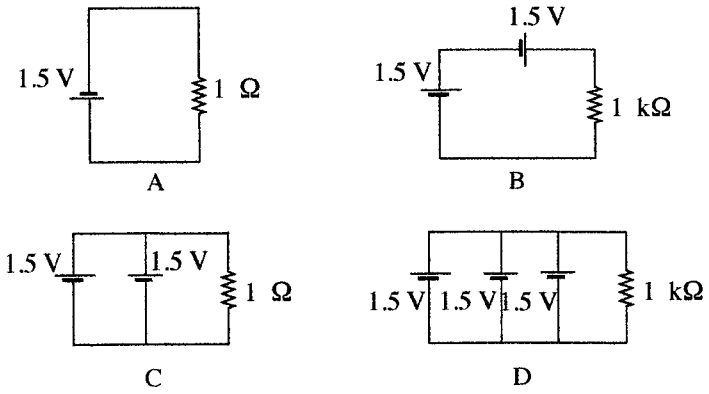
5. Figure shows the measurement of a work piece from a micrometer screw gauge. The micrometer screw gauge has no zero error. The least count of the gauge is 0.01 mm. What is the reading of the micrometer screw gauge as shown in the figure below?



(1) 20.33 mm (2) 20.66 mm (3) 22.33 mm (4) 25.30 mm (5) 22.00 mm

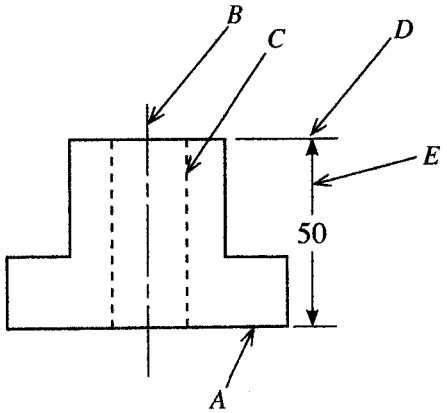
6. Which one is **not** a hardware component of a computer unit?
(1) hard disk (2) keyboard (3) mouse
(4) monitor (5) on-line storage space

7. Consider the following circuit diagrams.



Which of the above circuit/s with lowest current flow?
(1) A only. (2) B only. (3) D only.
(4) A and B only. (5) C and D only.

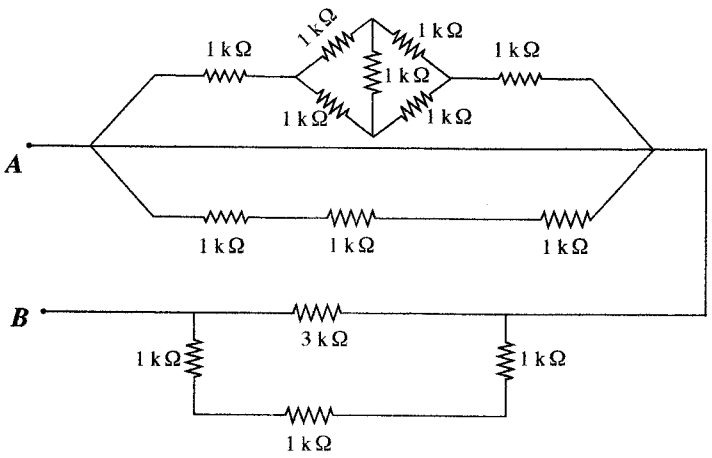
8. The figure shows a projected view of an machine component.



The line types labelled as *A*, *B*, *C*, *D* and *E* respectively are
(1) Part outline, Centerline, Hidden line, Extension line and Dimension line.
(2) Part outline, Centerline, Hidden line, Dimension line and Extension line.
(3) Part outline, Hidden line, Centerline, Extension line and Dimension line.
(4) Part outline, Hidden line, Centerline, Dimension line and Extension line.
(5) Extension line, Centerline, Hidden line, Part outline and Dimension line.

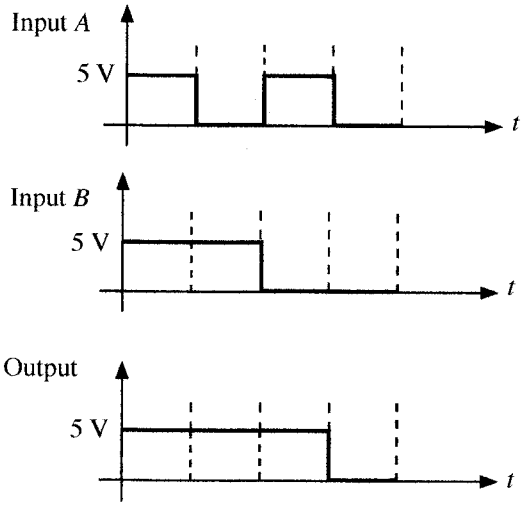
[*See page three*

9. What is the resistance between points ***A*** and ***B*** in the following circuit?



(1) 1.5 kΩ (2) 3 kΩ (3) 6 kΩ (4) 9 kΩ (5) 12 kΩ

10. Consider the following graphs.



Above logic output was observed when Input *A* and Input *B* are connected to its inputs of a logic gate. Here 5 V and 0 V voltages represent logic '1' and logic '0', respectively.

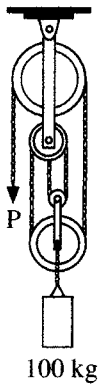
Identify the logic gate referring the above graphs.

(1) AND (2) OR (3) NOT (4) NOR (5) NAND

11. A 100 kg mass is hanging in a frictionless pulley system as shown in the figure. The force in Newton to be applied at the free end (P) in order to keep the system stable is (Neglect the weight of the pulleys, consider the acceleration due to gravity (g) = 9.81 m s^{-2})

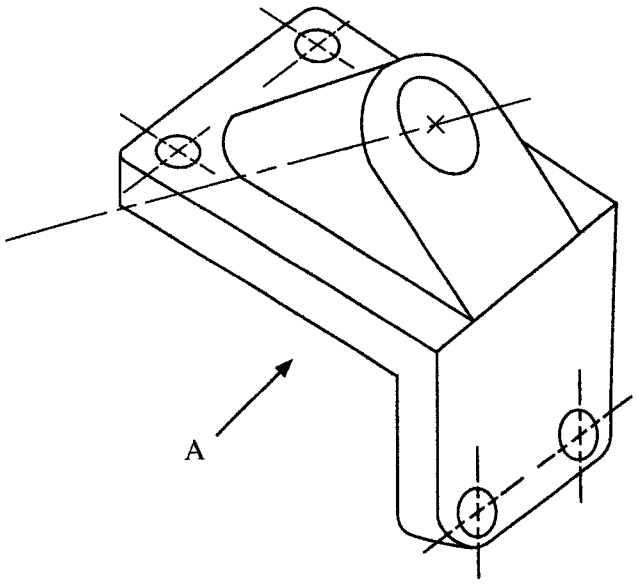
(1) 10g. (2) 25g. (3) 33g.

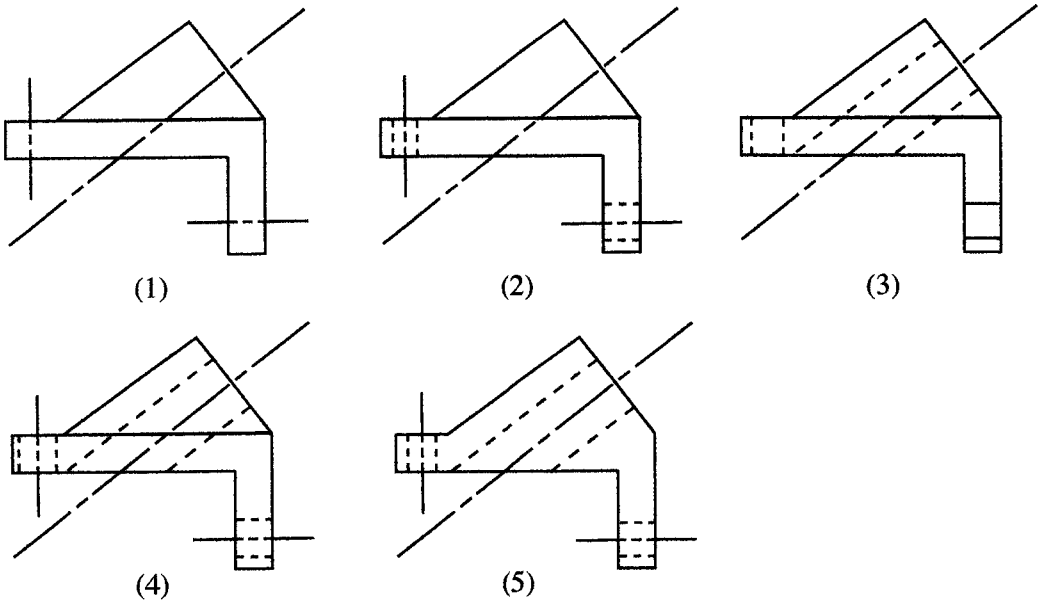
(4) 50g. (5) 100g.



[See page four

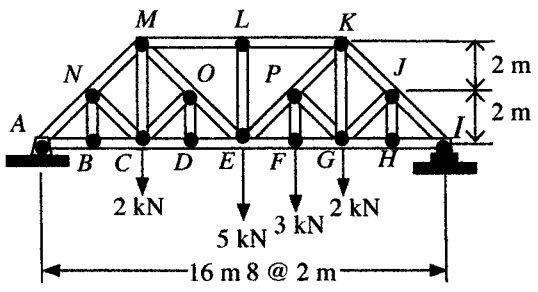
12. Which one shows correct view when projected from direction A?





13. Figure shows a Baltimore truss structure used in a bridge. Following gives some statements of the truss structure.

A - *LE* member force is more than 5 kN.
B - Member forces in *ML* and *LK* are compressive.
C - Member forces in lower chord are tensile.
D - Member *NB* and *NC* increase safety of truss structure.

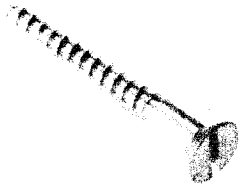


Out of the above statements, the correct statements are,

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

[*See page five*

14. Consider the following statements regarding a typical Brass screw used in a common door hinge which is shown in the figure.



A - Tapered shape helps it to be screwed in, using a screwdriver.
B - The screw is held tight by the frictional resistance of the helical thread.
C - The screw shaft is expected to provide a tensile resistance.
D - The screw shaft is expected to carry the force due to the weight of the door.

Which of the above statements are true regarding its use?

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

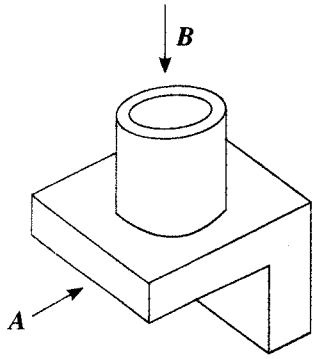
15. Consider the following statements.

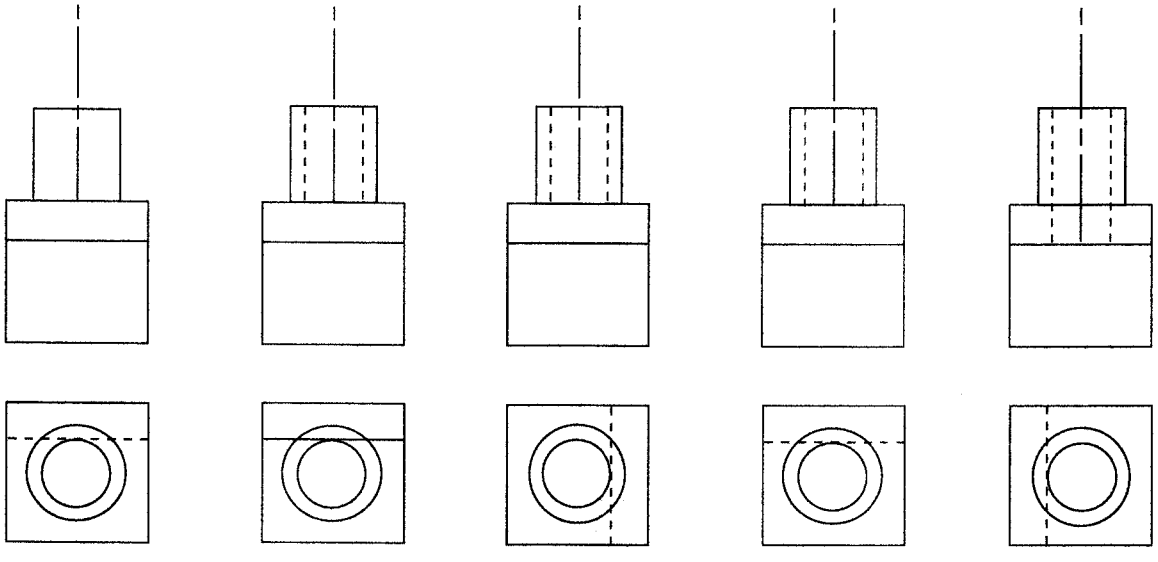
A - Fine carbon particles in human lungs cause respiratory issues.
B - Mercury accumulation in fish.
C - Accumulation of heavy metals in fly-ash heaps due to burning of coal.
D - Motor vehicle emissions building up in birds.

Which of the above statements describe the effects of bioaccumulation?

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

16. The figure shows an isometric view of a bar holder bracket. What are the correct orthographic projections when viewed from arrow ***A*** and ***B*** respectively?

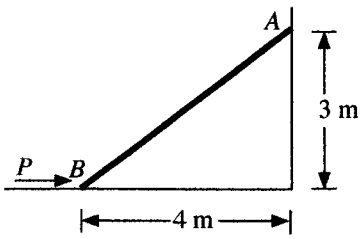




(1) (2) (3) (4) (5)

[See page six

17. 800 N weight rod *AB* positioned as shown in the figure. The contact surface at *B* is smooth, where as the coefficient of static friction (between the rod and the wall) at *A* is 0.2. The minimum force *P* to prevent rod *AB* from sliding is



(1) 221 N. (2) 321 N. (3) 421 N.

(4) 433 N. (5) 533 N.

18. Consider the following statements.

A - When using a meter ruler to measure a length, the smallest estimate is 0.0005 m.
B - The SI unit for measuring energy is Calorie.
C - Candela (Cd) is the SI unit for luminous cell voltage of 1.5 V.
D - Zinc-carbon AA type batteries have a nominal cell voltage of 1.5 V.

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) B, C and D only. (5) A, B, C and D all.

19. Consider the following statements.

A - Switch off the power supply to the motor prior to mounting or removing accessories.
B - Ensure that the emergency stop button is functioning.
C - The floor should be clean and non-slippery.
D - Reduce rotating speed when taking measurements.

Which of the above statements describe safety measures when operating a lathe machine?

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

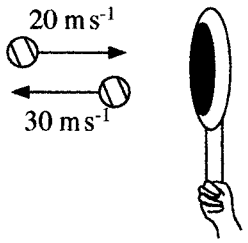
20. Consider the following statements.

A - Varnish used to preserve timber may consist of natural resins that dissolve in turpentine.
B - Aluminium Sulphate is a flocculating agent used to remove suspended solids in water.
C - Sillica is the main ingredient used when manufacturing glass.
D - When gluing two objects, high surface roughness causes good bonding.

Which of the above statements are true regarding the use of chemical compounds?

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

21. A player hits a tennis ball of mass 150 g with a racket. It changes its velocity and is shown in the figure. What is the momentum increase?



(1) 1.5 kg m s^{-1} (2) 2.5 kg m s^{-1} (3) 5.5 kg m s^{-1}

(4) 7.5 kg m s^{-1} (5) 10.0 kg m s^{-1}

22. Consider the following statements.

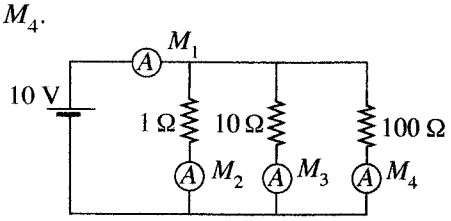
A - Ability to track the order and stating the delivery date.
B - Providing product information, availability in stock, price and alternatives.
C - Providing customer reviews on products.
D - Reduced transaction time and associated costs.

Which of the above statements describe entrepreneurship traits of a reputable online shopping enterprise?

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

[*See page seven*

23. Consider the following circuit. In this circuit ideal ammeters are connected and their readings are M_1, M_2, M_3 and M_4.



Which of the following statement is **incorrect**?

(1) Value of $M_1 = M_2 + M_3 + M_4$
(2) Value of $M_3 = 1$ A
(3) M_4 is the smallest reading.
(4) M_1 is the largest reading.
(5) Value of $M_1 > (M_2 + M_3 + M_4)$

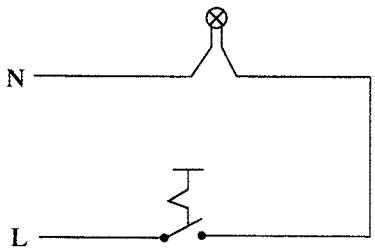
24. Ten 5 W LED bulbs are used in a house. Each bulb is used for 5 hours, daily. What is the daily electrical energy consumption?

(1) 0.025 kW h (2) 0.25 kW h (3) 2.5 kW h (4) 25 kW h (5) 250 kW h

25. Which statement correctly explains the reason for faster corrosion of a steel structure in coastal areas?

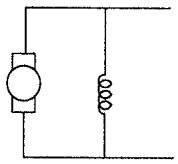
(1) The coastal areas do not have sufficient trees to provide oxygen.
(2) The wind in the coastal areas contains salt which accelerates corrosion.
(3) Extreme heat in coastal areas causes the rapid corrosion.
(4) High solar irradiation in coastal areas accelerates corrosion.
(5) Tidal waves of the sea affect rapid corrosion of steel.

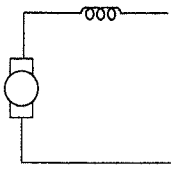
26. Consider the line diagram of a domestic circuit given in the figure and select the correct type of the circuit.

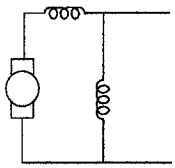


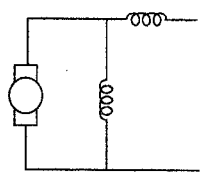
(1) Circuit with a switch and a lamp.
(2) Circuit with a two way switch arrangement.
(3) Circuit with three socket outlets and a lamp.
(4) Circuit with three lamps.
(5) Circuit with three socket outlets.

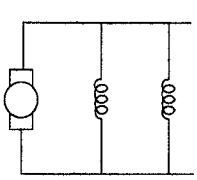
27. Select the circuit diagram of DC series motor.

(1) 

(2) 

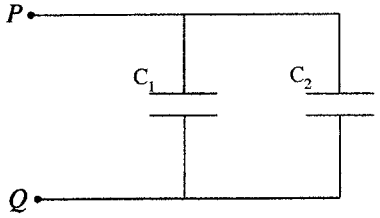
(3) 

(4) 

(5) 

[See page eight

28. Two capacitors are connected as in following figure.



	Cross section Area	Distance between plates	Permittivity
C_1	A	d	ε
C_2	$2A$	$2d$	10ε

What is the total capacitance of the network between P and Q?

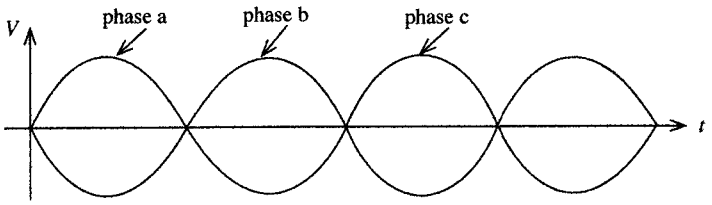
(1) $\frac{\varepsilon A}{d}$ (2) $\frac{2\varepsilon A}{d}$

(3) $\frac{4\varepsilon A}{d}$ (4) $\frac{11\varepsilon A}{d}$

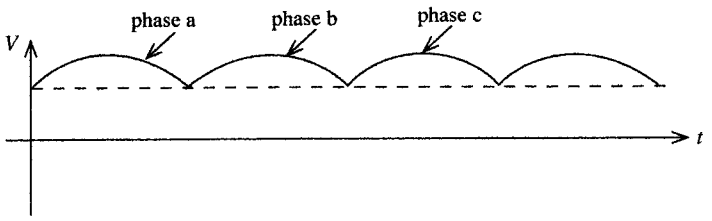
(5) $\frac{40\varepsilon A}{d}$

29. Select the proper three phase waveform.

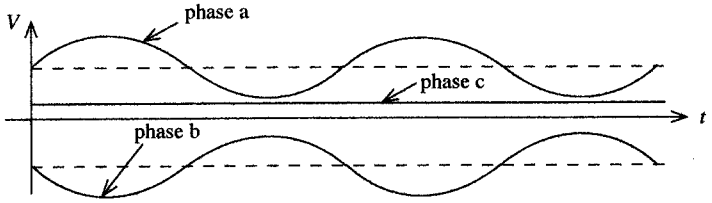
(1)



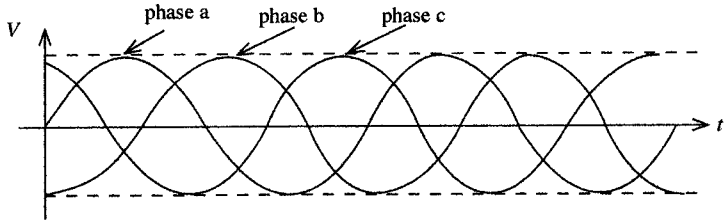
(2)



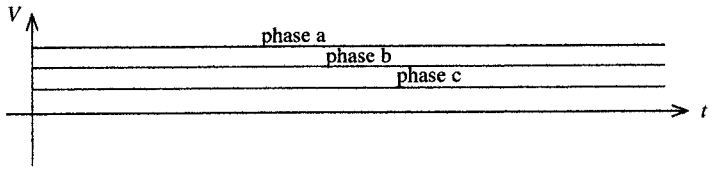
(3)



(4)

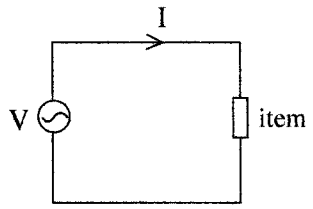


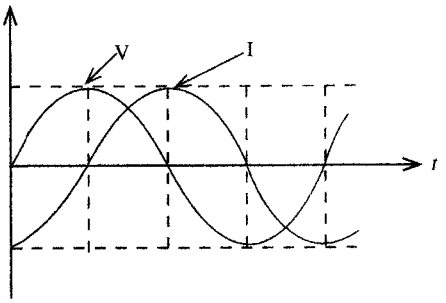
(5)



[See page nine

30. Following arrangement is used in a circuit and observed the voltage (V) and current (I). Waveforms were observed as shown in the following graph.





Above item is,

(1) resistor. (2) ideal capacitor. (3) ideal inductor.
(4) transistor. (5) diode.

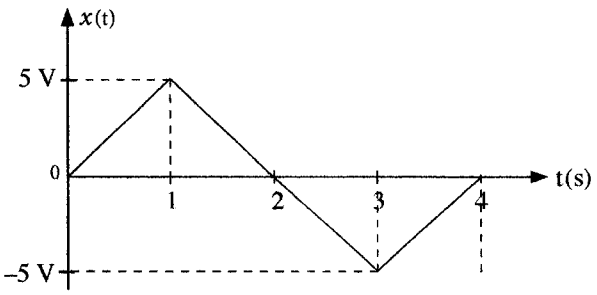
31. Consider following statements regarding online delivery of lessons.

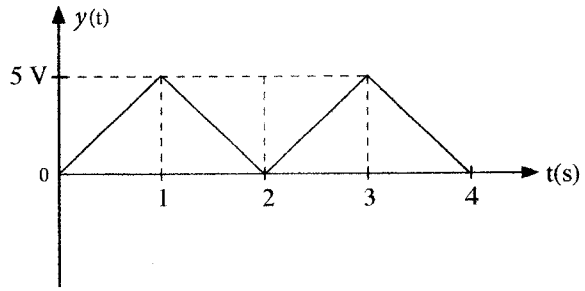
A - Video conferencing facilities can be used for teaching.
B - Hardware component such as mic and video camera are required for computers.
C - Online documents can be used for group activities.

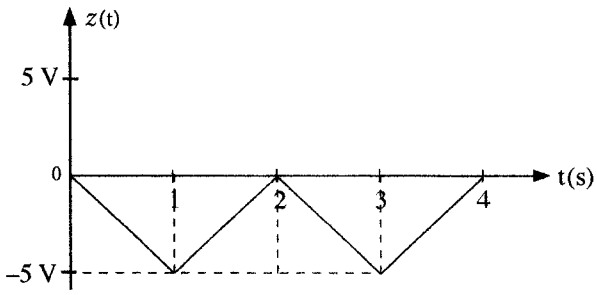
Select the option with correct statement/statements.

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

32. Three wave forms are shown in following figures.





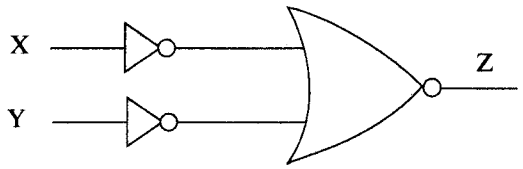


What are the average values of $x(t)$, $y(t)$ and $z(t)$ respectively?

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

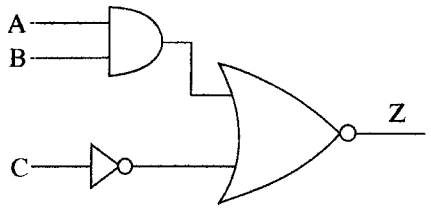
[See page ten

33. What is the equivalent logic gate for the following logic circuit?



(1) NOR (2) NAND (3) XOR (4) OR (5) AND

34. What is the output of the following logic circuit?



(1) $AB + \overline{C}$ (2) $\overline{(A + B) + \overline{C}}$ (3) $\overline{AB + \overline{C}}$ (4) $\overline{AB} + C$ (5) $\overline{AB + C}$

35. Consider the following statements regarding semi-conductors.

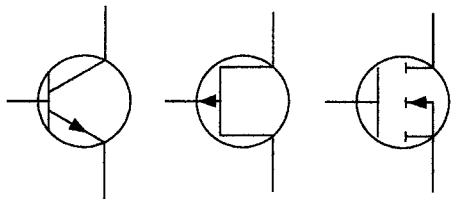
A - Intrinsic semiconductors are developed by adding impurities to extrinsic semiconductors.
B - An n-type semiconductor can be developed by doping Si with As.
C - A p-type semiconductor can be developed by doping Si with P.

Out of these select the answer with correct statement/s regarding semiconductors

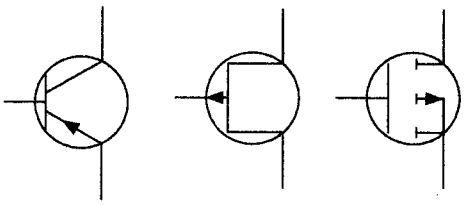
(1) A only. (2) B only. (3) A and B only.
(4) B and C only. (5) A, B, and C all.

36. Which option shows the symbol of an NPN bipolar junction (BJT) transistor, an n-channel junction field effect transistor (JFET), an n-channel enhancement type metal-oxide semiconductor field effect transistor respectively (MOSFET)?

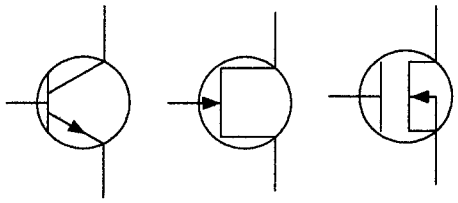
(1)



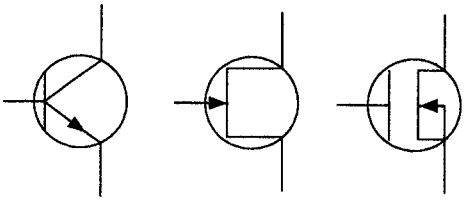
(2)



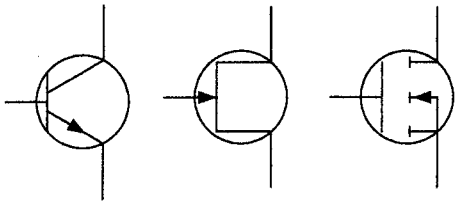
(3)



(4)



(5)



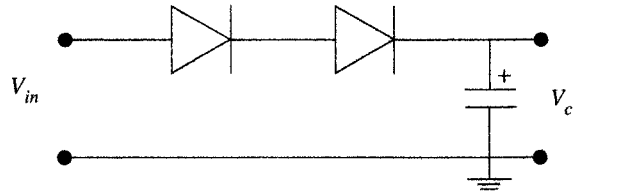
[See page eleven

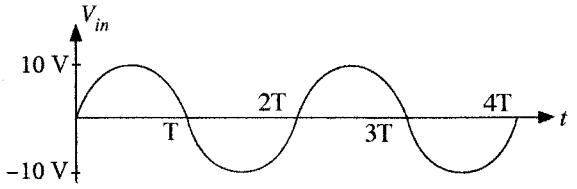
37. An NPN BJT transistor is used as an amplifier with the common-emitter configuration. The transistor is in the active region, and $I_B = 20\ \mu A$ and $\beta = 100$. Determine the collector current I_c?

(1) 200 nA (2) 20 μA (3) 2 mA

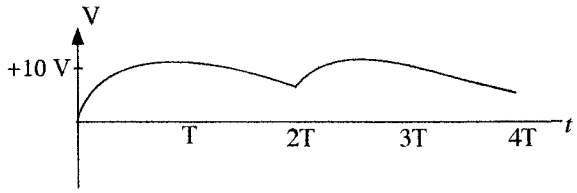
(4) 200 μA (5) Data is not sufficient to determine I_c.

38. A sinusoidal voltage supply shown below is given as the input to the following circuit where diode is made of Si. What is the voltage across the capacitor, V_c?

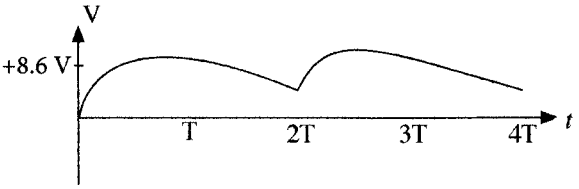




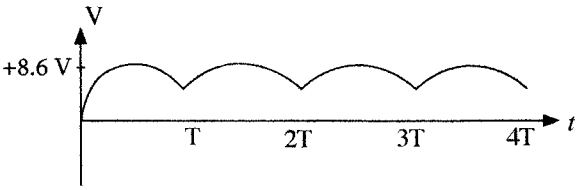
(1)



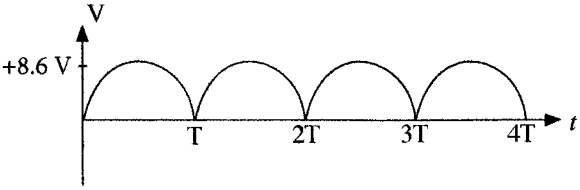
(2)



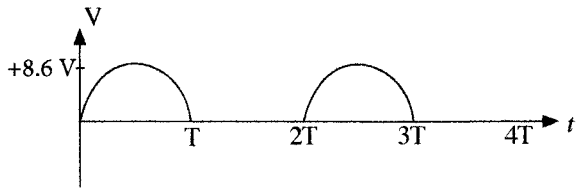
(3)



(4)



(5)



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39. Consider the following statements corresponding to an ideal operational amplifier.

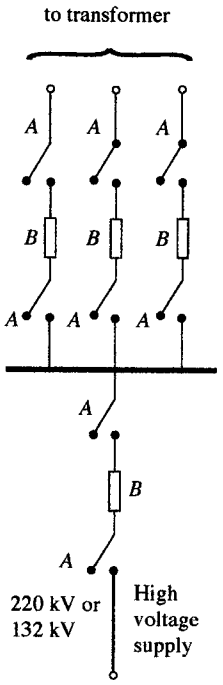
A - Open-loop voltage gain is infinite.
B - The input resistance is infinite.
C - The output resistance is 100 Ω.
D - The voltage between the inverting and non-inverting inputs is 1 mV.

Which of the above statement is/are correct?

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

Answer questions **40** and **41** by considering the following description and the diagram.

"A team of electrical engineers are referring the following single line diagram of a Grid substation during an assignment for studying all island black out of power supply (total supply failure for Sri Lanka). They are observing the status of three phase transformers, circuit breakers, isolators and bus bars..."



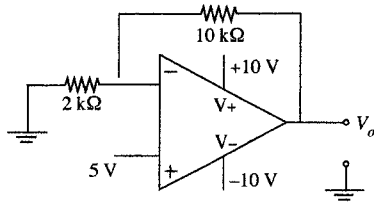
40. The item *A* in above single line diagram is

(1) circuit breaker. (2) SF_6 circuit breaker.
(3) air circuit breaker. (4) bus bar.
(5) isolator.

41. The item *B* in above single line diagram is

(1) circuit breaker. (2) bus bar.
(3) transformer. (4) bulb.
(5) resistor.

42. What is the output voltage V_o of the following circuit?



(1) −30 V (2) −25 V (3) 2 V (4) 10 V (5) 30 V

43. What is the equivalent expression that can be obtained by applying Boolean theorems to the following Boolean expression?

$$f(x,y,z) = xyz + \bar{x}yz + \bar{y}\bar{z} + y\bar{z}$$

(1) $xy + \overline{yz}$ (2) $yz + \bar{y}\bar{z}$ (3) $x + \bar{z}$ (4) $yz + \bar{z}$ (5) $xyz + \bar{y}\bar{z}$

44. A 1100 W heater is used for heating water for 1 hour daily. Furthermore a solar PV system is installed to reduce the electricity bill. What is the monthly (30 days) energy consumption after reducing daily supply of 100 W from the solar panel?

(1) 0.3 kWh (2) 3 kWh (3) 30 kWh (4) 33 kWh (5) 66 kWh

[*See page thirteen*

45. What is the specification table of an induction motor?

(1)

Phase	1 ϕ
Amp	1 A
Volt	230 V
frequency	50 Hz
Power	0.5 kW
RPM	1200

(2)

frequency	50 Hz
ratio	230 V/12 V
Power	0.5 kW

(3)

volt	1 – 24 V±1%
current	0 – 10 A

(4)

Volt	0–230 V AC
current	10 A
frequency	50, 60 Hz

(5)

Power	5 W
light output	1000
life time	1000 h

46. Select the option with equipment used in high voltage installations.

(1) SF_6 current circuit breaker, oil circuit breaker and air circuit breaker

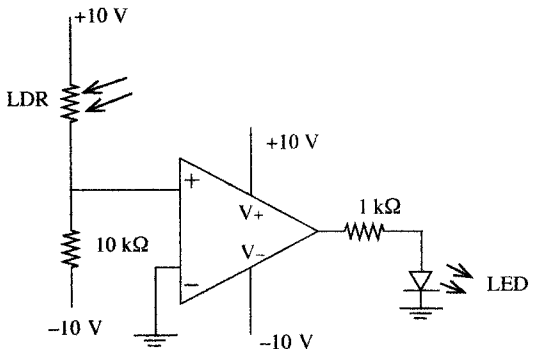
(2) Residual current circuit breaker, transistor and diode

(3) Capacitor, oscilloscope and transistor

(4) SF_6 circuit breaker, oscilloscope and transistor

(5) Oil circuit breaker, oscilloscope and transistor.

47. Consider the statements regarding the circuit shown below. Here LDR has a resistance of 1 MΩ in the dark and 100 Ω in the sunlight.

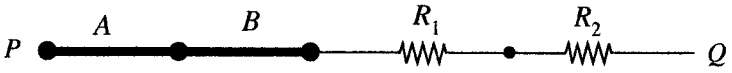


A - The operational amplifier acts as a comparator.
B - The operational amplifier acts as a non-inverting amplifier.
C - The LED is ON when with the LDR is in the dark.
What is the option with the correct statement/statements?

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

[See page fourteen

48. Two conductors, A and B and two resistors, R_1 and R_2 are connected as show in the figure. Consider connecting wires of R_1 and R_2 are ideal conductors with zero resistance.



Conductor	Cross section	Length	Resistivity
A	2 a	l	ρ
B	a	$2\,l$	ρ

Resistor	Resistance
R_1	10 Ω
R_2	100 Ω

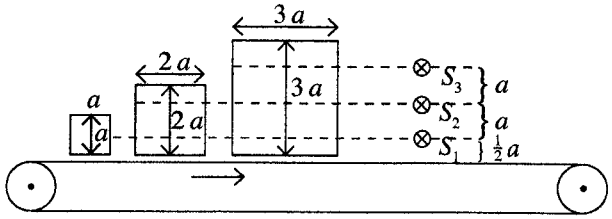
What is the total resistance between P and Q?

(1) $\frac{\rho l}{a} + 110$ (2) $\frac{2\rho l}{a} + 110$ (3) $\frac{5\rho l}{2a} + 110$

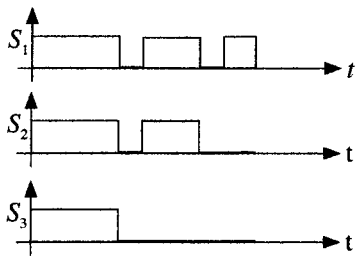
(4) $\frac{5\rho l}{2a} + 100$ (5) $\frac{\rho l}{a} + 10$

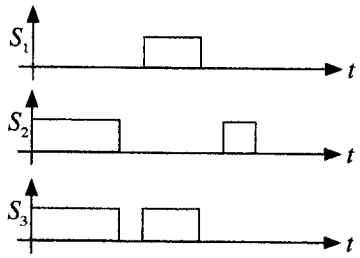
Questions **49** and **50** based on the following process.

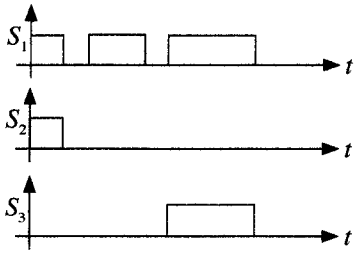
Items are moved by a conveyor as in following figure. S_1, S_2 and S_3 sensors are placed to identify sizes of the items. The sensors outputs will be logic '1' when the item is passing the sensor.

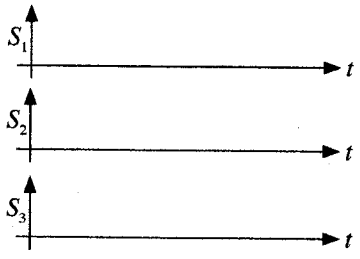


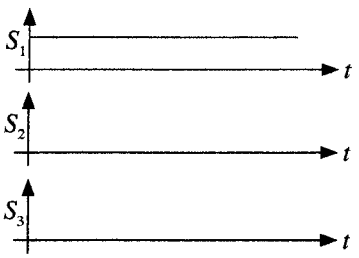
49. Select the correct sequence of sensor outputs for a sequence of three items as in above.

(1)


(2)


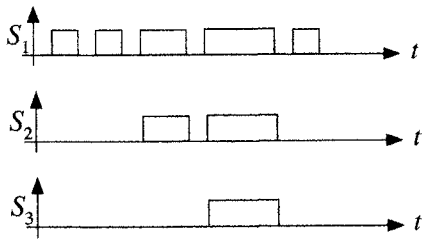
(3)


(4)


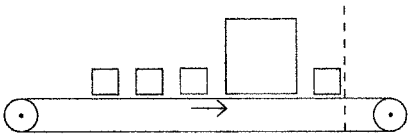
(5)


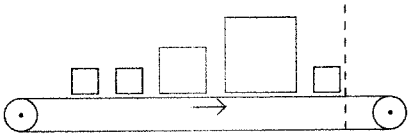
[See page fifteen

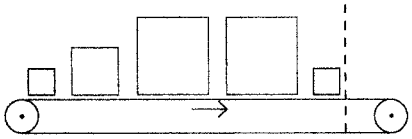
50. Consider following outputs of S_1, S_2 and S_3 sensors during another sequence of items.

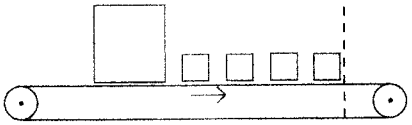


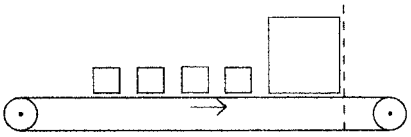
Select the answer with the correct sequence of items.

(1) 

(2) 

(3) 

(4) 

(5) 

* * *

නව/පැරණි නිර්දේශය – புதிய/பழைய பாடத்திட்டம் – New/Old Syllabus

NEW/OLD

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2020
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2020
General Certificate of Education (Adv. Level) Examination, 2020

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* **14** *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 (09 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 (05 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		
Percentage		

Final Marks

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)*

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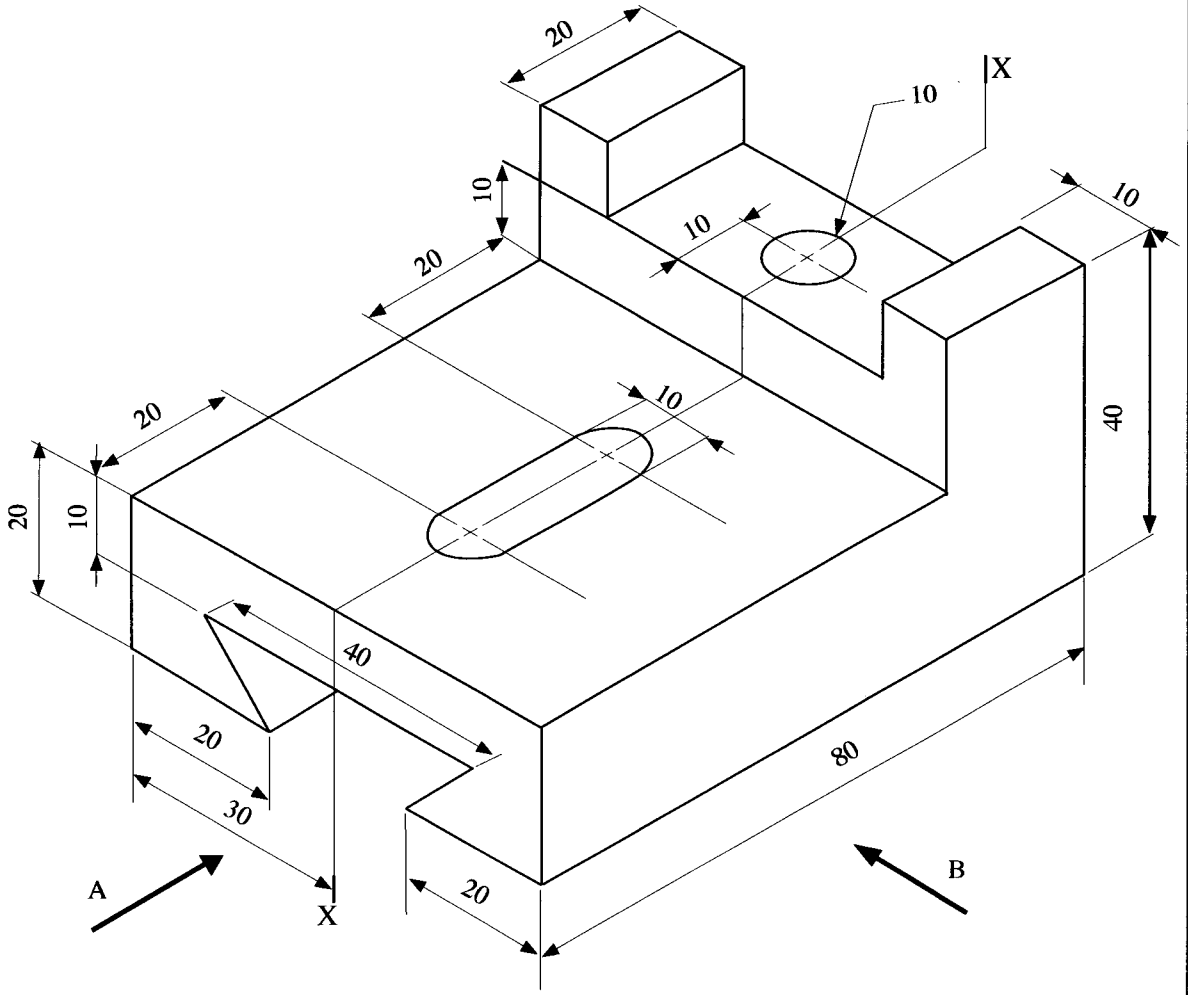
1. The diagram shows an isometric view of a bracket made of light steel. The bracket is symmetric along the vertical plane passing through X-X. Assuming any missing dimensions draw the following views to a suitable scale using first angle projection principles. Show all relevant dimensions in the sketches. Use the graph sheets given on page 3 and 4 to answer the questions. (All dimensions are in millimetres.)



(i) Front elevation seen through direction A

(ii) End elevation seen through direction B

(iii) Plan

[see page three

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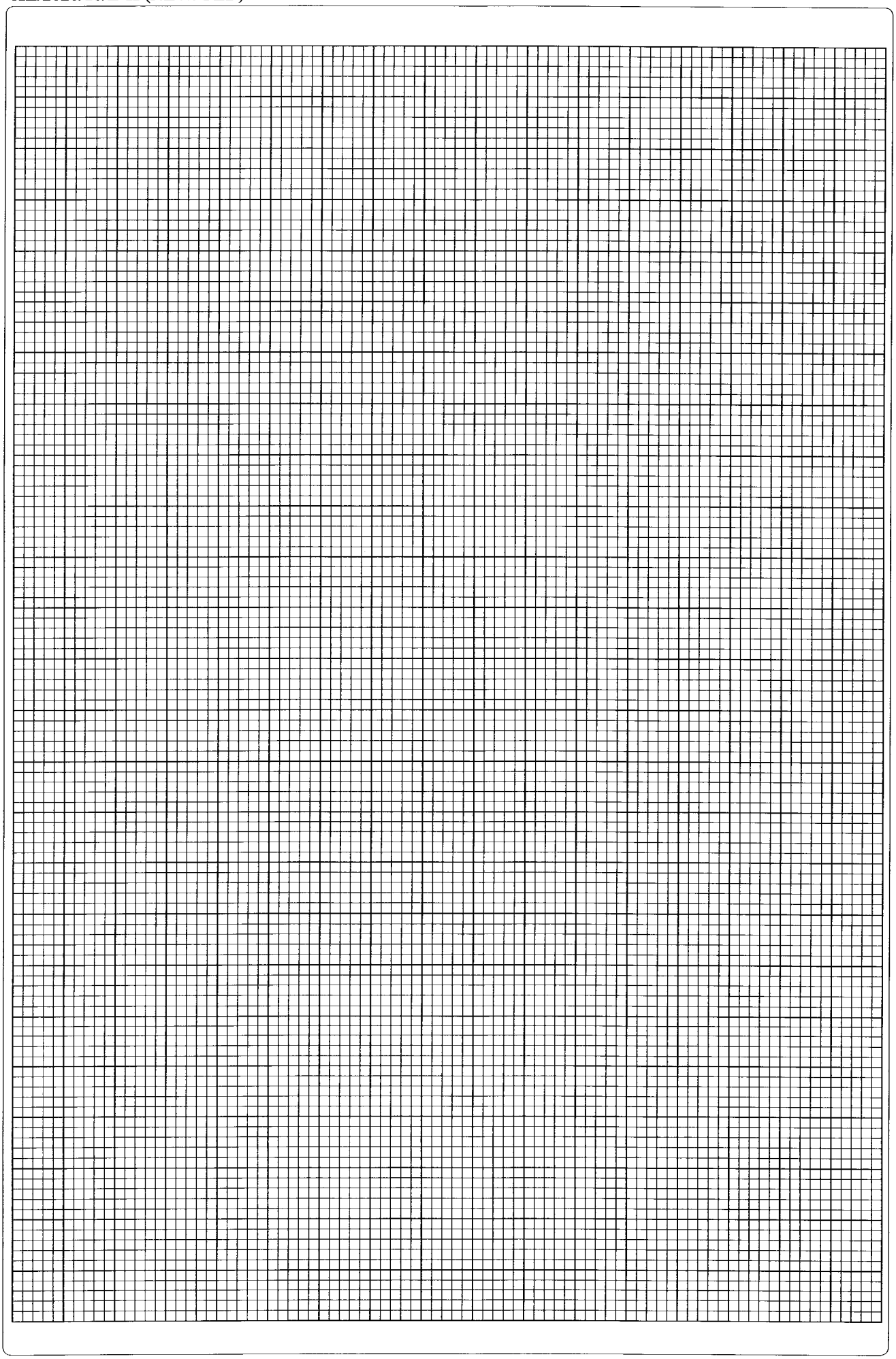

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2. Assume that you are assigned to develop the Information Technology (IT) infrastructure for conducting online classes for a school during Covid-19 pandemic. The requirements are given below:

   * A recording room to record video lessons to be uploaded to the school website.
   * A room for teachers to conduct online classes, in realtime. Students should be able to participate in the classes interactively.
   * Computer station to prepare teaching materials, e.g. power point slide presentations.
   * Use of online storage and online documents during classes.

   Assume that the school administration is designing a room with IT facilities.

   (a) There are stations with desktop computers (main central processing unit-CPU, monitor, keyboard and mouse) in the room.

   (i) Write **two** additional hardware items required for each station.

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   (ii) Name **one** software item that can be used to conduct and record online classes, in realtime.

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   (b) (i) Name **two** additional hardware items required by students to connect with online classes in realtime.

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   (ii) List one facility required for students in addition to the hardware items mentioned in (b)(i) above, to connect with online classes.

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   (c) If the learning activities require students to interactively prepare a group project report online, suggest one on-line facility that they could use for this purpose.

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   (d) A teacher has requested a method to share additional reading materials with students. State **two** ways you would suggest to fulfill this purpose.

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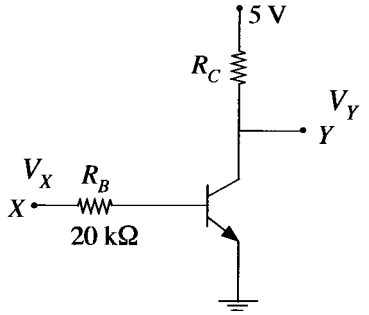
3. A circuit consisting of an NPN transistor is shown below. Here, X is the input and Y is the output. Assume that the transistor is made of Silicon, and $\beta = 50$.



(a) If $V_X = 0$ V, show that the transistor is in the cut-off region.

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(b) For the above case in (a), find the output voltage V_Y.

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(c) If $V_x = 5$ V, assuming that the transistor is in the saturation region determine I_B.

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(d) For the above case in (c), find the output voltage V_Y.

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(e) For the above case in (c), show that the transistor is actually in the saturation region by using the values of I_C an I_B.

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(f) If the voltage range for logic '0' is 0 V to 0.5 V and the voltage range for logic '1' is 4.5 V to 5 V. Can this circuit be used as a NOT gate? Briefly explain.

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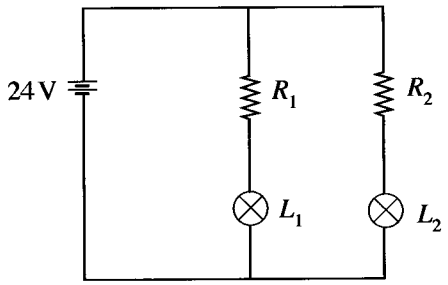
4. Following circuit is prepared by a teacher for demonstrating measurements during a laboratory session.



Resistances of R_1 and R_2 are 100 kΩ and 1 kΩ respectively. Resistance across L_1 and L_2 lamps are measured as 12 Ω and 10 Ω respectively.

(a) State measuring equipment and appropriate range for measuring following.

measurement	equipment	range
(i) voltage across R_1	.....	.....
(ii) voltage across R_2	.....	.....
(iii) current across R_1	.....	.....
(iv) current across R_2	.....	.....

(b) Draw the circuit in space below and indicate how each measuring equipment mentioned in (a)) can be connected.

[see page nine

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(c) Following components are given to a group of students in a school.

- 230 V to 30 V stepdown transformer
- 230 V to 12 V stepdown transformer
- one BJT transistor
- eight diodes
- one operational amplifier K
- 1000 μF capacitor

(i) List items required to develop a full bridge rectifier circuit for supplying 24 V DC from 230 V AC instead of 24 V DC source in the circuit.

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(ii) Draw the circuit diagram of the rectifier circuit.

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[see page ten

නව/පැරණි නිර්දේශය – புதிய/பழைய பாடத்திட்டம் – New/Old Syllabus

NEW/OLD

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2020
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2020
General Certificate of Education (Adv. Level) Examination, 2020

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

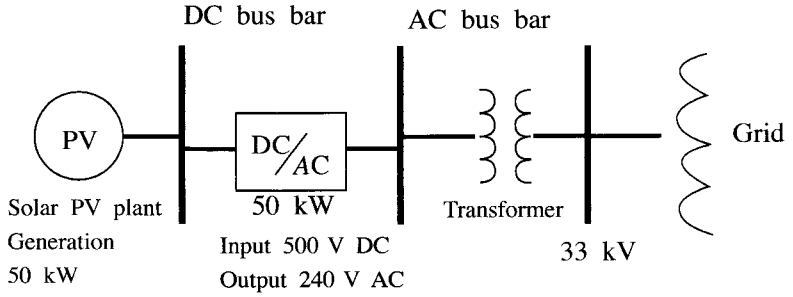
5. The Covid-19 is a recent pandemic situation that affected the whole world. During this pandemic certain technical and non technical measures have been taken in order to prevent the spread of the viral infection.

(a) Briefly explain how 'social distancing' was used to prevent of Covid-19 spread.

(b) Briefly explain **two** other **non** technical measures that were used to prevent the spreading of the virus.

(c) Describe **three** modern technology applications can be used to control the spreading of the virus.

6. Solar PV plants are developed in Sri Lanka to enhance the renewable energy component of the power supply mix. A large number of small capacity solar PV panel units are interconnected in a solar plant. Output voltage from a solar PV module will vary depending upon the availability of sunlight. A module has a nominal power and maximum voltage output. These units can be connected in series and or in parallel to obtain the required voltage and current outputs. Output of a collection of solar modules will be connected to a DC to AC converter and then a transformer is used to convert AC voltage to the relevant grid voltage. (refer the detailed diagram given below)



PV Solar module data (for one unit)

- Power : 200 W
- Voltage V_{max} : 50 V

(a) Compute the number of PV modules to be used in a Solar PV plant of 50 kW.

(b) Assume that the width and length of a solar PV unit is 34" and 52" respectively. Compute the total area required for this plant.

(c) A DC bus voltage of 500 V is required at the DC to AC converter. Suggest a methodology to generate the required DC Voltage from the given PV modules.

(d) Suggest a method to supply electricity from the solar PV plant during the night when electricity from the main grid is not available.

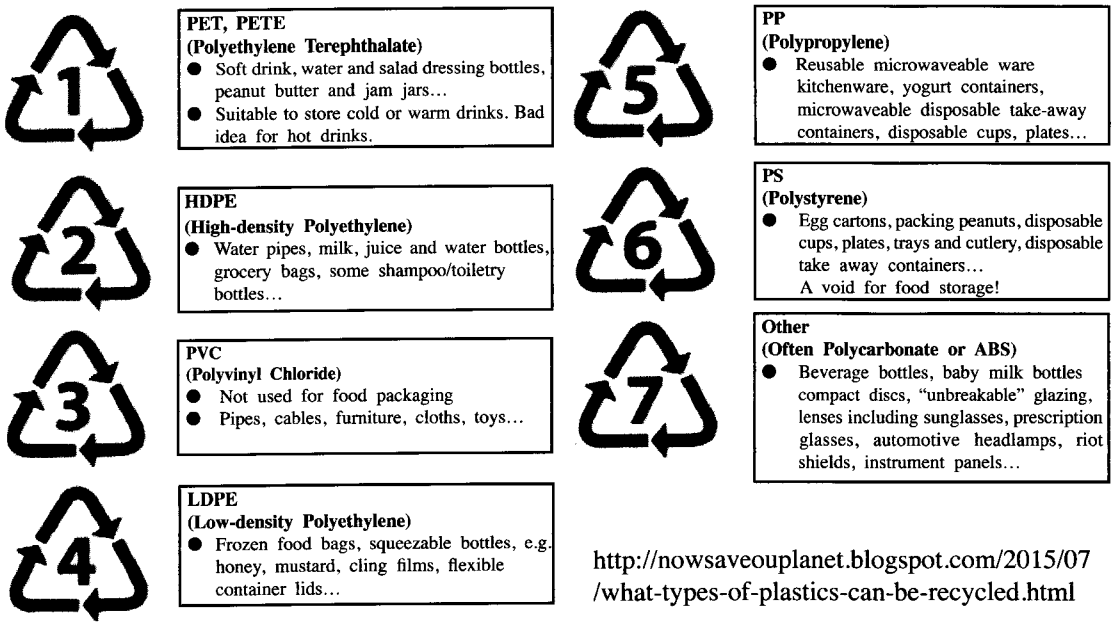
[see page eleven

(e) Describe **two** benefits for Sri Lanka in using solar PV plants.

7. Generation and unsafe disposal of plastic waste is an ongoing issue in Sri Lanka. Even though we use 'safe' plastics to wrap food, being poly-carbonate compounds, they tend to bond with harmful chemicals in unregulated disposal sites. The leachate (i.e. liquid waste) and micro-plastics produced tend to contaminate surface and groundwater bodies, and the marine environment. These pollutants enter the food chains of human beings and animals.

Figure shows the classification system developed by the Society of Plastic Industry, in 1988.

WHAT DO RECYCLING SYMBOLS ON PLASTICS MEAN?



http://nowsaveouplanet.blogspot.com/2015/07/what-types-of-plastics-can-be-recycled.html

The recycling rates of each type reduces with ascending numbers. This depends on the usage, the collection, the technology and the cost of processing of each type. The recycled products should also be used as a raw material for another finished product. The recycling percentage of each type in the developed world is around 20-40%. A small portion is burnt to produce energy, many end up in regulated and unregulated landfills, waste dumps, or in the sea.

(i) Classify the different types of waste produced in your local government (Pradesheeya Sabha, Urban council or Municipal Council) division, based on the above classification.

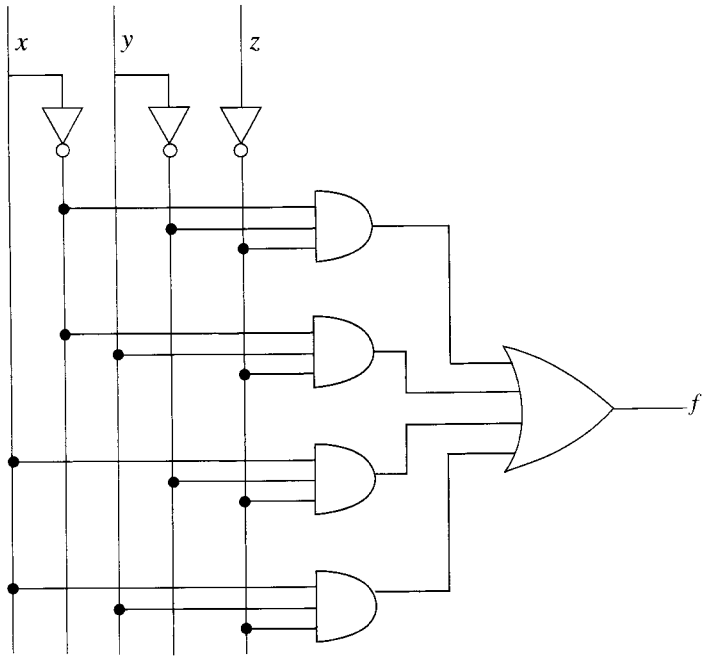
(ii) Propose to your local government institution as to how they should handle the different types of wastes. Identify their respective cost implications to the community.

(iii) Discuss **three** strategy to influence your community to use alternate non-plastic products or to reduce plastic usage significantly.

[see page twelve

Part C

8. (a) A combinational logic circuit with three inputs and one output is shown below.



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

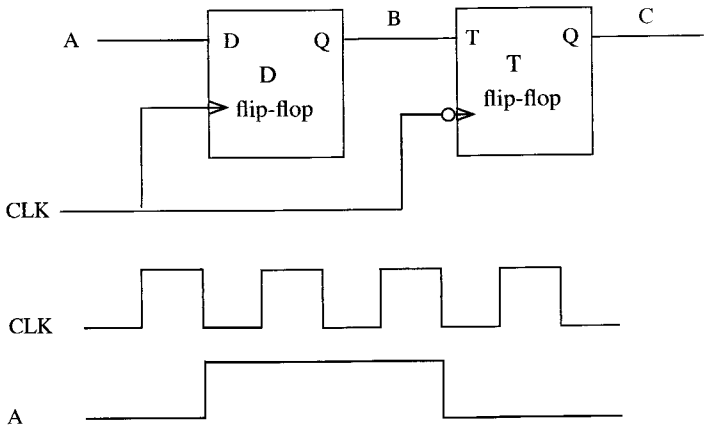
(ii) Using relevant axioms and theorems, show that the Boolean expression derived in (i) can be simplified as $f = \bar{z}$.

(iii) Derive the truth table for the circuit.

(iv) Briefly explain whether the above circuit can be used to detect even numbers between 0 and 7.

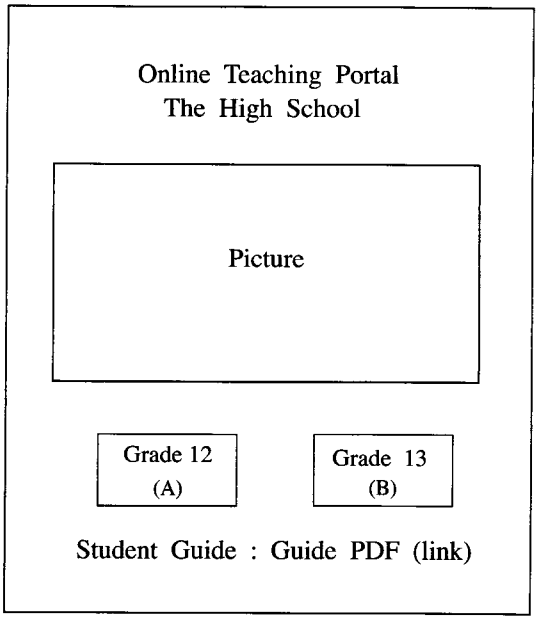
(b) (i) Draw the circuit of an SR flip-flop using NAND gates.

(ii) A simple sequential logic circuit consisting of a positive-edge triggered D flip-flop and a negative-edge triggered T flip-flop is shown below. If the initial states of both flip-flops are '0', draw the signals B and C for the input signal A and the clock signal 'CLK'.



[see page thirteen

9. Following web interface is developed for facilitating online teaching during the Covid-19 pandemic. Details can be accessed through the grade 12 (A) and 13 (B) tabs.



(a) Write a program with HTML tags to develop the above web interface.

(b) A separate web page is developed for each grade including lessons in PDF forms and video lectures.

(i) Sketch a layout for a separate page of Grade 12.

(ii) Write a program with HTML tags to develop the web page for Grade 12.

(c) An online form is suggested to get the questions and feedback from the students.

(i) Sketch the layout for an online form.

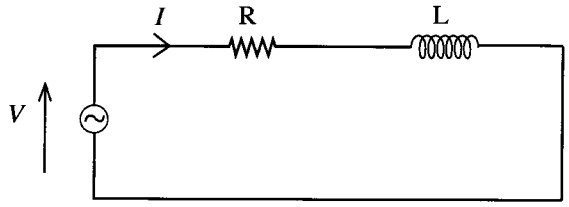
(ii) Suggest one option for preparing the online form.

(iii) Explain how to link the online form to your web page. Write the relevant HTML program (only the relevant section).

10. (a) A resistor will consume active power when connected to an alternating current source but ideal capacitor or ideal inductor will not consume active power when connected to an alternating current source.

(i) Draw the phasor diagrams indicating supply voltage and current through the component when a resistor, ideal inductor and ideal capacitors are separately connected to alternating current sources.

(ii) Consider following circuit with resistor (R) and an ideal inductor (L) connected to an AC source. Draw the phasor diagram and indicate supply voltage V and current I.

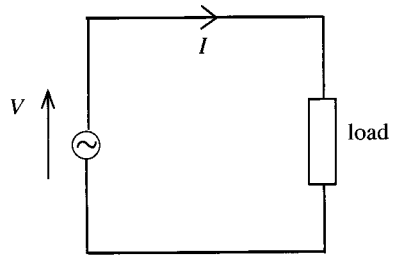


(iii) Write expressions for active power and reactive power consumption of the circuit indicated in (ii).

(iv) What are the units for measuring active power and reactive power?

[see page fourteen

(b) An inductive load (not ideal) is connected to an AC source as in following figure.



(i) Draw the phasor diagram.

(ii) Define power factor.

(iii) Explain how to improve the power factor.

(iv) What is the main advantage of improving power factor towards unity power factor (i.e. 1)?

* * *