

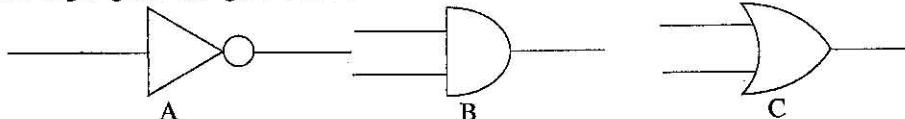
16 E I

பூர் தேவை  
இரண்டு மணித்தியாலம்  
**Two hours**

**Instructions:**

- \* Answer all the questions.
- \* Write your **Index Number** in the space provided in the answer sheet.
- \* Use of calculators is not allowed.
- \* Instructions are given on the back of the answer sheet. Follow those 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 (x) in accordance with the instructions given in the back of the answer sheet.

1. Symbols of three logic gates are give below.



Select the answer which gives the correct matching of logic gates.

(1) A-AND, B-NOT, C-OR.  
(2) A-NOT, B-AND, C-OR.  
(3) A-NOT, B-OR, C-AND.  
(4) A-OR, B-AND, C-NOT.  
(5) A-OR, B-NOT, C-AND.

2. A 75W incandescent bulb is installed in a house wiring circuit. It is switched ON 5 hours a day. What is the daily energy saving, if this bulb is replaced by a 10W LED Lamp?

(1) 375Wh (2) 325Wh (3) 50Wh (4) 3.75kWh (5) 5 kWh

3. Consider the following statements.

- A - Cost of treatment of the worker
- B - Cost of lost time of the worker and co-workers in the production line
- C - Salary paid during the recovery period
- D - Compensation to be paid for any disability arising from the accident

Of the above, statements that mention the cost associated with an industrial accident are

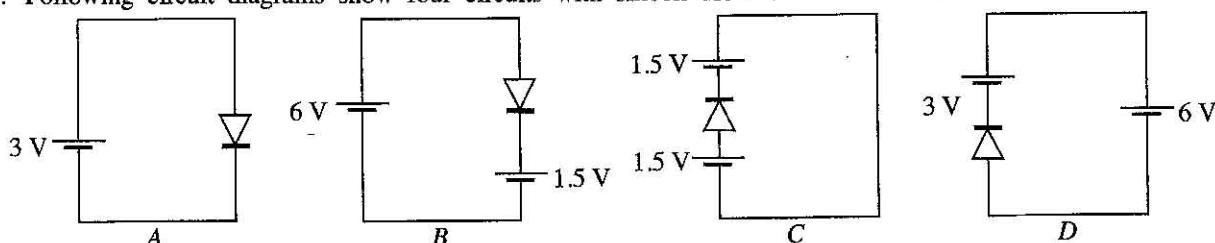
(1) A, B and C only. (2) A, B and D only. (3) A, C and D only.  
 (4) B, C and D only. (5) A, B, C and D all.

4. Which of the following statements describe chemicals used at home?

A - NaOH is used in toothpaste to whiten teeth.  
B - NaOCl is a common bleaching agent used in toilet cleaning fluids.  
C - NaCl is used when preparing food.  
D - Methanol is used as a disinfectant.

(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.

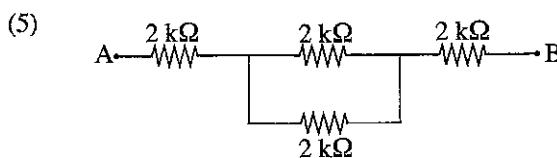
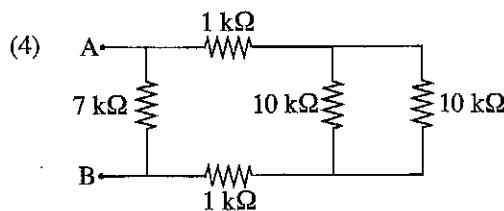
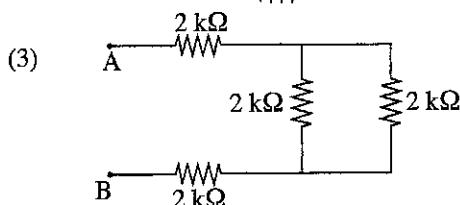
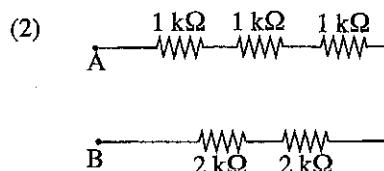
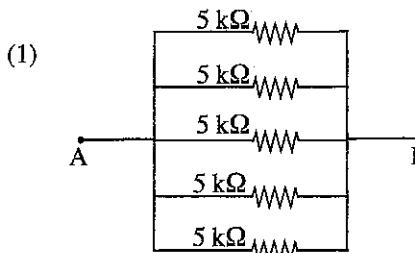
5 Following circuit diagrams show four circuits with silicon diodes.



Circuits with forward biased diode 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.

6. Which of the following resistor arrangements has the highest resistance between points A and B?

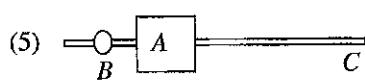
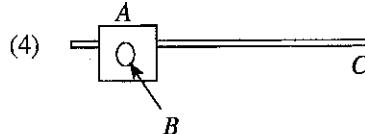
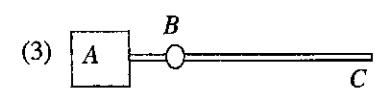
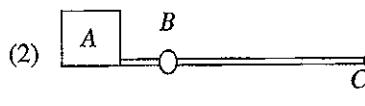
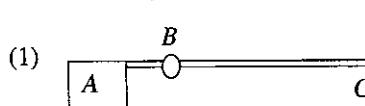


7. A person who has a fruit stall also serves as a property broker who negotiates sales, leases and rentals. Which of the following actions demonstrate his entrepreneurship traits?

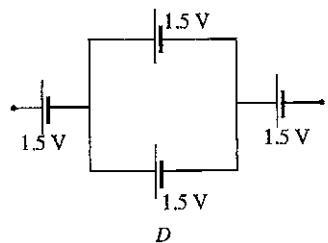
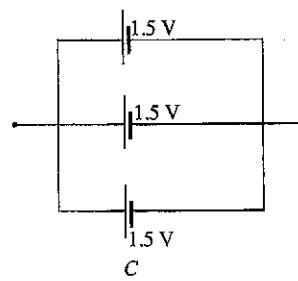
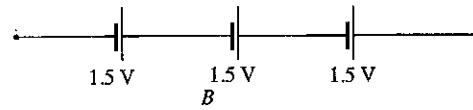
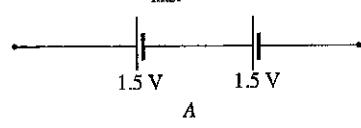
- A - Uses his mobile phone to network with potential clients and fellow property brokers.
- B - Employs a trainee-assistant to help with the sale of fruits.
- C - Maintains a database of information relevant to recent sales, leases and rentals.
- D - Displays a noticeboard with the property details and contact details of clients.

(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.

8. Which of the following configurations is used by a designer to reduce motor torque of a motorized gate? Side view of the gate is shown in configurations. (A - Counterweight, B - Pivot point, C - Gate).



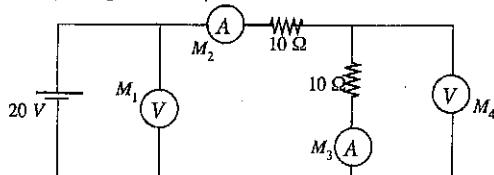
9. Consider following battery arrangements prepared by a student. What are the minimum voltage ( $V_{\min}$ ) and maximum voltage ( $V_{\max}$ ) values obtained by the student?



(1)  $V_{\min} = 0.5V$ ,  $V_{\max} = 3.75V$   
 (3)  $V_{\min} = 3.0V$ ,  $V_{\max} = 3.75V$   
 (5)  $V_{\min} = 3.0V$ ,  $V_{\max} = 4.5V$

(2)  $V_{\min} = 1.5V$ ,  $V_{\max} = 4.5V$   
 (4)  $V_{\min} = 0.5V$ ,  $V_{\max} = 3.0V$

10. Two ideal voltmeters and two ideal ammeters are connected in a circuit as shown in Figure. Find the answer with correct reading of  $M_1$ ,  $M_2$ ,  $M_3$  and  $M_4$  in same order.



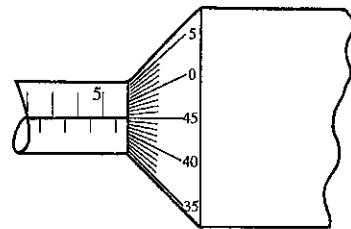
(1) 20V, 1A, 1A, 10V.      (2) 20V, 2A, 2A, 20V.      (3) 20V, 1A, 2A, 10V.  
 (4) 20V, 1A, 1A, 20V.      (5) 10V, 1A, 1A, 10V.

11. A small fire breaks out in electrical equipment in a factory. Which is the best type of fire extinguisher that can be used to minimise damage to the equipment?

(1) Foam      (2) Water      (3) Carbon Dioxide  
 (4) Powder      (5) Wet chemical

12. Figure shows a Micrometer screw gauge. When the circular scale rotates a turn, it moves 0.5 mm along the linear scale. The linear scale is in mm. Reading of the Micrometer is

(1) 5.45 mm.      (2) 5.82 mm.      (3) 6.40 mm.  
 (4) 5.95 mm.      (5) 6.95 mm.



13. Select the component which is **not** used in house wiring circuits.

(1) Residential current circuit breaker (RCCB).      (2) Miniature current circuit breaker (MCCB).  
 (3) Earth Electrode.      (4) Socket outlet.  
 (5) Oscilloscope.

14. If a 1kW electric iron is connected to a domestic electricity supply in Sri Lanka, the supply AC voltage, supply frequency and approximate energy consumption respectively for one hour usage are

(1) 400V, 60Hz, 1kWh.      (2) 230V, 50Hz, 1kWh.      (3) 230V, 60Hz, 50kWh.  
 (4) 50V, 230Hz, 1kWh.      (5) 50V, 50Hz, 1kWh.

15. Which of the following devices is **not** suitable for storing your personnel data?

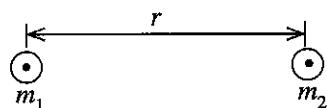
(1) Compact Disk(CD)      (2) Flash drive      (3) Floppy disk  
 (4) ROM      (5) Hard drive

16. What is the basic requirement of a fuse in an electrical circuit?

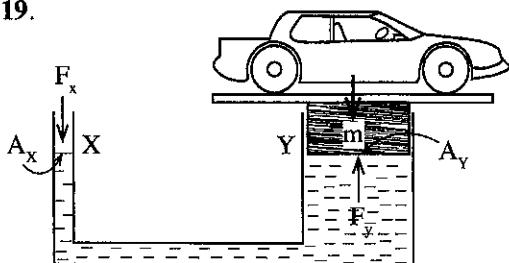
(1) To ensure that the current is maintained at correct temperature.  
 (2) To protect the circuit against excessive current flow.  
 (3) To allow any current flow into the circuit continuously.  
 (4) To ensure continued current flow in the event of short circuit.  
 (5) To control the temperature of the circuits.

17. The gravitational force,  $F$ , between two objects with masses  $m_1$  and  $m_2$  are expressed as  $F = G \frac{m_1 m_2}{r^2}$ ,  $r$  is the centre to centre distance between two objects, and  $G$  is the gravitational constant. The SI units of  $G$  are

(1) Pas      (2)  $\text{m kg}^{-1}\text{s}$   
 (3)  $\text{m}^2\text{s}^{-1}$       (4)  $\text{m}^3\text{s}^{-2}\text{kg}^{-1}$   
 (5)  $\text{Nm}^{-2}\text{s}$



● Following figure shows hydraulic lift used in a vehicle service station. Use the figure to answer questions 18 and 19.



$$\begin{aligned} A_x &= \text{cross sectional area of } X \\ A_y &= \text{cross sectional area of } Y \\ P_x &= \text{Pressure at } X \\ P_y &= \text{Pressure at } Y \end{aligned}$$

18. Which of the following statements is true if  $A_x < A_y$ ?

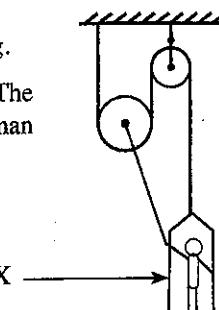
(1)  $P_x < P_y$       (2)  $P_x > P_y$       (3)  $P_x = P_y$       (4)  $P_x + P_y = 0$       (5)  $P_x A_x = P_y A_y$

19. If  $A_x = 100 \text{ mm}^2$  and  $A_y = 10000 \text{ mm}^2$ , what is the minimum value of  $F_x$  in order to lift a car of mass 1000 kg?

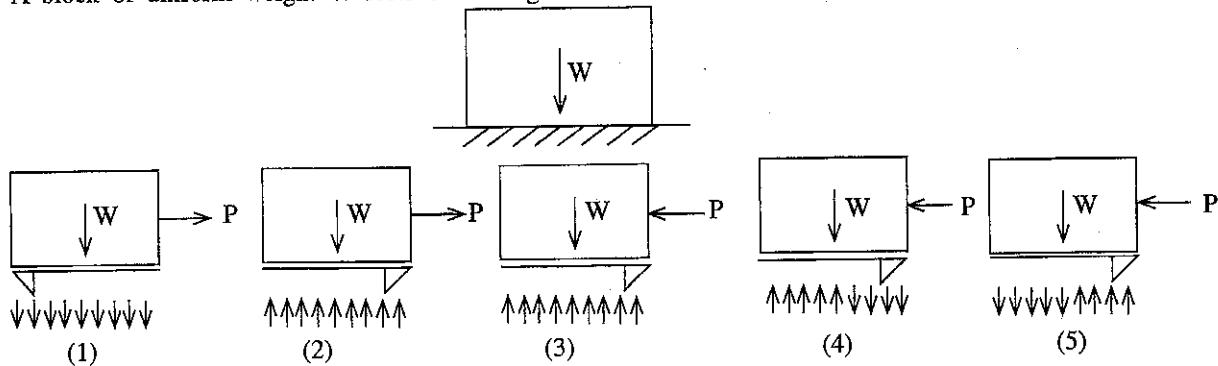
(1) 10 kg. (2) 100 kg. (3) 5 kg. (4) 20 kg. (5) 0 kg.

20. A man weighing 75 kg supports himself by a cable-pulley system (refer Figure). The weight of the chamber, X is 75 N. The minimum pull that has to be applied by the man to maintain equilibrium is

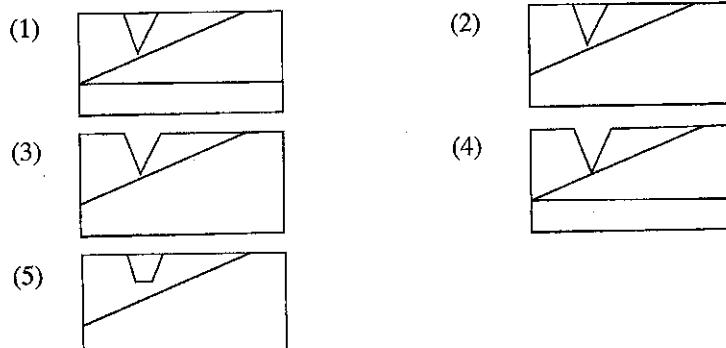
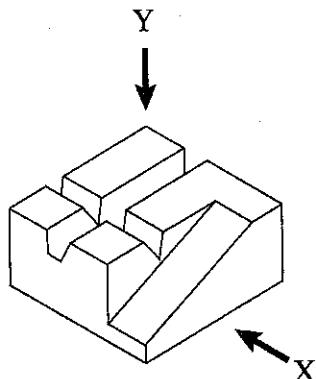
(1) 750 N. (2) 550 N.  
(3) 500 N. (4) 450 N.  
(5) 275 N.



21. A block of uniform weight W rests on a rough horizontal surface. What is the correct free body diagram?



22. Isometric view of an object is shown in the figure below. Select the correct view when looking from direction X.



23. Consider the following statements.

A - Concave mirrors are used in car headlights.  
B - Convex mirrors are used as side mirrors of car.  
C - Convex lenses are used as magnifying glasses.  
D - Concave mirrors are used in solar cooking.

The correct statements that describe applications of mirrors and lenses 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.

24. Consider the following characteristics:

A - Addressing challenges.  
B - Demonstrating creativity.  
C - Maximising profits as the key objective.

From the above, the characteristics of an entrepreneur 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.

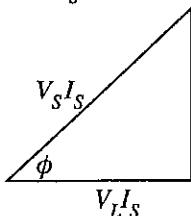
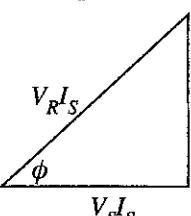
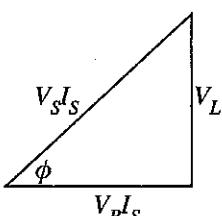
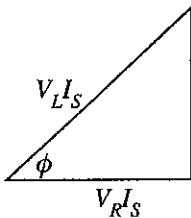
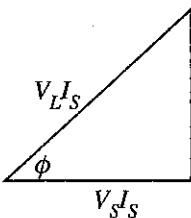
25. What is the colour of the hat an electrician is expected to wear in the worksite?

(1) Yellow. (2) Red. (3) White. (4) Blue. (5) Green.

26. A pure inductor of inductance  $L$  is connected to an alternating current (AC) supply of frequency  $f$  and supply voltage  $V$ . What is the correct equation of inductive reactance ( $X_L$ )?

(1)  $X_L = \frac{2\pi fL}{V}$  (2)  $X_L = \frac{1}{2\pi fL}$  (3)  $X_L = 2\pi fL$   
 (4)  $X_L = 2\pi fLV$  (5)  $X_L = \frac{V}{2\pi fL}$

27. A resistive load and an inductive load are connected in series and the series combination is connected to an AC supply. Voltage across resistive load is  $V_R$ , voltage across inductive load is  $V_L$ , supply voltage is  $V_s$  and supply current is  $I_s$ . What is the answer with correct power triangle?

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

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28. What is the answer with correct colour code of resistor  $4.7k\Omega \pm 5\%$ ?

(1) Yellow, Violet, Brown, Gold. (2) Yellow, Violet, Gold, Gold.  
 (3) Yellow, Violet, Black, Gold. (4) Yellow, Violet, Red, Gold.  
 (5) Yellow, Violet, Orange, Gold.

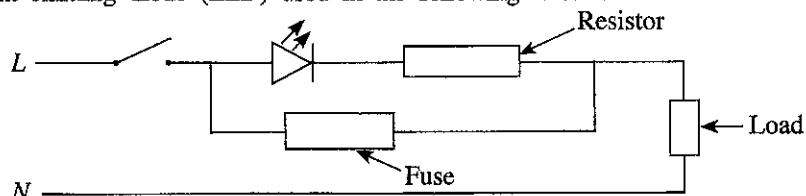
29. What is the meaning of AC-  $50k\Omega/V$  indicated on a multimeter?

(1) Maximum resistance that can be measured from this meter is  $50k\Omega$ .  
 (2) Internal resistance for any AC voltage measurement is  $50k\Omega$ .  
 (3) Internal resistance for each 1V of any AC voltage measurement is  $50k\Omega$ .  
 (4) Resistance of ameter shunt of multimeter is  $50k\Omega$ .  
 (5) Value of inductive reactance used for measuring higher voltages is  $50k\Omega$ .

30. What are the maximum number of lamps and standard wire size for a 5A sub circuit of a domestic installation according to IET wiring regulations?

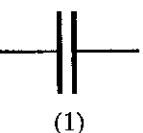
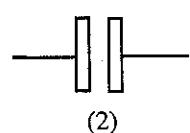
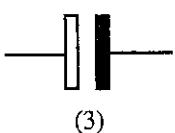
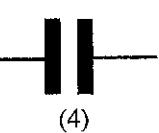
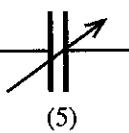
(1) 5, 1/1.13. (2) 5, 1/1.04. (3) 10, 1/1.04 (4) 10, 1/1.13 (5) 15, 1/1.13

31. For what is Light emitting diode (LED) used in the following circuit?



(1) checking availability of power supply. (2) checking the switch status is off or on.  
 (3) checking the fuse burnt or not. (4) checking voltage stay constant or not.  
 (5) all purposes stated in above.

32. What is the symbol of polarized electrolytic capacitor?

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

33. Three types of work done with the aid of computer and suitable software are given in following statements.  
A - preparing a letter and doing relevant editing - MS Word.  
B - preparing a database - MS Access.  
C - preparing list of marks and calculating the average - MS Excel.

What is/are the correct statement/s?

34. Water head is used as a factor for categorising hydropower stations. What is the correct answer with correct type of large scale hydropower stations in Sri Lanka and their type of turbines?

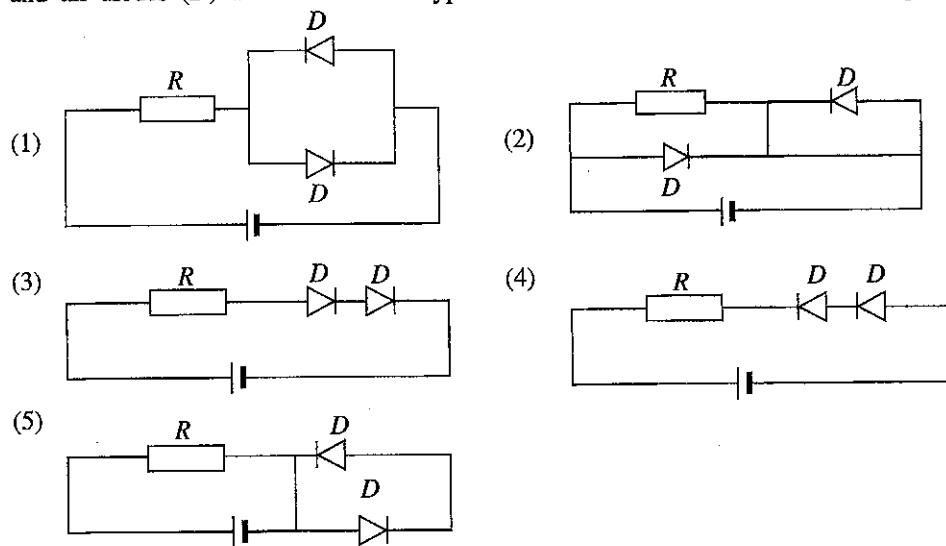
(1) Low head, Francis turbine. (2) Low head, Kaplan turbine.  
(3) Medium head, Francis turbine. (4) Medium head, Pelton turbine.  
(5) High head, Pelton turbine.

35. Consider following statements regarding AC induction motors (with squirrel cage rotor) and synchronous motors.

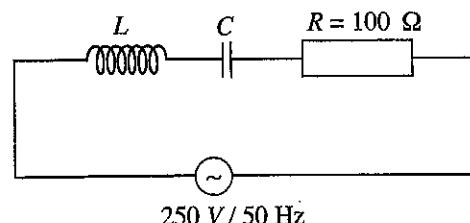
- A - There are no any winding in rotor of an induction motor (squirrel cage type) and there are windings in rotor of synchronous motors.
- B - Speed of a synchronous motor is same as the speed of changing magnetic poles in stator windings but speed of an induction motor is less than the speed of changing magnetic poles in stator.
- C - Speed of both induction motors and synchronous motors depends on the number of poles in stator windings.

Select the correct answer regarding the above statements.

36. Select the circuit which is drawing maximum current from the battery. (All resistors are in equal value  $R$  and all diodes ( $D$ ) are from similar type. Further batteries are in similar voltages).



37. What is the current taken from the source when inductive reactance ( $X_L$ ) and capacitive reactance ( $X_C$ ) are equal in the following circuit?

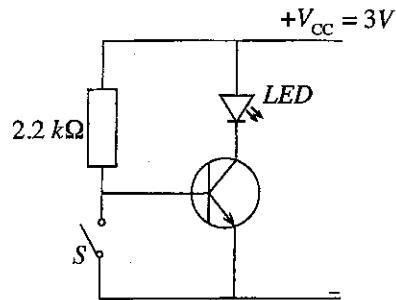


38. What is the correct Boolean expression for the following combined logic circuit?

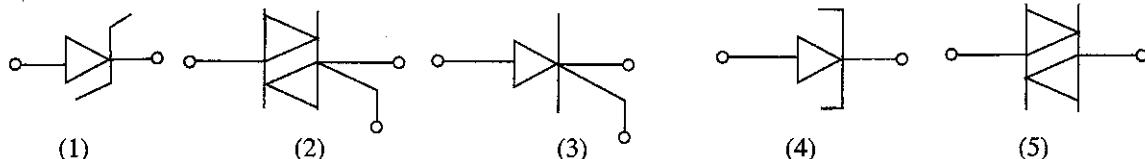
(1)  $Y = A$   
 (2)  $Y = B$   
 (3)  $Y = \overline{A + B}$   
 (4)  $Y = \overline{A} + B$   
 (5)  $Y = \overline{\overline{A} + \overline{B}}$

39. In the following transistor circuit what is the correct state when switch  $S$  is closed?

- (1) LED is ON and transistor is in cut off region.
- (2) LED is OFF and transistor is in cut off region.
- (3) LED is ON and transistor is in saturated region.
- (4) Collector emitter voltage  $V_{CE}$  of the transistor is approximately zero.
- (5) LED is OFF and transistor is in saturated region.



40. Electronic control circuits with power electronic components are commonly used for controlling electric motors in industrial sector. What is the symbol for Silicon control rectifier (SCR) which is commonly used as a power electronic component?



41.  $1000 \mu\text{F}$  capacitor and  $12\text{k}\Omega$  resistor are connected in series and series combination has been connected to  $200\text{V}$  DC supply. What is the approximate value of the time taken to charge the capacitor to  $130\text{V}$ ?

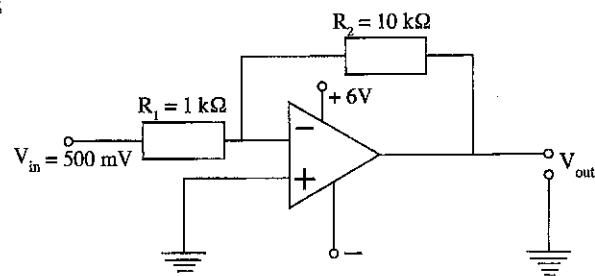
- (1) 4s
- (2) 8s
- (3) 12s
- (4) 12ms
- (5) 60s

42. What is the peak voltage value ( $V_p$ ) of AC supply required for obtaining heating output from a heating coil equal to the heating output of the coil when it is connected to a  $10\text{V}$  DC supply?

- (1)  $7\text{V}$
- (2)  $10\text{V}$
- (3)  $6\text{V}$
- (4)  $14\text{V}$
- (5)  $28\text{V}$

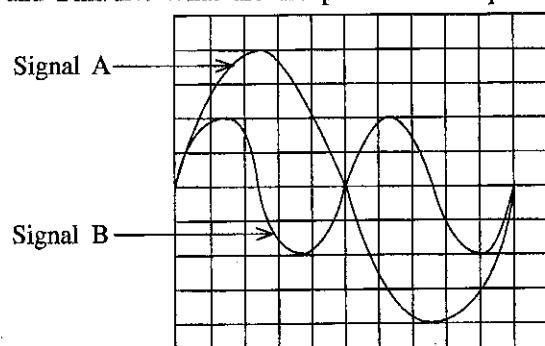
43. What are the type and output voltage of following operational amplifier?

- (1) Inverting amplifier,  $-6\text{V}$
- (2) Inverting amplifier,  $-5\text{V}$
- (3) Inverting amplifier,  $+6\text{V}$
- (4) Non inverting amplifier,  $+5\text{V}$
- (5) Non inverting amplifier,  $+6\text{V}$



44. Following figure shows two sinusoidal signals which are observed by an oscilloscope. Voltage magnitude scale and time scale settings of the oscilloscope are  $10\text{V}/\text{div}$  and  $2\text{ms}/\text{div}$ . What are the period and frequency of sinusoidal signals?

- (1) signal A:  $20\text{ ms}$ ,  $50\text{ Hz}$ .  
signal B:  $10\text{ ms}$ ,  $50\text{ Hz}$ .
- (2) signal A:  $20\text{ ms}$ ,  $50\text{ Hz}$ .  
signal B:  $10\text{ ms}$ ,  $100\text{ Hz}$ .
- (3) signal A:  $10\text{ ms}$ ,  $50\text{ Hz}$ .  
signal B:  $10\text{ ms}$ ,  $100\text{ Hz}$ .
- (4) signal A:  $50\text{ ms}$ ,  $20\text{ Hz}$ .  
signal B:  $100\text{ ms}$ ,  $10\text{ Hz}$ .
- (5) signal A:  $20\text{ ms}$ ,  $50\text{ Hz}$ .  
signal B:  $10\text{ ms}$ ,  $100\text{ Hz}$ .



45. What are the statements that include advantages of using thyristor for controlling a motor instead of a relay in a motor controlled by an electronic control circuit?

- A - starting speed becomes high
- B - no component with wear and tear
- C - not damage components of the control circuit due to generation of back emf

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

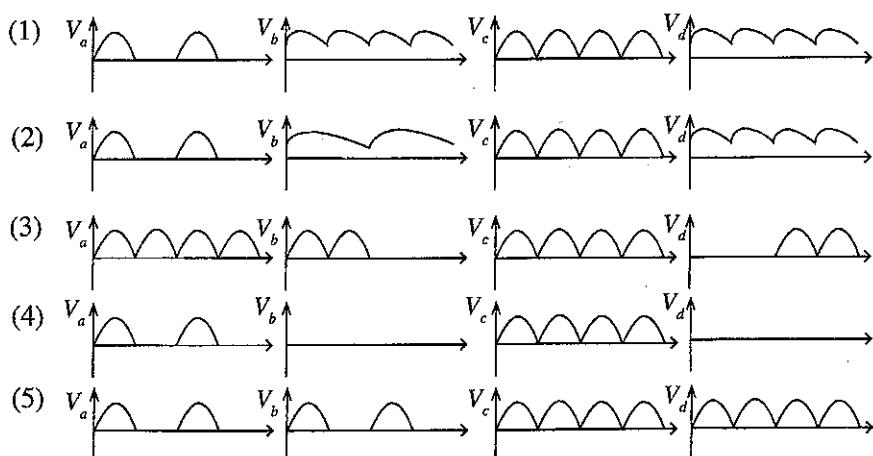
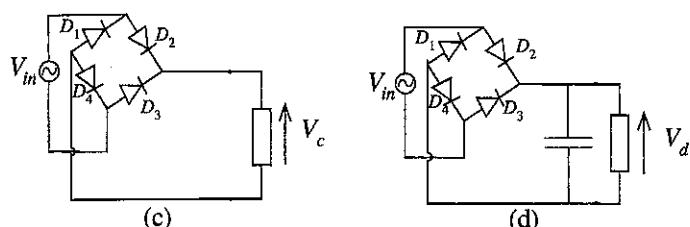
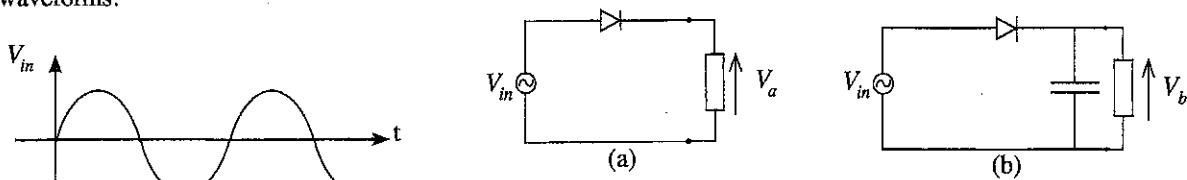
46. Consider the following statements regarding computer networks.

- A - Computer networks can be arranged into Star network, Ring network and Bus network configurations.
- B - Network cables, switches, and hubs are used in setting up computer networks.
- C - Fiber optic cables cannot be used in computer networks.

Select correct statement(s) from the above.

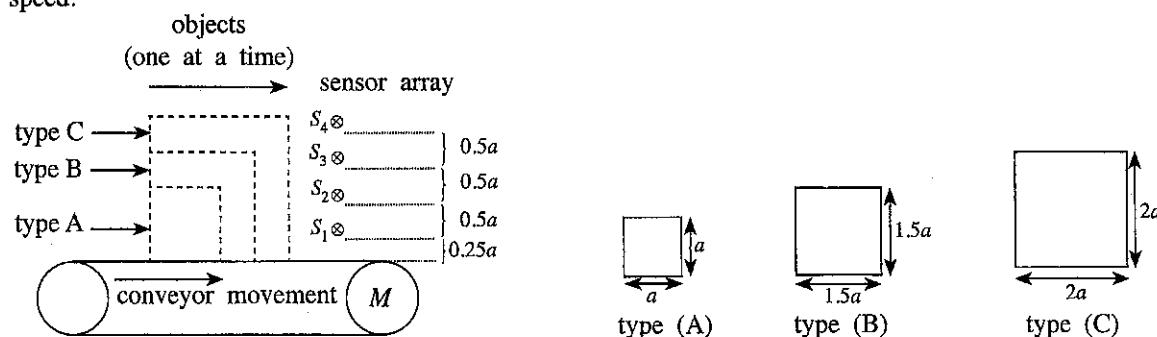
- (1) A only
- (2) B only
- (3) A and B only
- (4) B and C only
- (5) A, B, and C all

47. Following rectifier circuits are prepared by a student. Assume that each circuit is connected to an AC power supply ( $V_{in}$ ) and observed the output Waveform by an oscilloscope. Select the answer with correct output waveforms.

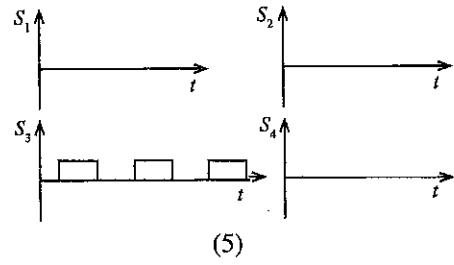
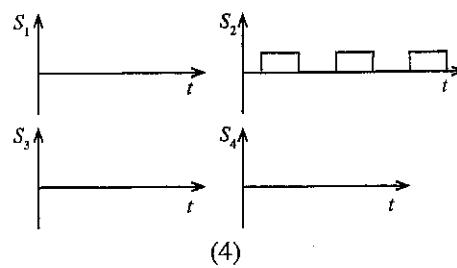
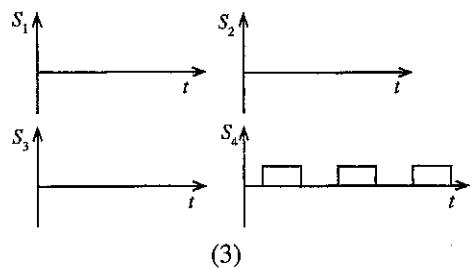
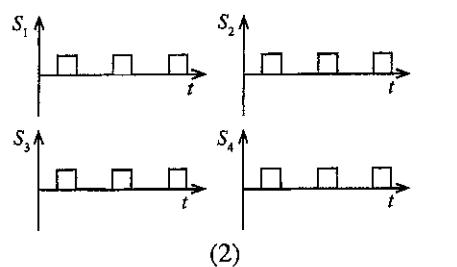
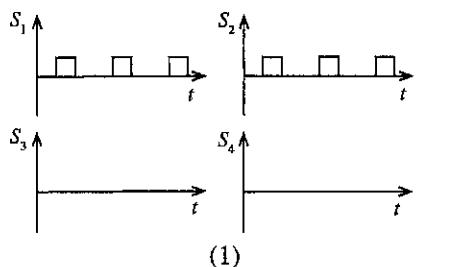


● Answer following question 48, 49 and 50 based on following conveyor system.

Conveyor systems are used in industry for transporting items. Consider following arrangement used for three types of items. Conveyor is operated by a DC Motor (M). Consider that the conveyor is operated at constant speed.



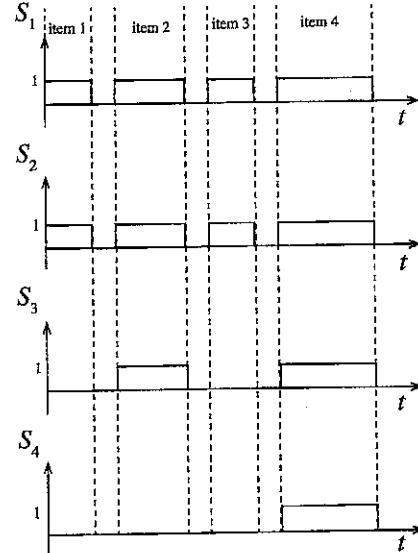
48. Find the answer with correct outputs of sensors  $S_1$ ,  $S_2$ ,  $S_3$  and  $S_4$  when only type A is fed to the conveyor. Assume the sensor output status will be logic '1' when object is covering the sensor, i.e. if object height is higher than the sensor position, sensor output will be '1'.



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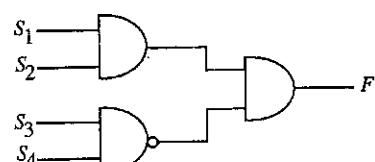
49. Consider the following outputs of  $S_1$ ,  $S_2$ ,  $S_3$  and  $S_4$  sensors. When four items are fed to the conveyor one after the other in sequence of item 1, item 2, item 3 and item 4, identify the correct sequence of types.

- A, B, A, C
- A, B, A, A
- B, A, B, C
- A, A, A, B
- B, A, C, B



50. Consider the following logic circuit that is prepared for detecting object type. What is/are the object type/s that the logic output is '1'?

- type A only
- type B only
- type C only
- type A and B only
- type A and C only



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16 E II

ஒரை நூற்று  
மூன்று மணித்துப்பியாலம்  
*Three hours*

**Index No.:** .....

**Important :**

- \* This question paper consists of 12 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 (04 pages)**

- \* Select minimum of 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	1	
	2	
	3	
C	4	
	5	
	6	
Total		
Percentage		

## Final Marks

In Numbers	
In Words	

## **Code Numbers**

Marking Examiner 1	
Marking Examiner 2	
Checked by	
Supervised by	

**PART A – Structured Essay**  
*Answer all four questions on this paper itself.*  
*(Each question carries 10 marks)*

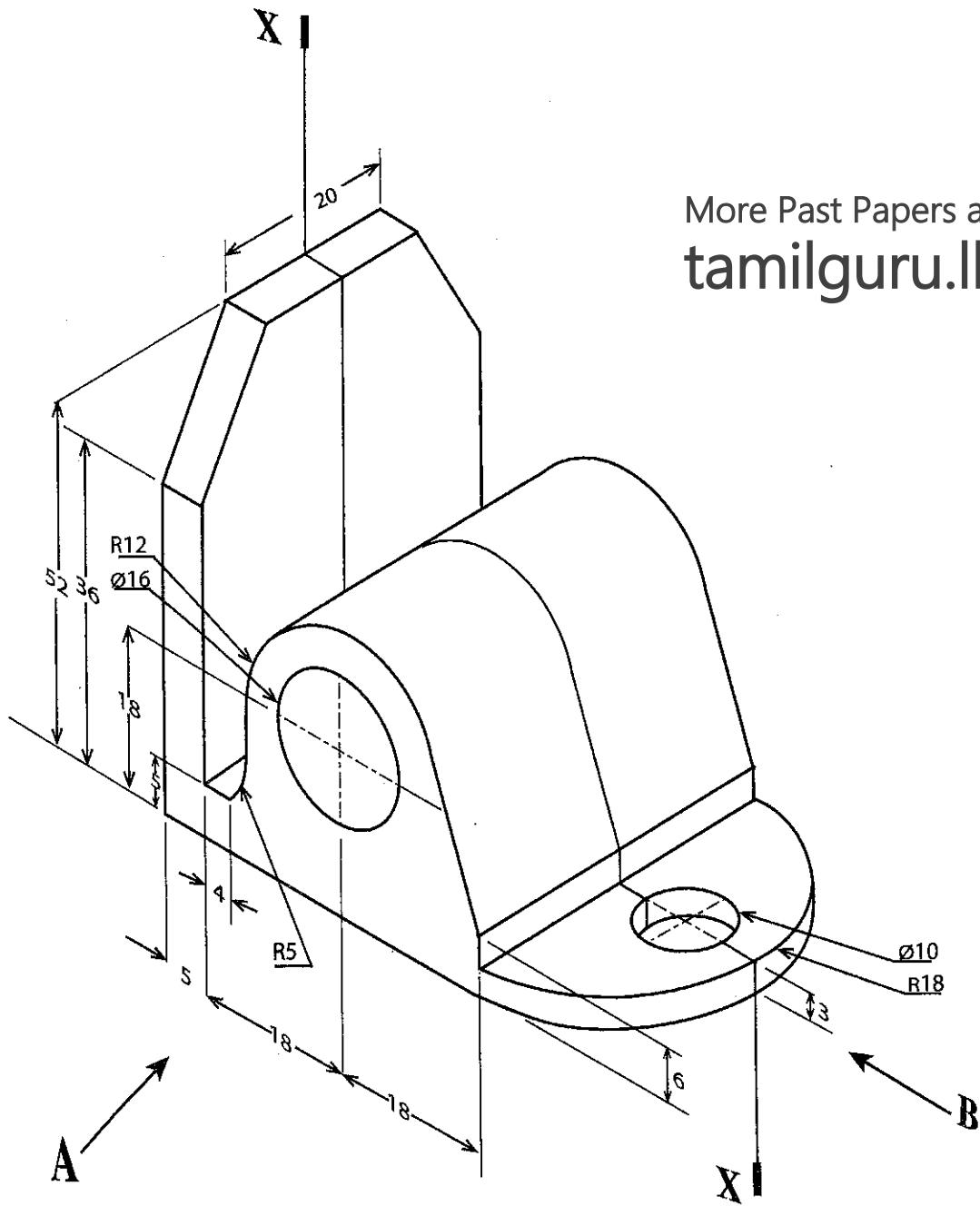
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## Part A

1. Following figure shows an isometric view of a machine component. It 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 principle.

Show all relevant dimensions in the views. Use the graph sheets given on page 3 and 4 to answer the questions. (All dimensions are in mm).

- (i) Front elevation seen through direction A.
- (ii) End elevation seen through direction B.
- (iii) Plan view.



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0049



2. Online data storages are commonly used in IT industry and for personal use. Furthermore, online version of documents and presentation slides are frequently used. These online versions facilitate collaborative editing of documents by multiple users from different computers. Consider 'ABC Drive', a service provider available in online through the Internet who provide following facilities from an online storage facility.

- (i) Storage of files upto 10 GB for an login created based on an official email.
- (ii) Sharing folders, data files and documents among many users.
- (iii) Preparing documents and presentation slides online.
- (iv) Editing online documents and presentation slides by many parties.

Assume that you are appointed as the IT technical officer responsible in formulating a plan to modernise the IT facilities of a company. Answer following questions by considering above mentioned details of online data storages.

(a) The company has a discussion room and a computer facility for design work. Assume a design team of five employees are preparing a document in a meeting which is scheduled in the discussion room. Furthermore, they are planning to use online document facilities.

- (i) State hardware required for each member to perform the above mentioned task.

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- (ii) State one facility required for the hardware mentioned in question (i).

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(b) Assume that one member of the team had a medical issue requiring him to rest at home for a period of two weeks. However he has decided to support the design team while being at home. He does not have any facility provided by the company. However, following hardware and relevant software are available in his personal capacities.

- a system unit with windows operating system.
- two keyboards and two mouses
- two monitors
- a laser printer
- a microphone and a speaker.
- a dongle with broadband internet connection

- (i) State **four** hardware components required for preparing fully functional computer capable of dealing with online documents by using only the components available at home.

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- (ii) Assume that Microsoft Office package is **not** installed in the computer mentioned in part (i). State an alternate method for preparing the document.

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(c) The team member mentioned in part (b) wishes to join the team in the discussion room of company through video conferencing facilities.

(i) State **two** other hardware components required for his purpose.

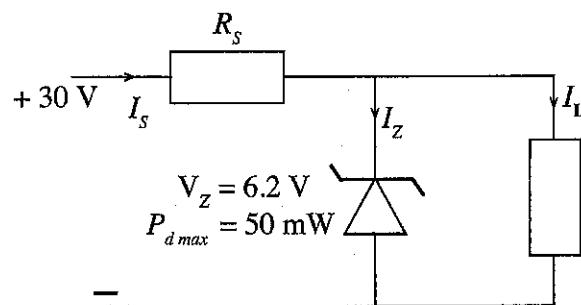
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(ii) State the relevant software package required to perform this task.

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3. Voltage stabilizers prepared based on zener diodes are used in electricity supply of Integrated Circuits (IC) in electronic circuits. A zener based stabilizer circuit is given in following circuit.



When supply voltage is 30V, current through zener diode ( $I_z$ ) is 5 mA and current taken by load is 10 mA.

(a) State **three** requirements that should be considered in using a zener diode as a voltage stabilizer.

(i) .....

(ii) .....

(iii) .....

(b) What is the current taken from the supply ( $I_s$ ) of above circuit?

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(c) What are the required value of  $R_s$  and its nominal power?

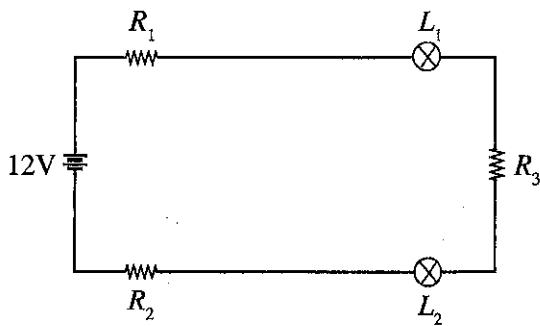
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(d) What is the maximum reverse biased current through the zener diode?

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4. Following circuit is connected during a laboratory experiment.



Resistances of the components were measured before connecting the components to the circuit. Their values are given below.

$$R_1 = 1\Omega$$

$$R_2 = 1\Omega$$

$$R_3 = 10\Omega$$

Resistances across  $L_1$  and  $L_2$  are  $24\Omega$  and  $12\Omega$  respectively.

Answer following questions.

(a) (i) Name the measuring equipment and their ranges required for measuring voltage drops across  $R_1$ ,  $R_2$  and  $R_3$  resistors, voltages across  $L_1$ ,  $L_2$  lamps and the circuit current.

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

(b) There is a plan to use an AC supply for obtaining the DC supply. Following items are available in the Laboratory.

230V to 6V step down transformer  
230V to 14V step down transformer  
4 diodes  
4 capacitors  
4 zener diodes

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(i) Sketch the circuit that can be prepared for obtaining 12V DC supply from the available 230V AC supply without using the zener diodes. You can use components only available in the laboratory.

(ii) Explain how you could connect zener diode(s) for smoothing the DC output by reducing the ripple.

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(c) Assume that you are asked to connect 12V AC source instead of 12V DC source. Consider  $L_1$  and  $L_2$  are incandescent lamps. Comment on the status of  $L_1$  and  $L_2$  lamps.

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ବିଦ୍ୟୁତ, ଇଲେକ୍ଟ୍ରାନ୍଱ିକ ଓ ତୋରତ୍ତର୍ ବାନ୍ଦଣାଙ୍କାରୀ ମଧ୍ୟ  
ମିଳି, ଇଲତ୍ତିରାଣ ତକବାଲ ତୋମାନ୍ତିନ୍ଦ୍ରିୟରେ  
**Electrical, Electronic and Information Technology**

16 E II

## Essay

\* Select two questions from each of the Parts B and C and answer four questions only.  
(Give concise answers. Sketch clear figures and label them where necessary.  
(Each question carries 15 marks.)

## Part B

1. An urban house consists of electrical items mentioned in table 1. Power ratings and average usage per month are given in columns 3 and 4 respectively.

Item	No of items	Power rating per item (W)	Usage per month (h) per item
Bulbs (CFL)	06	15	150
Fans	03	60	90
LED TV	01	55	150
Rice Cooker	01	300	10
Washing Machine	01	750	08
Refrigerator	01	600	70

Table 1

Table 2 summarizes the electricity tariff for electric consumption of domestic usage given by the electricity board.

Consumption (kWh)	Energy charge Rs.
0-30	2
31-60	5
61-90	10
91-120	25
121-180	32
more than 180	45

Table 2

(a) Making relevant assumptions, if any, calculate the total electricity consumption and the electricity cost per month.

(b) Owner of the house is planning to purchase a new electric vehicle that has following specifications.

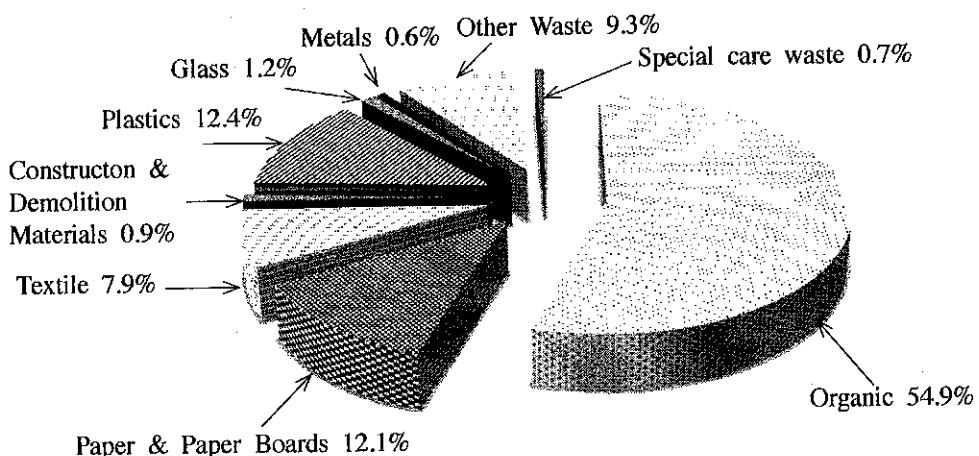
Range: 10 km/kWh

Battery Capacity: 10 kWh

(i) Calculate the additional electricity consumption and electricity cost per month resulting from this purchase. Assume that the monthly average travelling distance of the vehicle is 1600 km.

(ii) For the same price, it is possible to buy a petrol engine vehicle which has the average mileage of 14 km/l. Using the results from (i), briefly explain the criteria the owner should consider in purchasing an electric car or a petrol car when financial benefits are taken into consideration.

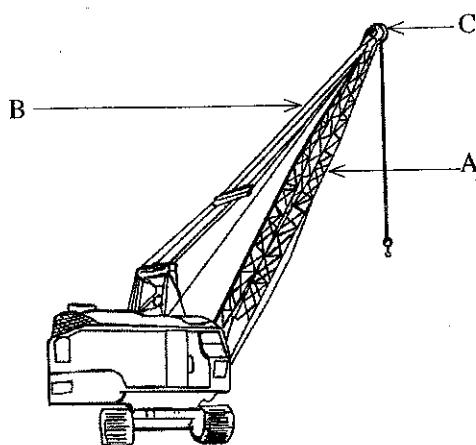
2. Figure shows average composition of Municipal Solid Waste (MSW) of the Colombo Municipal Council (CMC) area. The Organic Waste has a moisture content range of 60-75% with low calorific value of 6000-9000 kJ/kg.



(Source : Sri Lanka Sustainable Energy Authority)

- List the waste types that can be recovered for later processing and can be used to generate energy.
- The CMC requires households to separate organic waste from paper, plastics and glass. Discuss **two** benefits to CMC for mandating waste separation at source.
- Many countries consider Municipal Waste as an 'economic good'. Explain why it can be considered as an economic good.
- Waste to energy conversion requires burning of trash to generate steam, which in turn is used to drive a turbine to generate electricity. Explain how the solid waste can be processed in order to enhance efficiency of energy conversion.

3. Figure shows a track mounted crawler crane.



- Discuss the specific purposes of components A, B, and C as shown in Figure.
- Discuss the type of forces transferred via components A and B, when the crane has no load, and when it lifts a load.
- Explain how equilibrium is maintained while in operation without it tipping over.
- Sketch the configuration you would propose to use when the object is too heavy to be lifted using a single cable.
- Sketch the mechanism that can be used to rotate the crane about its vertical axis of rotation.
- Describe **two** instances where a track mounted crawler train is preferred over other types of mobile cranes.

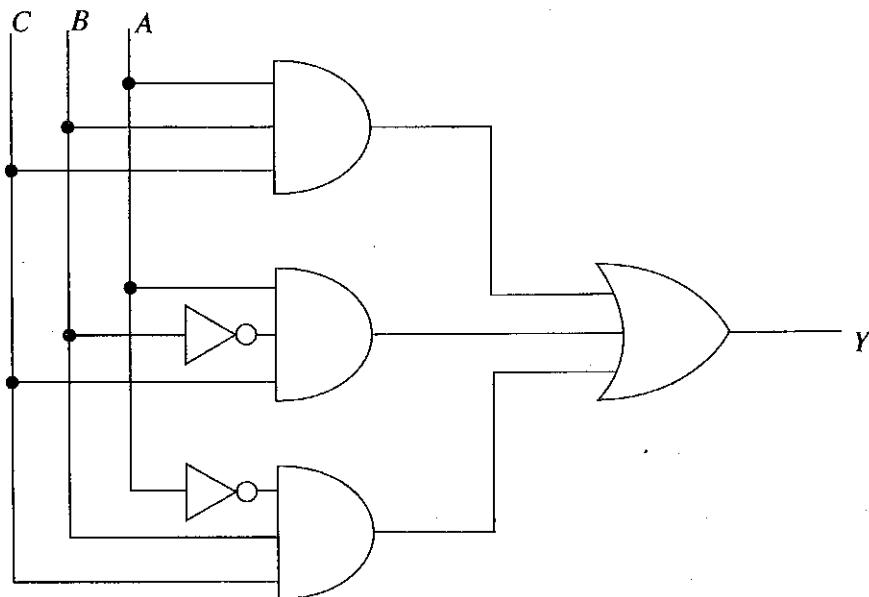
### Part C

4. Two types of design approaches are used in digital electronics technology.

Logic circuits that are deciding the logic output by a combination of logic actions and by considering available inputs are called as combinational logic circuit. Their basic building blocks are logic gates.

Logic circuits with memorising capabilities that can consider inputs available in previous states for obtaining the output are called sequential logic circuits and their basic building blocks are flipflops.

(a) Answer the following questions based on combinational logic circuit given in the following figure.



(i) Write the Boolean expression for the logic circuit output Y.  
 (ii) Simplify the above Boolean expression and obtain most simplified Boolean expression.  
 (iii) Write the truth table for the simplified Boolean expression.  
 (iv) Draw the logic circuit for the simplified Boolean expression.

(b) (i) Draw SR flipflop circuit based on NAND Logic gates.  
 (ii) Draw the symbol of SR flipflop.  
 (iii) Write truth table of SR flipflop (Mention whether it is "NOR" or "NAND" gate).

5. You have been asked to develop a new website using HTML for the science society of your school. Front page of the website is to be developed as given here. There is a plan to develop separate web pages accessible from front page for history, committee members and news.

(a) Write the program with HTML tags to develop the front page given below.

(b) Your school is planning to organize a science day at the end of the year and you have been asked to include this as a news item in the website as a separate page accessible from front page.

(i) Write down important information regarding this news that need to be included in the website.  
 (ii) Write the HTML program to include the news item on the web.

(c) Briefly explain the importance of developing a website for the science society of the school.

**Shilpa Shakthi National School  
Science Society**

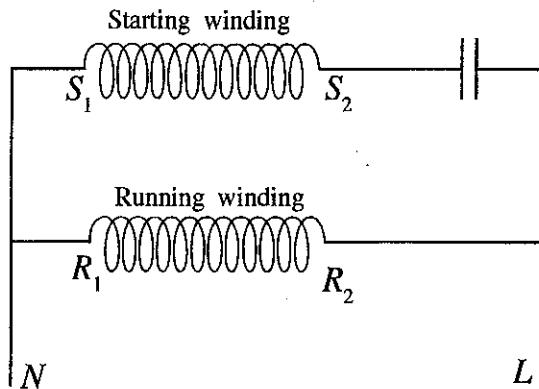
History	Committee members	News
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6. Electric Motor is commonly used as a prime mover in industrial sector. AC induction motors are common among the motors.

- (a) What is meant by the synchronous speed of an induction motor?
- (b) Calculate the synchronous speed of an induction motor which has four poles and connected to 400V/50Hz three phase supply.
- (c) Single phase induction motors can be categorized based on the technique used for obtaining the starting torque. Name **three** such types of motors.
- (d) Winding connections of an induction motor in a ceiling fan is given in the following figure. Draw the winding connection for rotating the motor in opposite direction.



\* \* \*