

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
 இலங்கைப் பரீட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம் இலங்கைப் பரීட்சைத் திணைக்களம்
 Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka
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අධ්‍යයන පොදු සාහිතික පාලන (උසස් පෙළ) විභාග, 2018 අගෝස්තු
 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தரப் பரீட்சை, 2018 ஆகஸ்ட்
 General Certificate of Education (Adv. Level) Examination, August 2018

14.08.2018 / 1300 - 15 00

යාන්ත්‍රික තාක්ෂණවේදය I
 பொறிமுறைத் தொழினூட்பவியல் I
 Mechanical Technology I

15 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.
- * 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. Young's modulus of steel is 1.9×10^{10} N/m². $1\text{N} = 10^5$ cmg/s². How is this value expressed in CGS (Centimetre, Gram, Second) units?

- (1) 1.9×10^9 (2) 1.9×10^{10} (3) 1.9×10^{11} (4) 1.9×10^{12} (5) 1.9×10^{13}

2. Figure shows a mercury column in a simple barometer.

- A - The height H depends on the atmospheric pressure.
 B - H is approximately equal to 760 mm.
 C - The presence of water above the mercury surface in the column increases the height H .
 D - The height H is an indicator of the maximum suction head when pumping water from a well.

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.

3. Consider the following statements that describe certain chemicals.

- A - A standard motor car battery has Sulfuric Acid and Lead.
 B - Soap molecule can attract water at one end, and oil at the other.
 C - Toilet bowl cleaning liquid has Sodium Hypochlorite.
 D - Salt helps to relax cramped muscles.

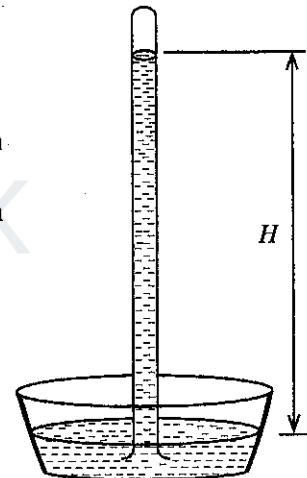
Which of the above statements describe a chemical used at home?

- (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 actions demonstrate entrepreneurship traits of an owner of a family that owns a restaurant?

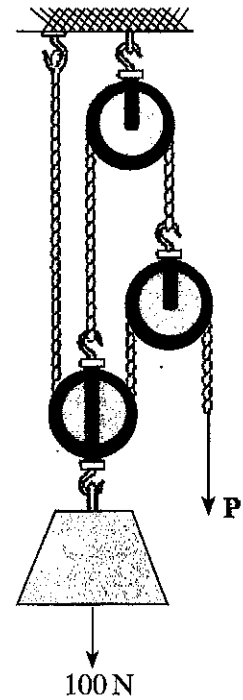
- A - The use of close circuit television cameras to cover the restaurant area
 B - Eldest daughter managing the cashier desk
 C - Using a separate freezer for ready-to-use fish and meat stocks
 D - Assigning two employees daily to clean and disinfect the kitchen area and the rest rooms twice a day

- (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.

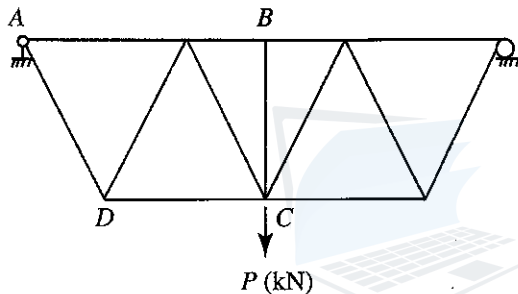


Figure

5. A pulley arrangement is shown to lift 100 N (approximately equal to 10 kg) as shown in the figure. Each pulley has a weight of 10 N (approximately equal to 1 kg). Force P , required for the equilibrium of the system is
- (1) 20 N.
 - (2) 22.5 N.
 - (3) 25 N.
 - (4) 27.5 N.
 - (5) 50 N.



6. A steel truss is used to support a load at point C as shown in the figure.



Consider the following statements on the steel truss given in the figure.

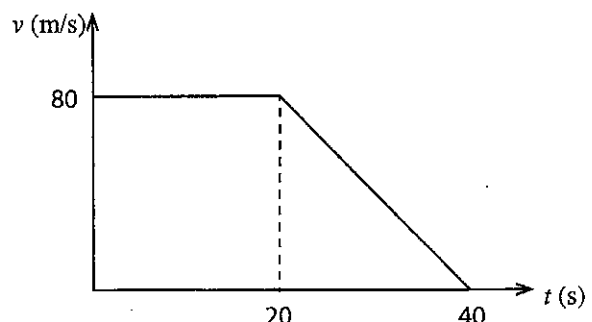
- A - All top chord members carry compressive forces.
- B - All bottom chord members carry tensile forces.
- C - Member BC is not required to maintain stability.
- D - Member AD carries a tensile force.

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.
7. Two cylindrical steel specimens, A and B , with similar length and diameter were subjected to a continuous load until failure. Specimen A failed at a load of 1200 kN with an elongation of 2.1 mm. Specimen B failed at a load of 1350 kN with an elongation of 1.9 mm.
- A - Specimen A is more ductile than B .
 - B - Specimen B is more ductile than A .
 - C - Specimen A has a higher ultimate tensile strength than B .
 - D - Specimen B has a higher ultimate tensile strength than A .

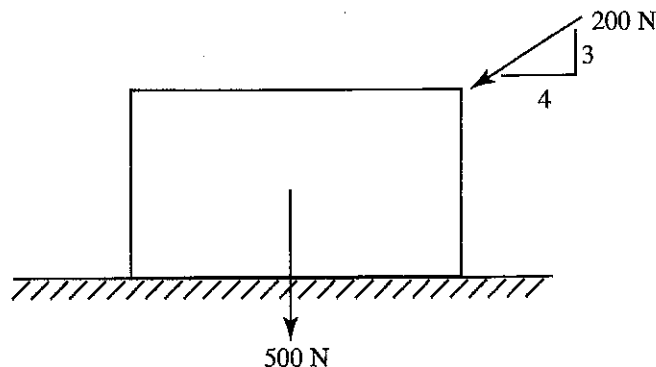
Which of these statements are true?

- (1) A and C only.
 - (2) A and D only.
 - (3) B and C only.
 - (4) B and D only.
 - (5) None of above.
8. A van travels along a straight road from points A to B , and its velocity versus time graph is shown in the figure. The total distance it travelled is



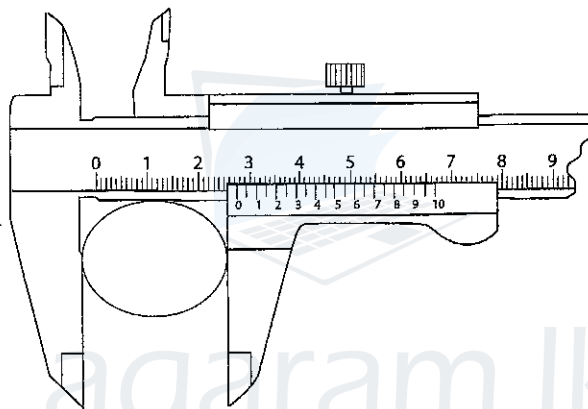
- (1) 1.8 km.
- (2) 2.0 km.
- (3) 2.4 km.
- (4) 2.6 km.
- (5) 2.8 km.

9. A uniform crate has a weight of 500 N (approximately equal to 50 kg) and it is pushed with a force of 200 N as shown in the Figure. Coefficient of static friction between the crate and ground is 0.3.



The friction force at the limiting equilibrium state is

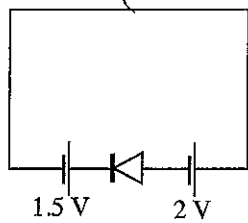
- (1) 186 N. (2) 195 N. (3) 200 N. (4) 260 N. (5) 500 N.
- Following figure shows a measurement of a steel rod taken from a vernier calliper. Use the figure to answer questions 10 and 11.



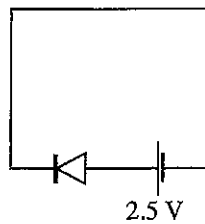
10. What is the minimum reading of the vernier calliper in mm?
 (1) 0.005 (2) 0.01 (3) 0.02 (4) 0.05 (5) 0.1
11. What is the diameter of the steel rod?
 (1) 2.75 cm (2) 2.80 cm (3) 2.55 cm (4) 2.59 cm (5) 2.42 cm
12. Which of the following describes the scale in nanotechnology?
 (1) 0 mm – 100 mm (2) 10^{-9} mm – 9×10^{-6} mm
 (3) 10^{-3} mm – 10^{-6} mm (4) 10^{-6} mm – 9×10^{-6} mm
 (5) 10^{-7} mm – 10^{-6} mm
13. Which of the following statement is most appropriate to the nanotechnology?
 (1) It is a technology related to static electricity.
 (2) It can be named as a green technology.
 (3) It is a branch of robotic technology.
 (4) Lotus effect can be described using nanotechnology.
 (5) It can be named as a new automobile technology.

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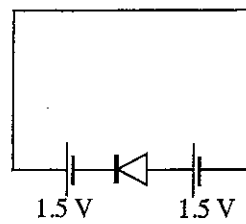
14. Following diagrams show circuits with silicon diodes.



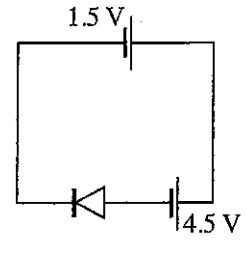
A



B



C

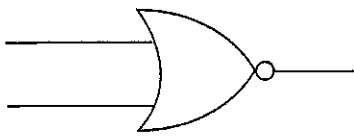


D

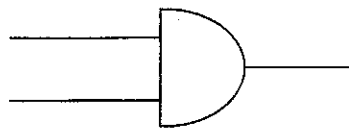
Which of the above circuits are forward biased?

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

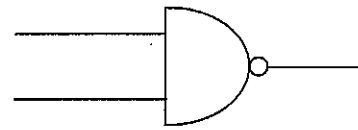
15. What is the symbol used for a logic gate with an output logic state equals to 1, when only logic state of all inputs are equal to 0?



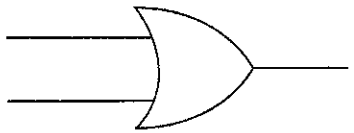
(1)



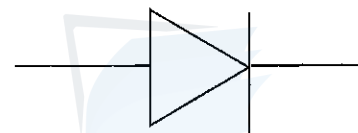
(2)



(3)

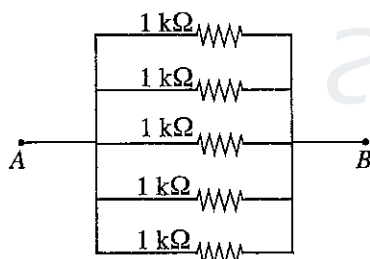


(4)

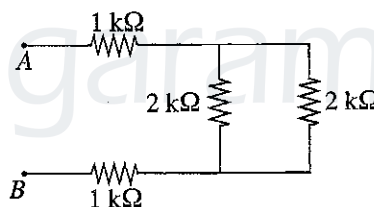


(5)

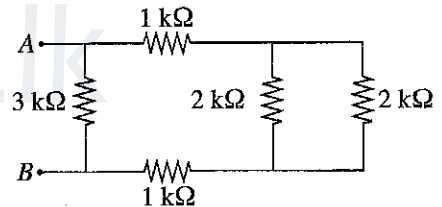
16. Which of the following resistor arrangements has the highest resistance between A and B?



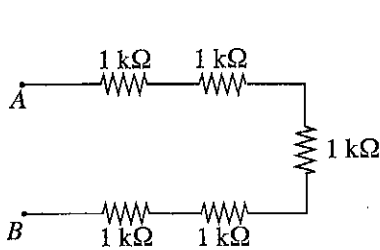
(1)



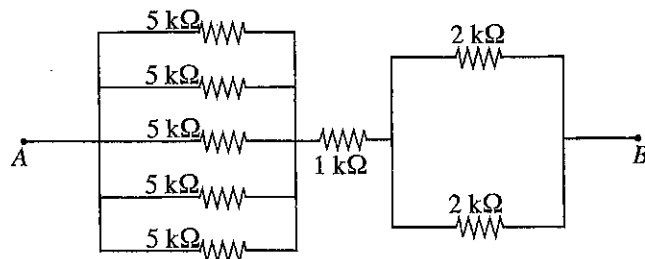
(2)



(3)

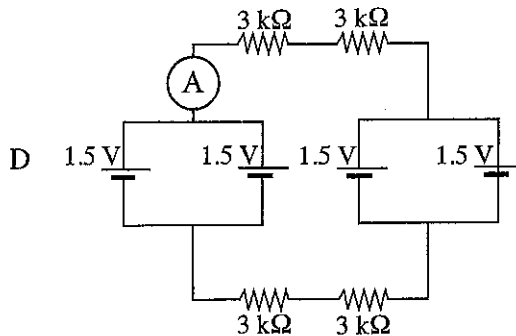
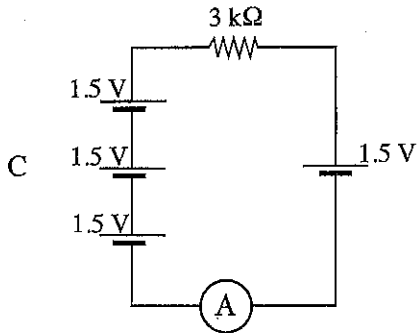
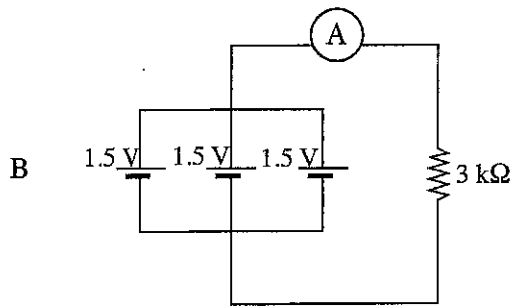
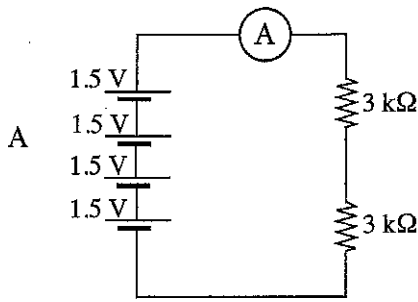


(4)



(5)

17. Consider the following circuit arrangements.



What is the option that gives the ascending order of ammeter readings?

- (1) A, B, C, D (2) A, B, D, C (3) D, B, A, C
 (4) D, C, A, B (5) D, C, B, A

18. A 10W LED lamp is installed in a house wiring circuit. It is switched 2 hours in the morning and for 6 hours at night. What is the daily power consumption of the lamp?

- (1) 0.08 kWh (2) 0.1 kWh (3) 0.8 kWh (4) 10 kWh (5) 80 kWh

19. Select the answer with the component which is **not** used in house wiring circuit?

- (1) Residual current circuit breaker (RCCB), Miniature current circuit breaker (MCCB), Socket outlet.
 (2) Earth electrode, RCCB, MCCB.
 (3) Oscilloscope, earth electrode, RCCB.
 (4) Electricity meter, earth electrode, RCCB.
 (5) Main switch, RCCB, MCCB.

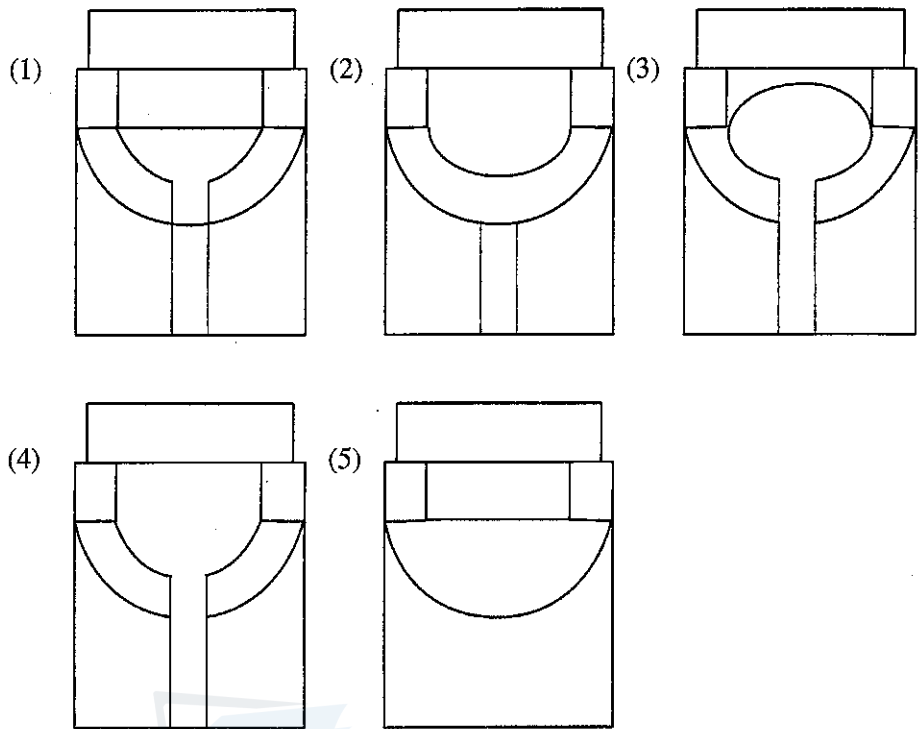
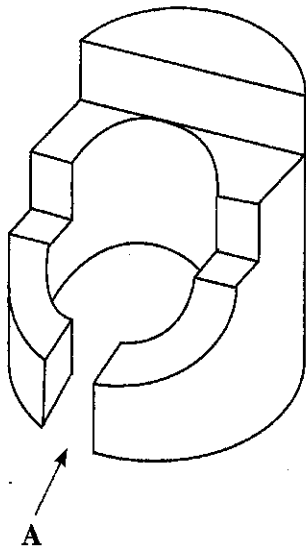
20. Consider the following electronic components.

- A - Capacitor B - Resistor
 C - Diode D - NPN transistor
 E - PNP transistor F - Light Emitting Diode (LED)

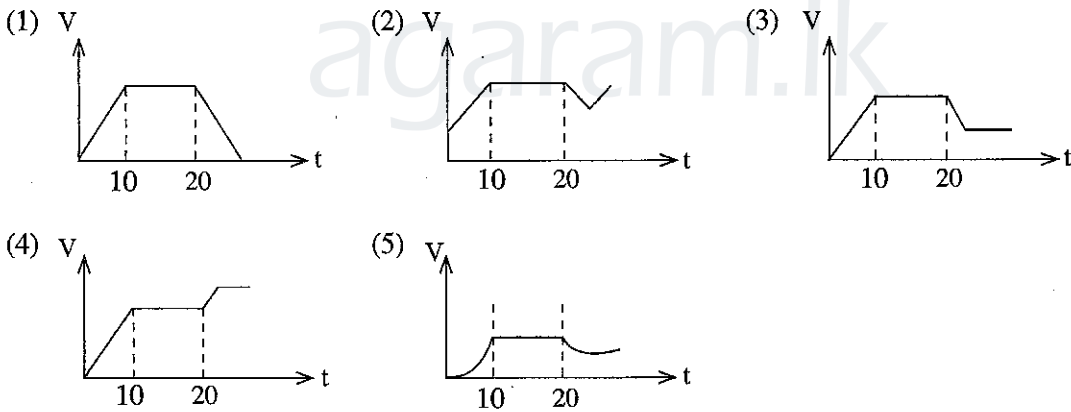
Select the option which gives the correct symbols for electronic components given above.

- (1) , , , , ,
- (2) , , , , ,
- (3) , , , , ,
- (4) , , , , ,
- (5) , , , , ,

21. Select the correct view of the given Isometric view when looking from direction A.

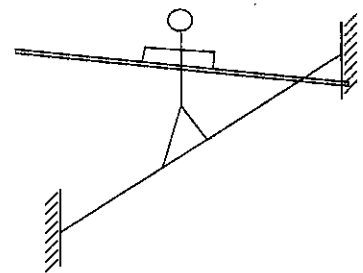


22. A motorcycle accelerates constantly from the rest for 10 seconds and maintains a constant velocity for another 10 seconds. Due to a pedestrian crossing the road, the rider applies sudden brakes to slow down and keeps moving in a lower velocity than before. Which velocity-time graph represents this motion correctly?



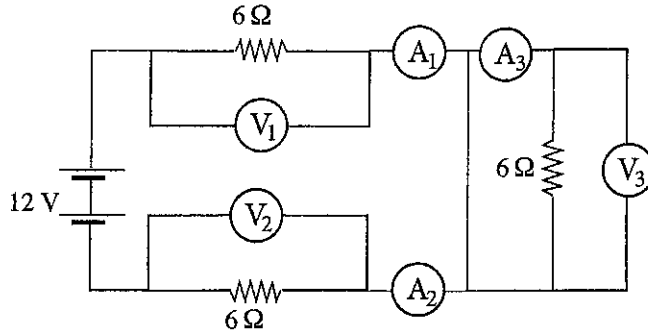
23. As shown in the figure gymnast usually takes a long pole when he walks on a rope at heights. What is the best explanation for this?

- (1) To use the pole to touch the floor in case he tilts.
- (2) To establish the balance by wide spreading the weight of the person and pole.
- (3) To entertain the crowd more as it is difficult to walk with the pole.
- (4) To change the moment of inertia to re-establish the balance using the pole in case of out of balance situations.
- (5) To increase the reaction force from the rope.



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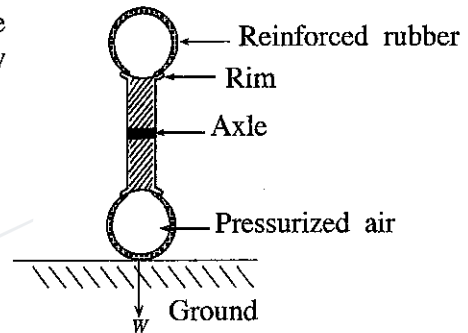
● Consider the following circuit and answer questions 24 and 25.



24. Select the answer with correct ammeter readings of A_1 , A_2 and A_3 respectively.
- (1) 1A, 1A, 1A
 - (2) 1A, 1A, 0A
 - (3) 2A, 2A, 2A
 - (4) 6A, 6A, 6A
 - (5) 12A, 12A, 0A
25. Select the answer with correct voltmeter readings of V_1 , V_2 and V_3 respectively.
- (1) 1V, 1V, 0V
 - (2) 6V, 6V, 0V
 - (3) 6V, 6V, 6V
 - (4) 12V, 6V, 0V
 - (5) 12V, 12V, 12V

26. Figure shows a cross section of a vehicle wheel with the rim, axle and tyre. The load acting on the axle should flow through

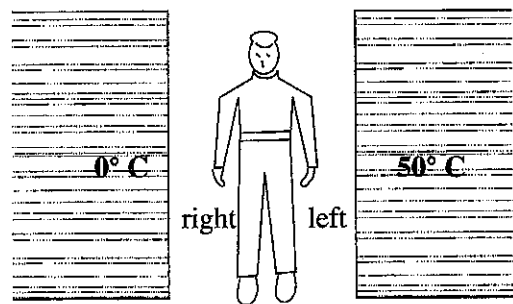
- (1) rim and ground.
- (2) rim, reinforced rubber and ground.
- (3) rim, pressurized air, reinforced rubber and ground.
- (4) rim, reinforced rubber, pressurized air and ground.
- (5) rim, pressurized air and ground.



27. Suppose that the designed Octane number of the fuel (gasoline) of a car engine is 92, but only 90 and 95 are available in the market at rates of Rs. 100 and Rs. 120 respectively. Which of the following options gives the most techno-economic option for pumping fuel into the car?

- (1) Pump only Octane 95 gasoline
- (2) Pump only Octane 90 gasoline
- (3) Pump 50% Octane 95 and 50% Octane 90
- (4) Pump 90% Octane 95 and 10% Octane 90
- (5) Pump 40% Octane 95 and 60% Octane 90

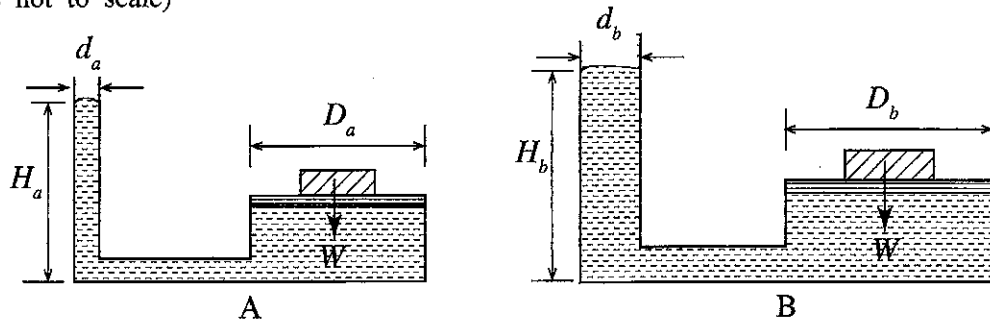
28. Figure shows a man standing between two solid walls which are at two different temperatures, 0°C and 50°C . If there is no convection or conduction heat transfer and the man feels that his left side is relatively warmer than the right side, which of the below statement/s describe/s the heat transfer **incorrectly**?



- A - Hot radiation from hot wall makes his left side warm.
 - B - Cold radiation from cold wall makes his right side cold.
 - C - Net radiation on left side is greater than that of right side.
 - D - Net radiation on left side is lower than that of right side.
- (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) All A, B, C and D.

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29. Figures A and B show two different water columns holding two similar pistons of the same weight of W . If $d_a < d_b$ and $D_a = D_b$ which of the following statements are **incorrect**? (Figures are not to scale)



A - $H_a = H_b$

B - $H_a > H_b$

C - $H_a < H_b$

D - cannot be decided without water properties

- (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) All A, B, C and D.
30. A cyclist can balance the cycle and stay upright easily while riding, but he cannot do so while he is not riding the cycle. Assume that rider does not keep his leg on the ground in both cases. The most suitable reason for this is
- (1) the change of the position of his own center of gravity.
 (2) the change of the pedaling pattern.
 (3) the activation of brakes.
 (4) the development of a resistive force on the front wheel against tilting.
 (5) the turning of the handle here and there randomly.
31. Firing order of a six cylinder in-line engine is usually,
- (1) 1-4-3-2-6-5. (2) 1-6-3-5-2-4. (3) 1-5-3-6-2-4.
 (4) 1-3-6-2-4-5. (5) 1-6-2-5-3-4.
32. Out of the following, what are the correct statements regarding Ergonomics?
- A - Ergonomics is not related to human comfort.
 B - Ergonomics principles suggest that visual systems are preferable than auditory systems in noisy environments.
 C - Accidents in a factory can be reduced by using Ergonomics principles.
 D - Ergonomics takes action to reduce strain on the body by reducing repetitive motions.
- (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) All A, B, C and D.
33. Select the choice which includes correct statements that explain open loop and closed loop control systems.
- A - Closed loop control system is also known as an automatic control system.
 B - Open loop control system is simple and economical than closed loop control system.
 C - In a closed loop control system, the output influences the input.
 D - Open loop control systems are accurate than closed loop control systems.
- (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) All A, B, C and D.

34. Out of the statements given below, which statements are correct on isometric drawings?

- A - Two main axes are perpendicular.
 B - Measurements can be made along the isometric axes.
 C - Measurements can be made parallel to the isometric axes.
 D - All sides are equally distorted.

- (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) All A, B, C and D.

35. A circle will appear on an isometric drawing as a

- (1) Circle. (2) Cycloid. (3) Ellipse. (4) Parabola. (5) Hyperbola.

36. Consider the following statements on two stroke engines.

- A - A two stroke engine has a good power to weight ratio.
 B - Energy fluctuation is relatively high in two stroke engines when compared to four stroke engines.
 C - The thermal efficiency is relatively high in two stroke engines when compared to four stroke engines.

Which of these statement/s properly describe/s the two stroke engine?

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

37. A factory running mostly with manual labour needs to be automated. The production executive has submitted a proposal with following statements to the management regarding the automation.

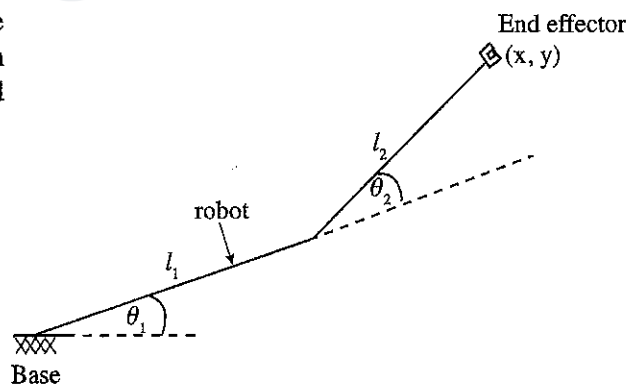
- A - The quality of life of the employees can be improved.
 B - Complex manufacturing processes can be carried out easily.
 C - Productivity of the factory can be improved.
 D - Same quality products can be manufactured repeatedly.

Select the choice included the correct statements regarding automation.

- (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) All A, B, C and D.

38. Schematic diagram of a robot working in a plane is shown in the figure. It has two links of length l_1 and l_2 . What is the x coordinate of the end effector relative to the base?

- (1) $l_1 \sin \theta_1 + l_2 \sin(\theta_1 + \theta_2)$
 (2) $l_1 \cos \theta_1 + l_2 \cos(\theta_1 + \theta_2)$
 (3) $l_1 \cos \theta_1 + l_2 \sin(\theta_1 + \theta_2)$
 (4) $l_1 \sin \theta_1 + l_2 \cos(\theta_1 + \theta_2)$
 (5) $l_1 + l_2$



39. In a manufacturing process, a metal is caused to flow through a restricted orifice to create an extremely elongated strip of uniform and comparatively smaller cross-sectional area. This process is known as

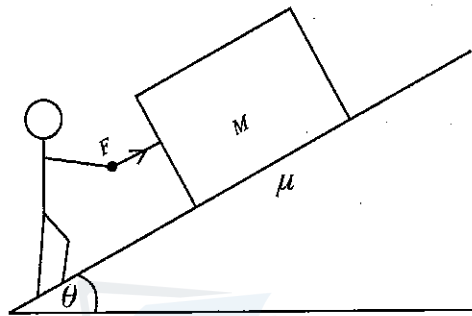
- (1) Rolling. (2) Extrusion. (3) Drawing. (4) Spinning. (5) Forging.

40. Which manufacturing process/es are used to make a kitchen knife with a wooden handle?

- A - Forging B - Heat treating
 C - Grinding D - Riveting

- (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) All A, B, C and D.

41. Which of the following is an example for constant mass manufacturing process?
 (1) Sawing (2) Turning (3) Broaching (4) Rolling (5) Grinding
42. Out of the following statements, what are the reasons for cutting tools to become fail generally?
 A - Mechanical breakage due to excessive force.
 B - Quick dulling by plastic deformation.
 C - Gradual wear of the cutting tool at its flanks and rake face.
 D - Breakage due to excessive shock load.
- (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) All A, B, C and D.
- A person is trying to push an object of mass M on a slope of angle θ . The coefficient of friction of the contact surface of the object and the slope is μ . Use the figure to answer questions 43 to 45.



43. What is the minimum force (F) that the person should apply just to start moving the object?
 (1) $\mu Mg \cos \theta + Mg \sin \theta$ (2) $\mu Mg \cos \theta$ (3) $Mg \sin \theta$
 (4) Mg (5) $Mg \cos \theta + \mu Mg \sin \theta$
44. If both object and slope surfaces are frictionless and the person still can move the object upwards the slope, what is the minimum force that the person should apply just to start moving the object?
 ($M = 30 \text{ kg}$, $g = 10 \text{ ms}^{-2}$, $\theta = 30^\circ$)
 (1) $30 \times 10 \times \frac{1}{2}$ (2) $30 \times 10 \times \frac{\sqrt{3}}{2}$ (3) $30 \times \frac{1}{2}$
 (4) $30 \times \frac{\sqrt{3}}{2}$ (5) $30 \times 10 \times \frac{\sqrt{3}}{2} + 30 \times 10 \times \frac{1}{2}$
45. If the person pushes the object 2 m by applying 175 N force in 2 s, what was the power required to perform this motion?
 (1) $\frac{25 \times 2}{2} \text{ W}$ (2) $\frac{175 \times 2}{2} \text{ W}$ (3) $\frac{150 \times 2}{2} \text{ W}$ (4) 50 W (5) 100 W
46. What are the technical purposes of a rear spoiler in a sports car?
 A - To improve the aesthetic appearance of the car.
 B - To increase the grip on the road by pressing the car downwards at high speeds.
 C - To distract the drivers coming behind.
 D - To reduce the lift force at high speed.
- (1) A and B only. (2) A and C only. (3) A, B and D only.
 (4) B and D only. (5) All A, B, C and D.
47. What is the most suitable statement that describes the function of an alternator in an automobile?
 (1) It acts as a reservoir of electrical energy.
 (2) It converts mechanical energy into electrical energy to recharge the battery.
 (3) It converts electrical energy into kinetic energy.
 (4) It powers the radiator fan.
 (5) It ensures efficient combustion of fuel.

48. Which of the following reasons are true for reduction of lubricant oil in an engine?
A - Leakage of oil through oil pan gasket
B - Poor quality or improper viscosity of the engine oil
C - Badly worn piston rings
- (1) A only. (2) A and B only. (3) A and C only.
(4) B and C only. (5) All A, B and C.
49. Which of the following statements describe the term 'Wheel base' of a vehicle?
(1) Distance between front and rear axles
(2) Distance between the front wheels
(3) Distance between the rear wheels
(4) Extreme length of the vehicle
(5) Extreme width of the vehicle
50. Which of the following statements are true for excessive or uneven tyre wear in an automobile?
A - Poor road surfaces
B - Wheels are misaligned.
C - Incorrectly inflated tyres
D - Brake pads are worn out.
- (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) All A, B, C and D.



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 Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka Department of Examinations, Sri Lanka

අධ්‍යයන පොදු යභනික පත්‍ර (උසස් පෙළ) විභාගය, 2018 අගෝස්තු
 கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2018 ஆகஸ்ட்
 General Certificate of Education (Adv. Level) Examination, August 2018

යාන්ත්‍රික තාක්ෂණවේදය II
 பொறிமுறைத் தொழினூட்பவியல் II
Mechanical Technology II **15 E II** **16.08.2018 / 13 00 - 16 10**

පැය තුනයි
 மூன்று மணித்தியாலம்
Three hours

අමතර කියවීමේ 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 and decide on the questions that you give priority in answering.

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	

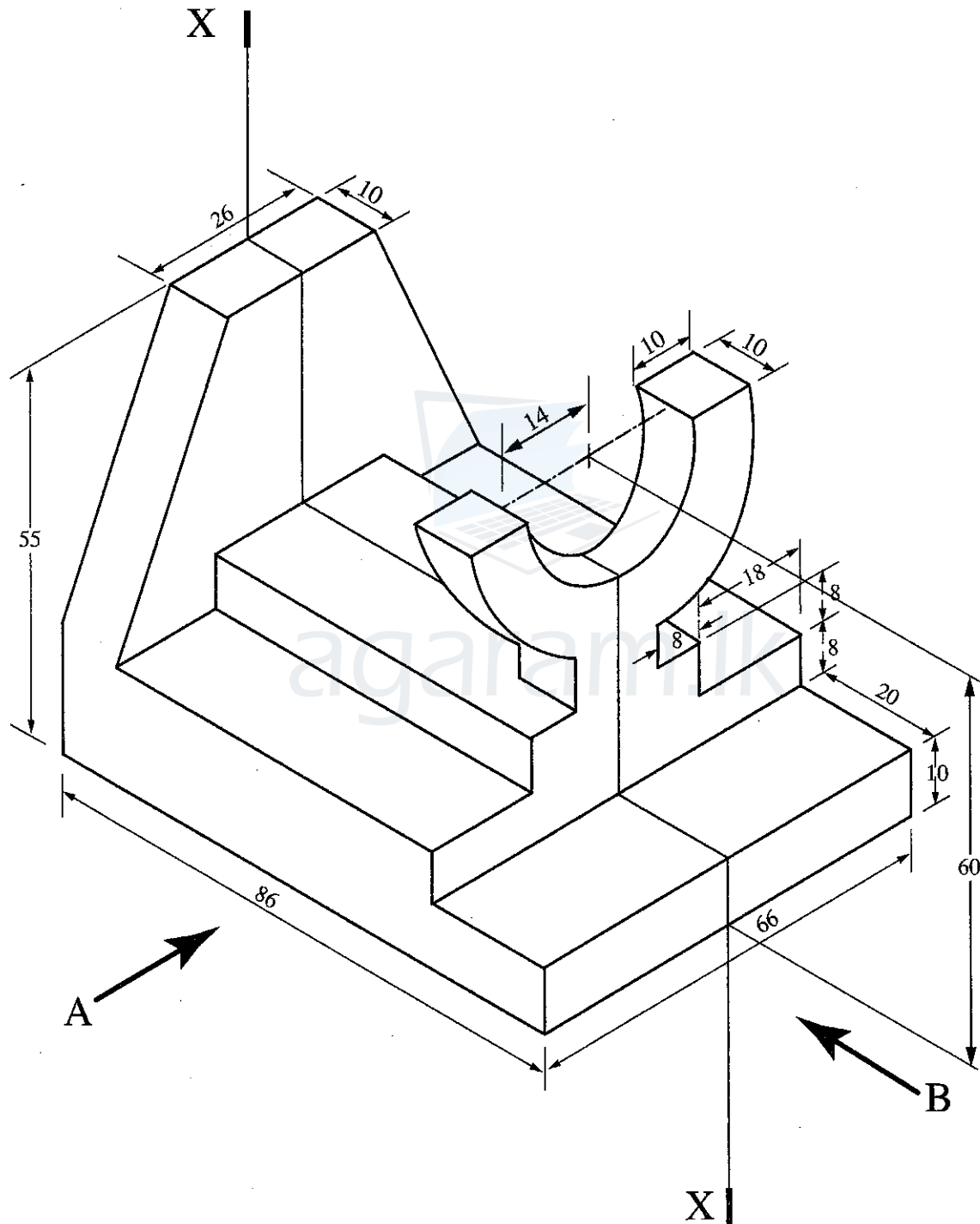
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PART A – Structured Essay
 Answer *all four* questions on this *paper itself*.
 (Each question carries 10 marks)

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1. An isometric view of a machine component is shown in the figure. Machine component 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 sketches. 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.



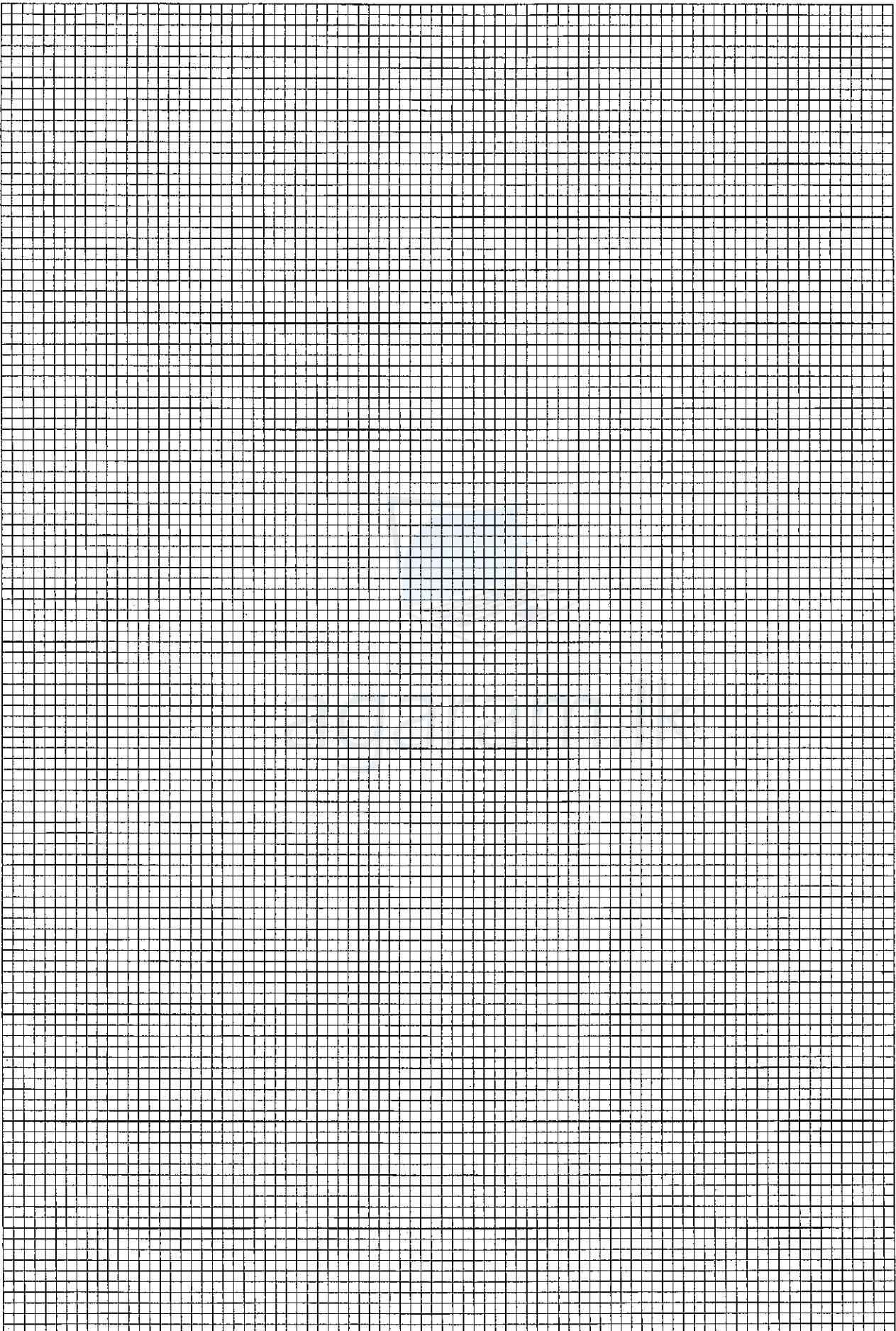
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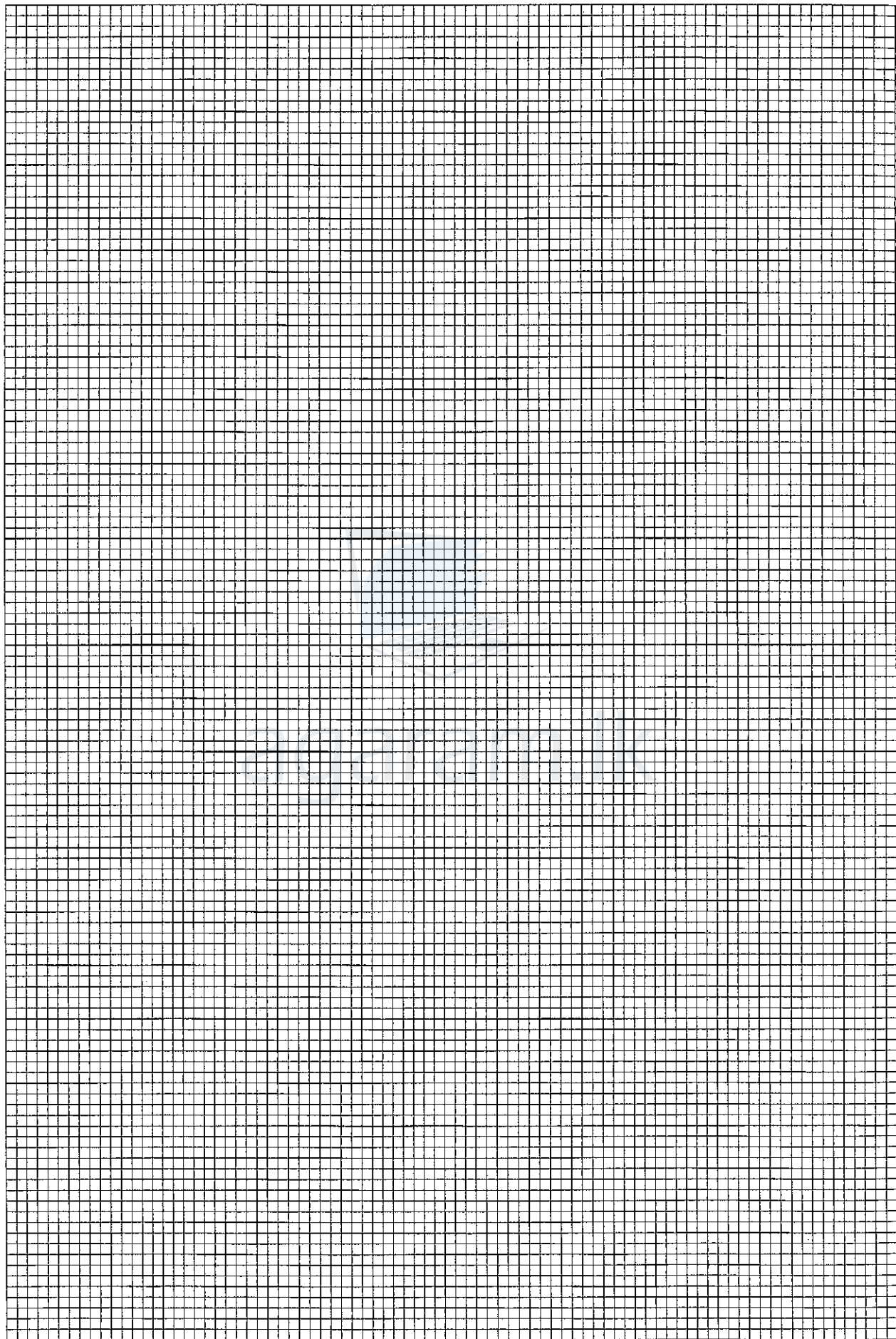
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Index No. :

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[see page five

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2. Assume that you have been appointed as the IT technical officer responsible for improving IT facilities of a school. Answer the following questions related to IT facilities.

(a) School has decided to establish a computer laboratory with 25 desktop computers. This laboratory will be used as a common facility for all students. The laboratory should include facilities for preparing documents, presentations and searching information in the Internet.

(i) State **four** hardware units required for a fully functional computer.

- (1)
- (2)
- (3)
- (4)

(ii) Give **two** software required for the computer units.

- (1)
- (2)

(iii) State **one** facility required for the computers.

.....

(b) It has been decided to improve the computer laboratory to facilitate programs conducted by teachers for other schools in remote areas through video conferencing.

(i) Name **two** additional hardware required for the computer laboratory in addition to the fully functional computers.

.....
.....
.....

(ii) State **one** software package required to carry out video conferencing.

.....
.....

(c) Assume that a project is being conducted by a group of 10 students under the supervision of a teacher from a school in a remote area, students are working in computer laboratory of the school and the teacher is at another school. Furthermore, assume that relevant hardware and internet facilities are available for the teacher and the students. State required software facilities for simultaneously preparing a report by 10 students and as the teacher can comment while preparing the report.

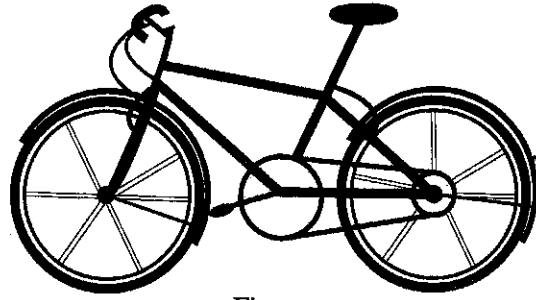
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3.



Figure

(a) Pick any **three** components/parts of the bicycle shown in the figure and list their manufacturing processes.

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.....
.....
.....

(b) Each wheel of the bicycle has a hub bearing. Give **two** functions of the bearing.

.....
.....
.....

(c) State **two** measures that have been taken to improve the safety of the rider.

.....
.....
.....

(d) If the chain drive gives a speed ratio of 1:3 and,

(i) if the front sprocket has 36 teeth, how many teeth should be available in the rear sprocket?

.....
.....
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(ii) if the wheel diameter is 75 cm, calculate the speed of the bicycle at 60 rpm pedaling rate.

.....
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.....
.....
.....

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4. Following figures show the front elevation and the plan of an object made out of sheet metal. The object does not have a bottom surface. (Figures are not to scale.)

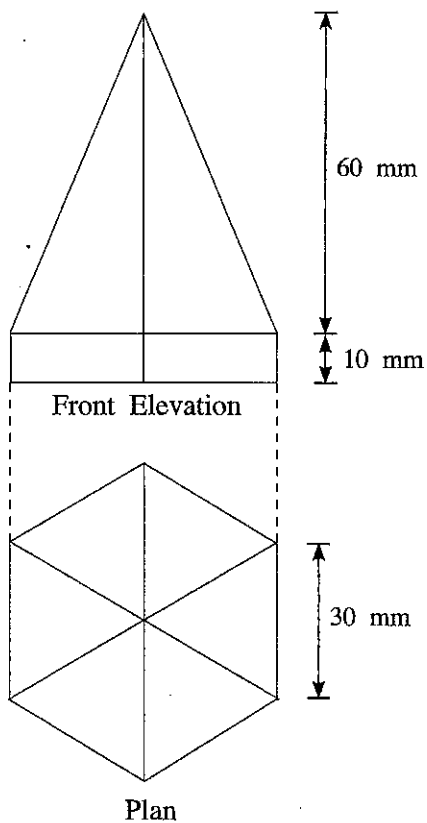


Figure 4.1

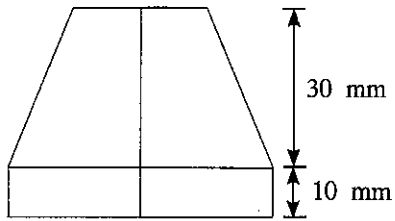
(a) Draw the development of the given object.

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[see page eight

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- (b) Top part of the object has been cut as shown in Figure 4.2. The figure is not to scale. Draw the new plan of the object.



Front Elevation

Figure 4.2



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- (c) Draw the new development of the object shown in Figure 4.2.



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අධ්‍යයන ජ්‍යෙෂ්ඨ කෘතීමය ජනු (උසස් පෙළ) විභාගය, 2018 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2018 ஆகஸ்ட்
General Certificate of Education (Adv. Level) Examination, August 2018

යාන්ත්‍රික තාක්ෂණවේදය II
பொறிமுறைத் தொழினுட்பவியல் II
Mechanical Technology II

15 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

1. The dengue fever has become an epidemic in Sri Lanka during the past few years. The fever is spreading rapidly, specially in slum areas. This situation has posed many challenges for controlling the spread of disease, in inter and intra regional communities.

(a) In order to curb this epidemic, following actions could be taken.

- ① To control breeding of mosquito carrying the virus
- ② To keep away the mosquito carrying the virus
- ③ To prevent spreading virus to inter regions

Briefly explain two suitable technological measures you could take with regard to

- (i) above ① at the school.
- (ii) above ② at your home.
- (iii) above ③.

(b) You are appointed to educate the people in slum areas to control the epidemic within their own community. Briefly explain how you could use technology to make people aware to control this.

2. A smart building is a new concept in the today's world with prime objectives such as saving energy and contributing to achieve the sustainability goals. In order to achieve sustainability goals the design of the electrical system is very important. Assuming that you are the technical officer in a smart building project, answer the following questions. Main electricity consuming equipments in the building are identified as below.

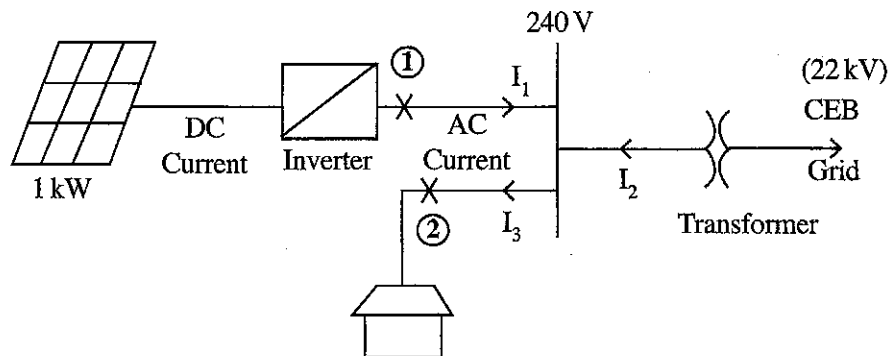
Equipment	Power	Quantity	Average daily usage (hours)
Bulbs	20 W	5	7
	100 W	2	2
Air Condition	4 kW	1	6
Refrigerator	100 W	1	15
Others	200 W	1	5

- (a) What is the total daily electricity consumption in kWh?
- (b) Calculate the maximum possible current taken by the building assuming 240 V supply voltage?
- (c) A single phase transformer is used to supply the above current. What is the minimum capacity of the transformer needed in kW?

[see page ten

(d) In order to convert the building into a sustainable building the owner is suggested to use solar energy from a roof-top 1kW photovoltaic (PV) plant. It will generate energy for 4 hours per day. The generated electricity will be sold to Ceylon Electricity Board (CEB) with the rate of Rs. 20 per kWh. Calculate the total income per month of 30 days from solar energy.

(e) Details of 1kW PV plant is given below.



(i) Find the maximum possible AC current generating from the PV plant.

(ii) Find the suitable rating of the fuses at point ① and ② .

3. A rural household receives pipe borne potable quality water, under gravity, from a community water supply scheme. It delivers water at daily, an average rate of 2 litres per minute, for a period of 5 hours, from 10 p.m. to 3 p.m.

The household has two adults, and three children of school going age and water is used for drinking, cooking, washing clothes, sanitary requirements and for home gardening.

- Estimate the daily household water requirement for each purpose listed above, stating the assumptions you have made.
- Show on a sketch the layout of the water storage and distribution system for this dwelling. Name the components of the system while stating their specific use.
- Suppose that the household wishes to collect rain water to enhance its water needs. Propose how you would integrate the rain water collection system, to meet the domestic water needs. Use of sketches is expected to convey the proposal.

Part C

4. Figure 4.1 shows a rice cooker which is an electrical kitchen appliance that can be used to boil or steam rice. Normally, it consists of three main components.

- A heat source
- A cooking bowl
- A thermostat

- (i) Briefly explain the functionality of the thermostat in the rice cooker.
- (ii) State **two** type of materials that can be used for making the thermostat.
- (iii) Explain **three** factors need to be considered when selecting materials for manufacturing a cooking bowl of the rice cooker.
- (iv) If you are asked to improve the efficiency of the rice cooker, propose **two** suitable modifications for the rice cooker shown in the Figure 4.1.



Figure 4.1

5. It is necessary to use correct amount of water to prepare the dough for making breads. A measuring cup is used to measure the required water amount to be added to the dough. Assume that you are using a water tap as shown in the Figure 5.1 to fill the measuring cup.

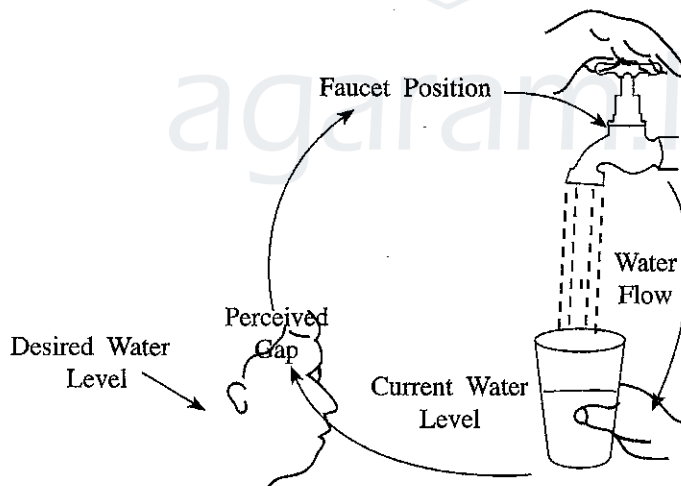


Figure 5.1

- (a) Using appropriate sketches briefly explain the difference between open-loop and closed-loop control systems.
- (b) What type of control system can be related to the process shown in Figure 5.1? Identify the critical components of the selected control system.
- (c) The control diagram of an electric oven used to bake breads is depicted in the Figure 5.2.

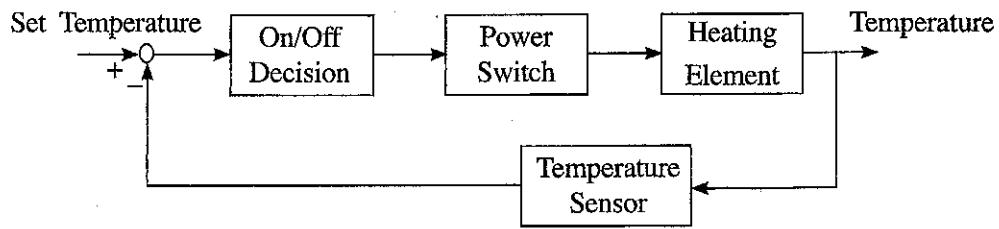


Figure 5.2

- (i) Give **two** types of temperature sensors that can be used to measure the internal temperature of the oven.
 - (ii) Identify controller, sensor, actuator and process/plant of the above system.
6. Solar energy is emerging as a sustainable energy source around the world today. As Sri Lanka is located in the tropical region, it is blessed with this natural and environmentally friendly source of energy throughout the year. On average, Sri Lanka receives a minimum of 15 MJ/m^2 of solar heat as thermal irradiation per day. Photovoltaic cell is one of the well-known technologies that is used to harness the solar energy.
- (a) State **two** other technologies that use solar energy.
 - (b) If an average house in Sri Lanka consumes 500 Wh and 300 Wh flat loads during the day (6.00 a.m. to 6.00 p.m.) and night respectively, propose a method to fully electrify a house using solar energy.
 - (c) If the electrical efficiency (electrical energy/solar irradiation) of a photovoltaic panel is 17% and a panel of $1209 \text{ mm} \times 537 \text{ mm}$ has a maximum power output of approximately 80W, calculate the minimum number of panels needed for the house to be electrified during a sunny day from 6.00 a.m. to 6.00 p.m. Assume that the minimum solar irradiation is 200 W/m^2 and the day time demand for electricity in the house remains unchanged from 6.00 a.m. to 6.00 p.m.
 - (d) If the roof has anterior slopes to the East, South, West and North, on what slope do you install your photovoltaic panels for the following electrical loading conditions? Justify your answer.
 - (i) Significantly high load during the morning hours.
 - (ii) Significantly high load during the afternoon hours.

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