

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

සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved

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

NEW/OLD

ශ්‍රී ලංකා විභාග දෙපාර්තමේන්තුව
இலங்கைப் பரீட்சைத் திணைக்களம்
Sri Lanka Department of Examinations, Sri Lanka
Department of Examinations, Sri Lanka

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

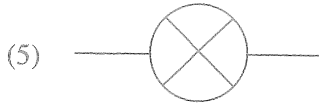
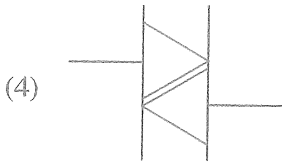
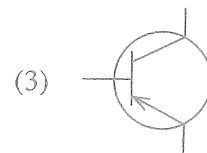
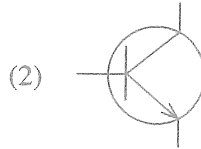
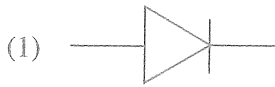
16 E I

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 (x) 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.



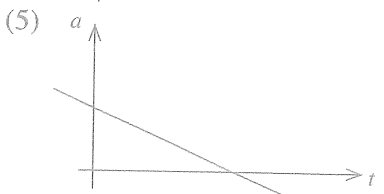
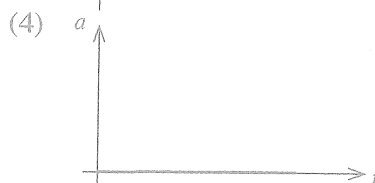
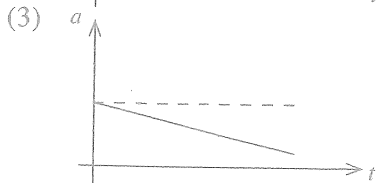
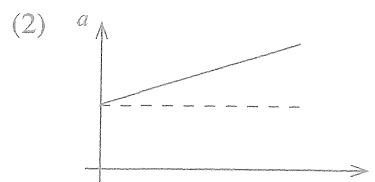
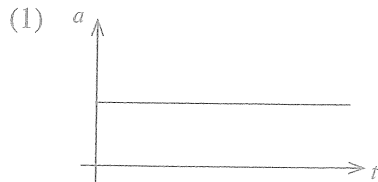
2. What is the nominal frequency of the domestic electricity supply in Sri Lanka?

- (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 $g = 9.81 \text{ m s}^{-2}$)

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

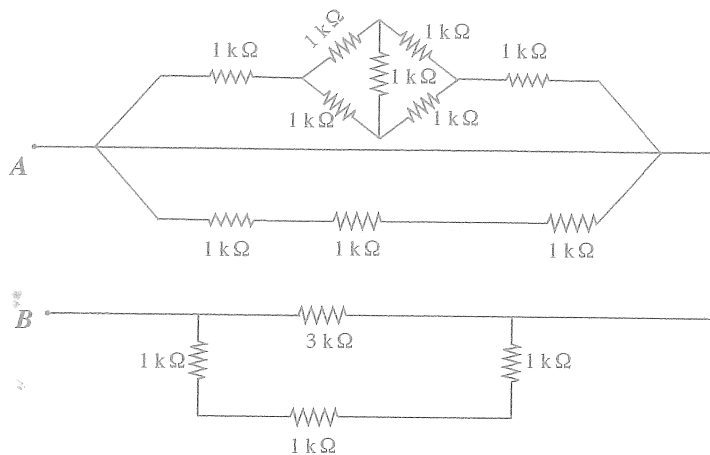
4. A ball is dropped from the top of a tall building. Which of the following acceleration-time graph shows the motion of the ball in air? (Assume that there is no air resistance.)



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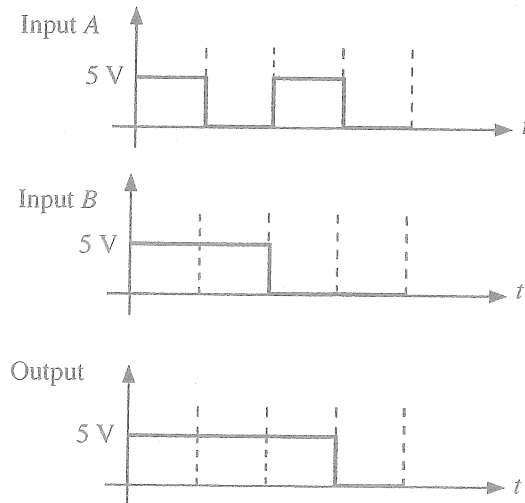


9. What is the resistance between points A and B in the following circuit?



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

10. Consider the following graphs.



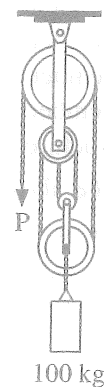
Above logic output was observed when Input A and Input B are connected to its inputs of a logic gate. Here 5 V and 0 V voltages represent logic '1' and logic '0', respectively.

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 $(g) = 9.81 \text{ m s}^{-2}$)

- (1) 10g. (2) 25g. (3) 33g.
 (4) 50g. (5) 100g.

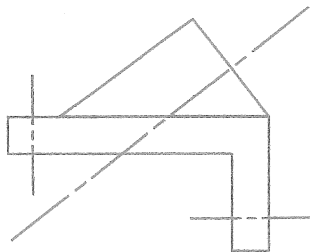
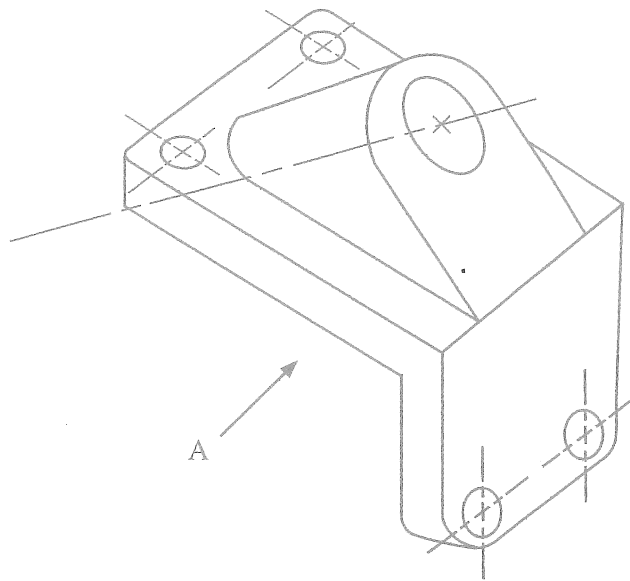


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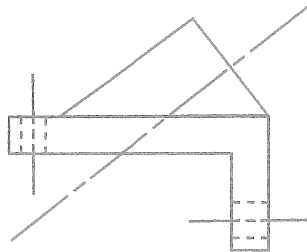
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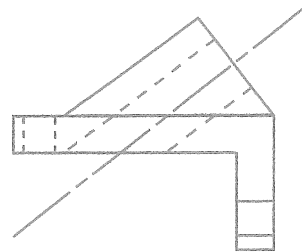
12. Which one shows correct view when projected from direction A?



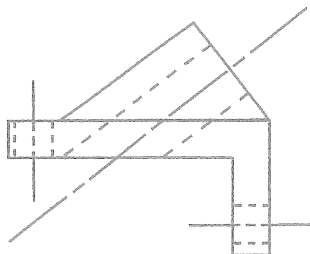
(1)



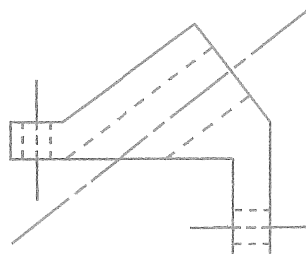
(2)



(3)



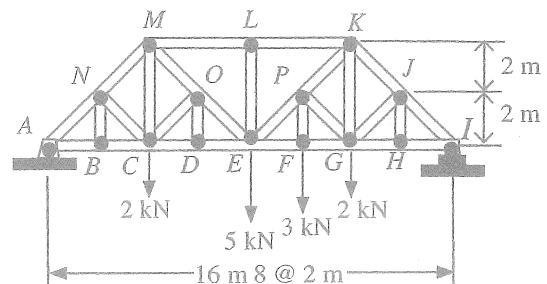
(4)



(5)

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.

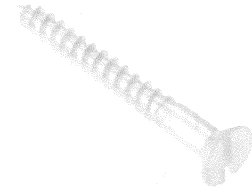


Out of the above statements, the correct statements are,

- (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.

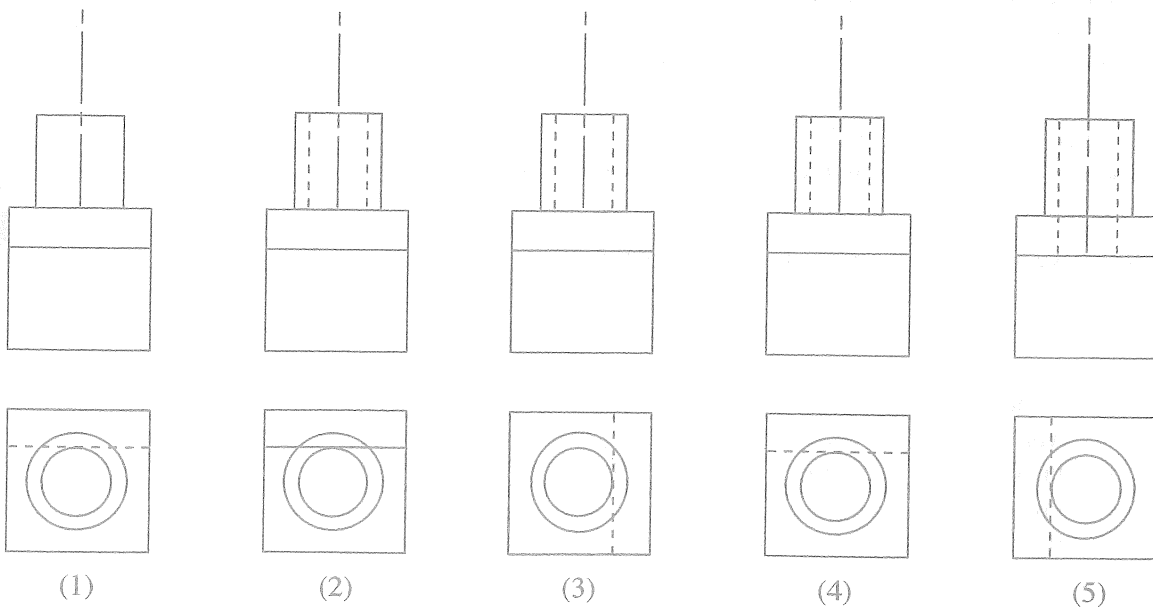
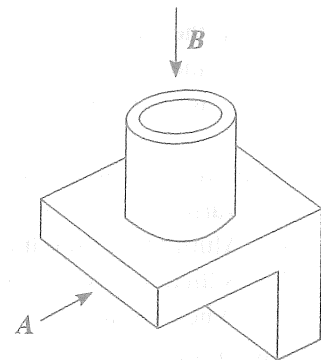
15. Consider the following statements.

- 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)

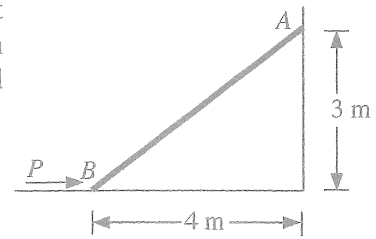
(3)

(4)

(5)



17. 800 N weight rod AB positioned as shown in the figure. The contact surface at B is smooth, whereas 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.

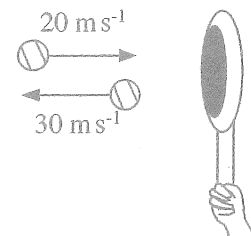
20. Consider the following statements.

- 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.

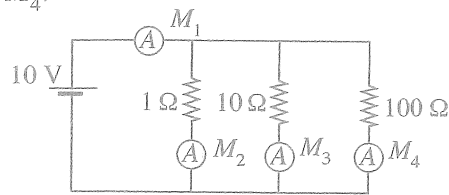
- A - Ability to track the order and stating the delivery date.
 B - Providing product information, availability in stock, price and alternatives.
 C - Providing customer reviews on products.
 D - Reduced transaction time and associated costs.

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.

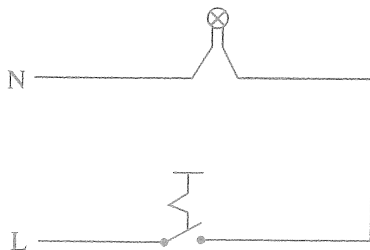
[See page seven

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 .

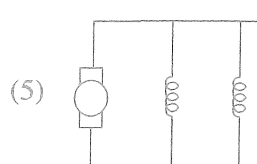
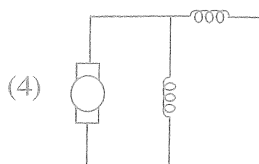
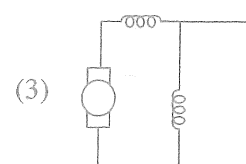
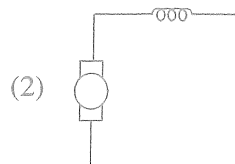
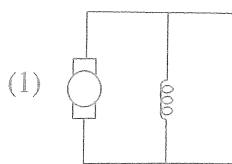


Which of the following statement is **incorrect**?

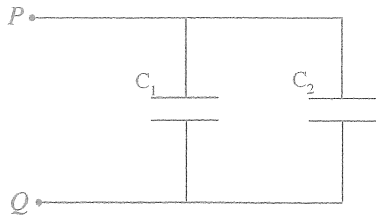
- (1) Value of $M_1 = M_2 + M_3 + M_4$
 - (2) Value of $M_3 = 1\text{ A}$
 - (3) M_4 is the smallest reading.
 - (4) M_1 is the largest reading.
 - (5) Value of $M_1 > (M_2 + M_3 + M_4)$
24. Ten 5 W LED bulbs are used in a house. Each bulb is used for 5 hours, daily. What is the daily electrical energy 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.



28. Two capacitors are connected as in following figure.

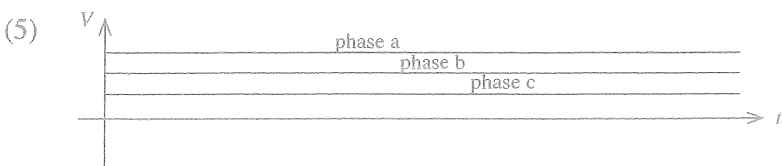
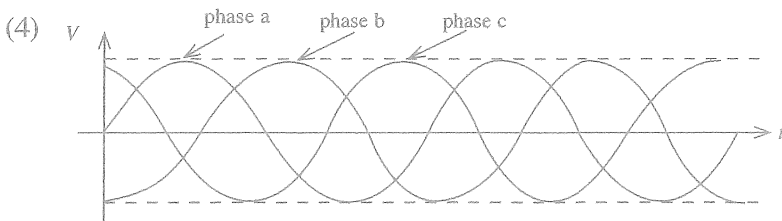
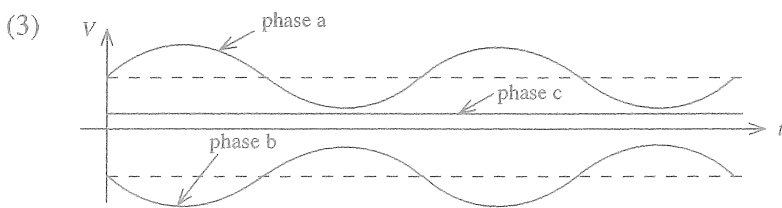
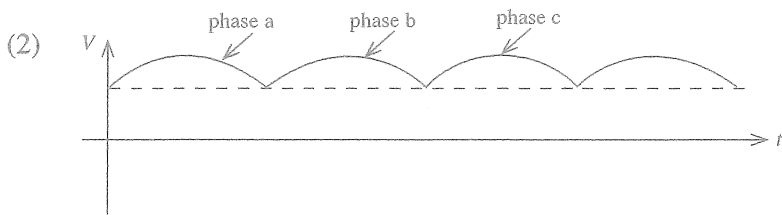
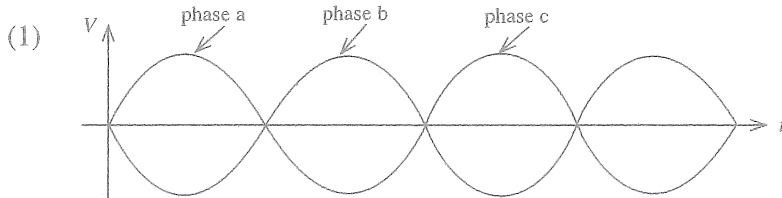


	Cross section Area	Distance between plates	Permittivity
C_1	A	d	ϵ
C_2	$2A$	$2d$	10ϵ

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

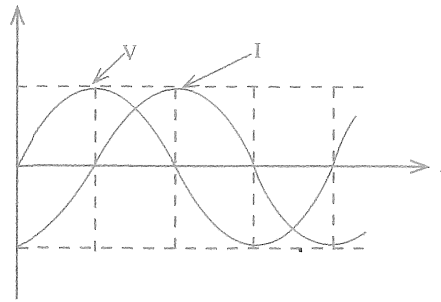
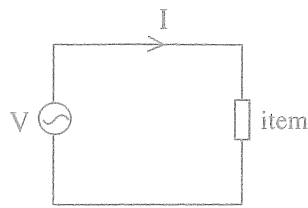
- (1) $\frac{\epsilon A}{d}$
- (2) $\frac{2\epsilon A}{d}$
- (3) $\frac{4\epsilon A}{d}$
- (4) $\frac{11\epsilon A}{d}$
- (5) $\frac{40\epsilon A}{d}$

29. Select the proper three phase waveform.



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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.

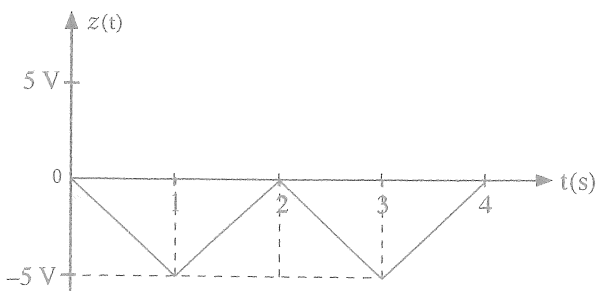
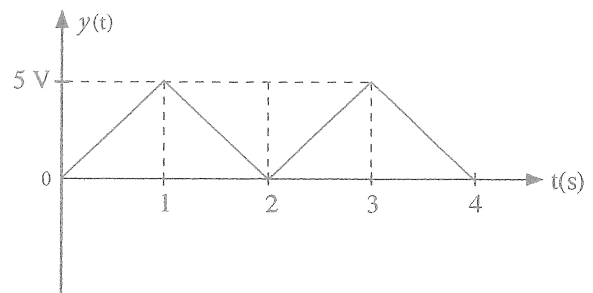
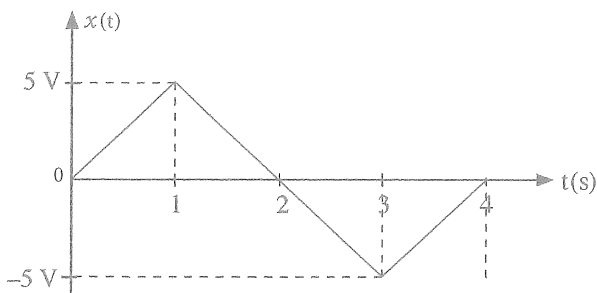
31. Consider following statements regarding online delivery of lessons.

- 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.

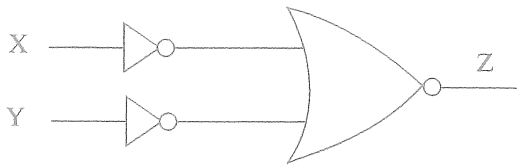
32. Three wave forms are shown in following figures.



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

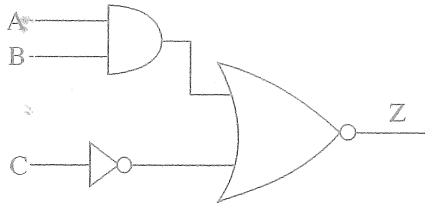
- (1) 2.5 V, 2.5 V, 2.5 V
- (2) 0 V, 2.5 V, -2.5 V
- (3) 0 V, 0 V, 0 V
- (4) 0 V, -2.5 V, 2.5 V
- (5) -2.5 V, -2.5 V, 0 V

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) $AB + \bar{C}$ (2) $\overline{(A + B) + \bar{C}}$ (3) $\overline{AB + \bar{C}}$ (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.

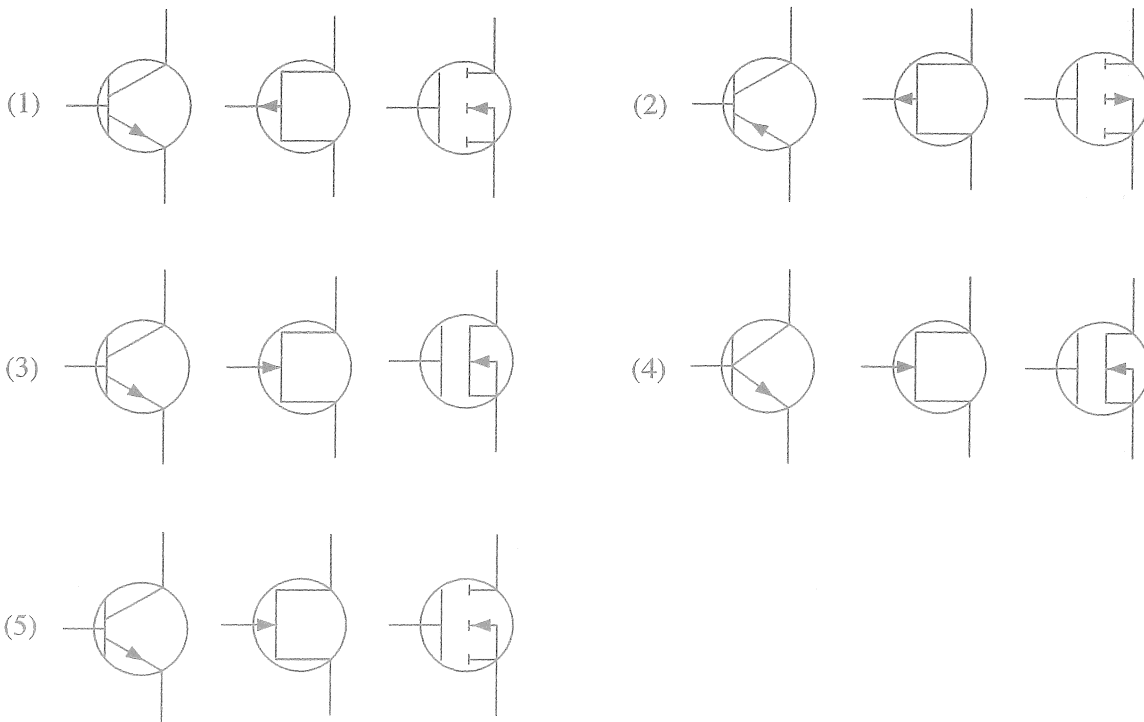
B - An n-type semiconductor can be developed by doping Si with As.

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.

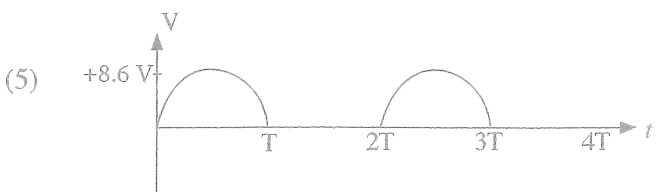
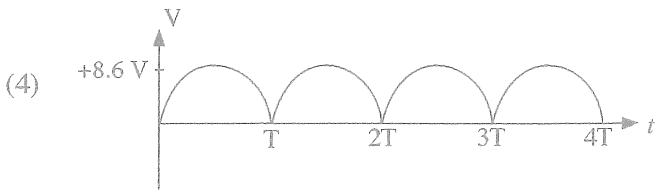
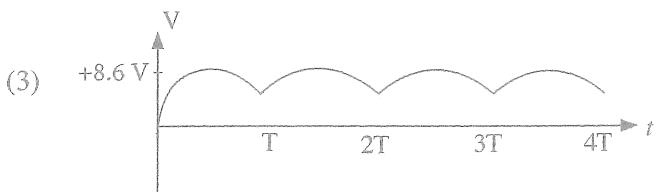
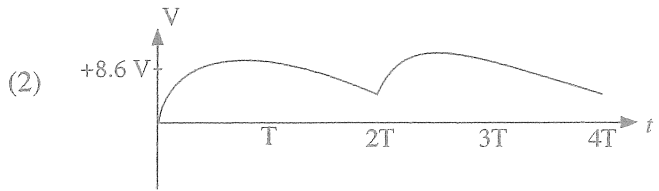
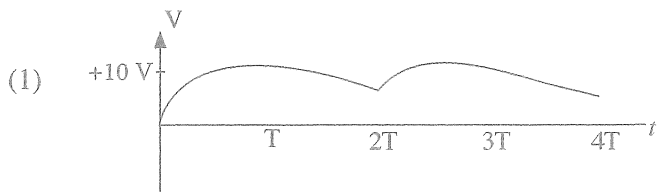
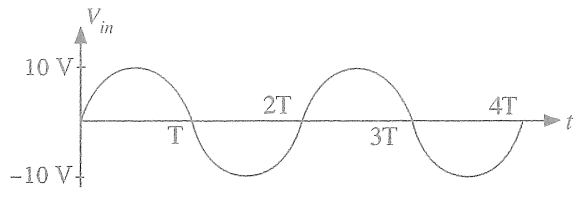
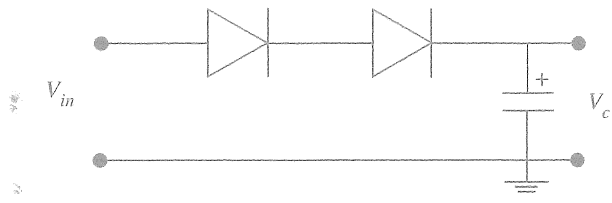
36. Which option shows the symbol of an NPN bipolar junction (BJT) transistor, an n-channel junction field effect transistor (JFET), an n-channel enhancement type metal-oxide semiconductor field effect transistor respectively (MOSFET)?



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) $20 \mu A$ (3) 2 mA
 (4) $200 \mu A$ (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 ?



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

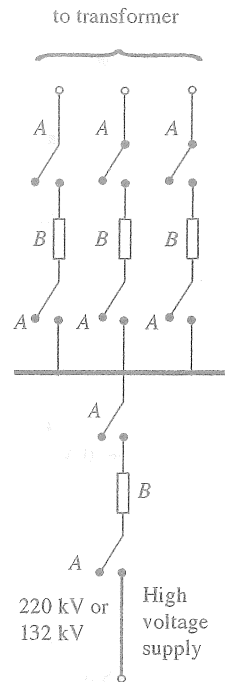
- A - Open-loop voltage gain is infinite.
- B - The input resistance is infinite.
- C - The output resistance is 100 Ω.
- D - The voltage between the inverting and non-inverting inputs is 1 mV.

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...”



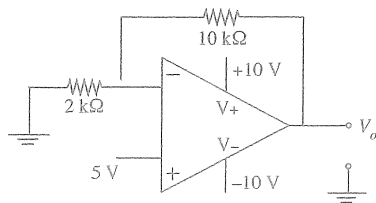
40. The item A in above single line diagram is

- (1) circuit breaker.
- (2) SF₆ 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) $xy + \bar{y}\bar{z}$
- (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

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 \pm 1%
current	0 – 10 A

(4)

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

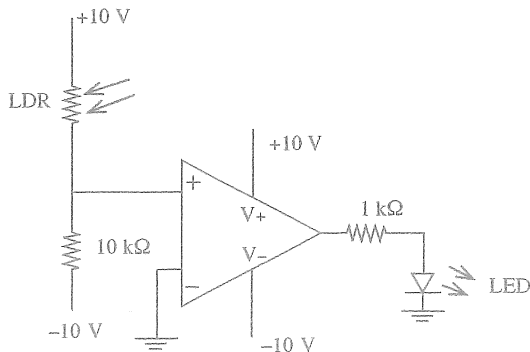
(5)

Power	5 W
light output	1000
life time	1000 h

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

- (1) SF₆ current circuit breaker, oil circuit breaker and air circuit breaker
- (2) Residual current circuit breaker, transistor and diode
- (3) Capacitor, oscilloscope and transistor
- (4) SF₆ 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 M Ω 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.

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

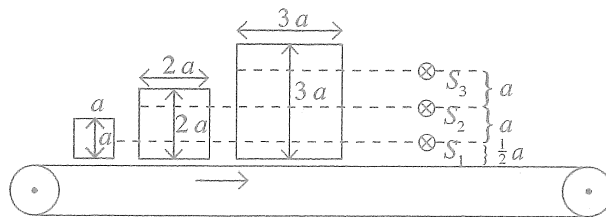
Resistor	Resistance
R_1	10 Ω
R_2	100 Ω

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.

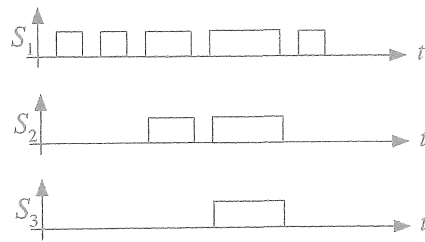
Items are moved by a conveyor as in following figure. S_1, S_2 and S_3 sensors are placed to identify sizes of the items. The sensors outputs will be logic '1' when the item is passing the sensor.



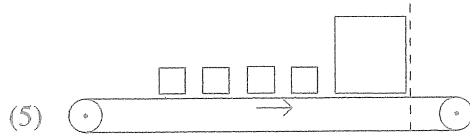
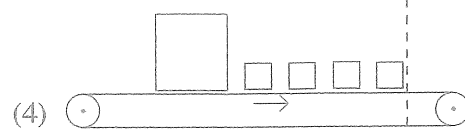
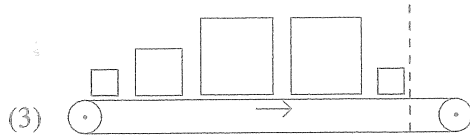
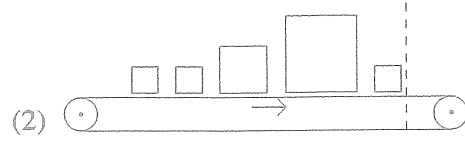
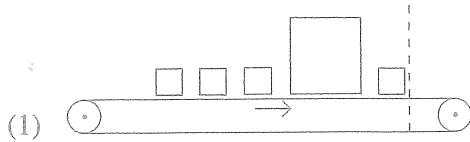
49. Select the correct sequence of sensor outputs for a sequence of three items as in above.

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

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.



* * *