සියලු ම හිමිකම් ඇවිරිණි / முழுப் பதிப்புரிமையுடையது / All Rights Reserved]

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

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

ඉංජිනේරු තාක්ෂණවේදය I பொறியியற் தொழினுட்பவியல் I **Engineering Technology I**	**65 E I**	පැය දෙකයි இரண்டு மணித்தியாலம் ***Two hours***

Instructions:

- *Answer* ***all*** *questions.*
- *Write your* ***Index Number*** *in the space provided in the answer sheet.*
- *Instructions are given on the back of the answer sheet. Follow them carefully.*
- *In each of the questions* **1** *to* **50**, *pick one of the alternatives from* (1), (2), (3), (4), (5) *which is* ***correct*** *or* ***most appropriate*** *and* ***mark your response on the answer sheet with a cross*** (×) *in accordance with the instructions given on the back of the answer sheet.*
- *Each question carries* **01** *mark totalling to* **50**.
- ***Use of non-programmable calculators is allowed.***

1. The capacitance of a capacitor denoted as 15 pF is

(1) 15×10^{-15} F. (2) 15×10^{-12} F. (3) 15×10^{-9} F.
(4) 15×10^{-6} F. (5) 15×10^{-3} F.

2. Consider the following statements regarding engineering standards and specifications.

A - Standards and specifications confirm that the wastage and defects are minimised in production.
B - ISO 9001(2015) is a specification related to quality management systems.
C - There can be contradictions among standards being used in the world.

Out of the above statements, the correct statement/s is/are

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

3. Consider the following statements regarding engineering technology.

A - Design of the computer can be considered as a turning point in engineering technology.
B - Through modelling and simulation of production processes using computer software, today's production sector is being focused towards a new direction.
C - By providing internet facilities, Sri Lankan goods and services can be connected to the global supply chains.

Out of the above statements, the correct statement/s is/are

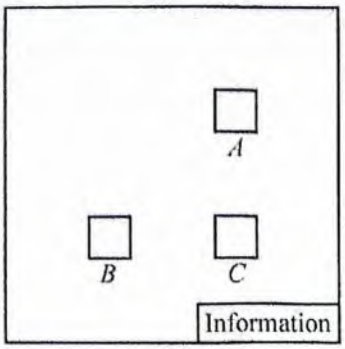
(1) A only. (2) B only. (3) A and C only.
(4) B and C only. (5) A, B and C all.

4. A dimension of a production drawing is depicted as ϕ 20.0 ± 0.1 mm. This means that the diameter of this component should be

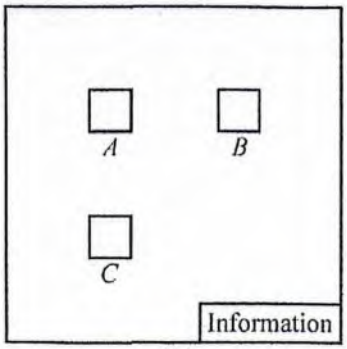
(1) not less than 9.95 mm and not more than 10.05 mm.
(2) not less than 19.9 mm and not more than 20.1 mm.
(3) 19.9 mm or 20.1 mm.
(4) not less than 39.8 mm and not more than 40.2 mm.
(5) not less than 39.9 mm and not more than 40.1 mm.

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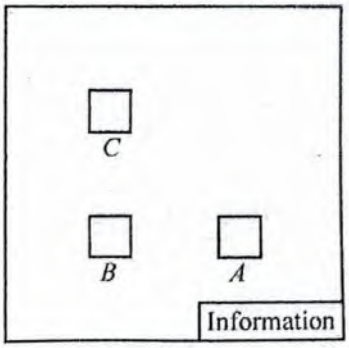
5. What is the correct arrangement of an engineering drawing, drawn according to the first angle projection method? (In the following figures, *A* represents the front elevation, *B* represents the end elevation and *C* represents the plan.)



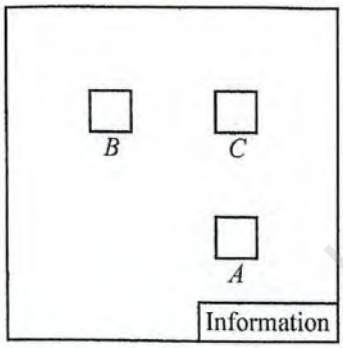
(1)



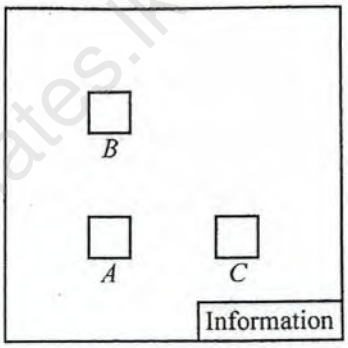
(2)



(3)



(4)



(5)

6. Consider the following statements regarding production and business development.
   A - Involvement of entrepreneurs is essential to add new goods and services to the market.
   B - All new inventions get added to the market as a good or a service.
   C - The personality traits inherent in entrepreneurs can be further developed.

   Out of the above statements, the correct statement/s is/are

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

7. The following facts have been revealed by a market research conducted in Sri Lanka.
   A - There is a trainable workforce.
   B - There is a demand for reconditioned vehicle spare parts due to the prevailing situation.
   C - Currently, there is a scarcity of production machinery.
   D - Although there are micro credit facilities, it is difficult to obtain them.

   Out of the above statements, for a business of reconditioned vehicle spare parts,

   (1) A can be identified as an opportunity while B can be identified as a strength.
   (2) A can be identified as a strength while C can be identified as a weakness.
   (3) A can be identified as an opportunity while C can be identified as a threat.
   (4) A can be identified as a strength while D can be identified as a weakness.
   (5) A can be identified as an opportunity while D can be identified as a threat.

8. Consider the following statements regarding lane markings on a highway system.
   A - Lanes are marked to minimise accident risks by minimising the hazards.
   B - Lanes are marked to minimise the accident risks by minimising the possibility of accidents.
   C - By marking lanes, hazards are highlighted to the drivers.

   Out of the above statements, the correct statement/s is/are

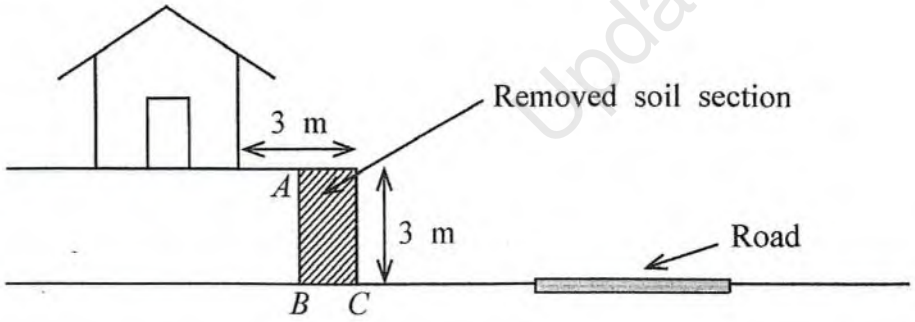
   (1) A only. (2) B only. (3) A and C only.
   (4) B and C only. (5) A, B, and C all.

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9. 'Bond' of a brick wall is
(1) laying bricks to avoid locating continuous vertical joints.
(2) laying bricks to strengthen the bonds between bricks.
(3) laying bricks to maintain an equal gap between courses.
(4) laying bricks to have all types of standard brick bats.
(5) laying bricks to have a systematic bond pattern.

10. When constructing a road, plants used to push soil, spread soil evenly on the ground, and compact soil respectively are
(1) Bulldozer, Backhoe loader, and Vibratory roller.
(2) Backhoe loader, Bulldozer, and Poker vibrator.
(3) Dragline, Excavator, and Poker vibrator.
(4) Excavator, Motor grader, and Vibratory roller.
(5) Bulldozer, Motor grader, and Vibratory roller.

● As shown in the figure below, there is a building at a higher elevation than a road. The soil in this land adjacent to the road has been cut and levelled to the road level. Use the figure to answer questions **11** and **12**.



11. Sometime after the removal of soil from the land, crack marks were visible on the wall near the door. The scientific reason for this is the
(1) reduction of the bearing capacity of the soil, where the building is located.
(2) soil being pushed out due to the pressure exerted by the building.
(3) imbalance in the ground surface due to the weight of the building.
(4) increment of the pressure exerted on the building due to the removal of the soil.
(5) increment of the pressure exerted by the building due to the removal of the soil.

12. An action that can be taken to arrest the crack propagation is to
(1) construct a horizontal concrete slab covering *BC*.
(2) construct a vertical concrete wall covering *AB*.
(3) employ concrete beams through *B*.
(4) employ concrete beams through *A* and *B*.
(5) employ concrete beams along *AC*.

13. A fact **not** considered when locating 'windows' of a building is
(1) wind direction. (2) location of the room. (3) size of the room.
(4) thickness of walls in the room. (5) direction of receiving sun light.

14. Transpiration related to the water cycle is the
(1) process of water falling under gravity as rain.
(2) process of removal of water as vapour from plants.
(3) process of absorbing rain water into soil via soil strata.
(4) process of rain water directly falling on to leaves, branches, and grass.
(5) process of transformation of water from the vapour state to liquid state.

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15. A physical property that should **not** be present in drinking water is
(1) having sufficient hardness. (2) being at room temperature.
(3) having a neutral taste. (4) transparency.
(5) having a neutral smell.

16. Following facts were presented by a student on the basic requirements of a sewerage system.
A - Minimum diameter which can be used in the sewerage pipes should be 100 mm.
B - When connecting a branch to the main waste line, the connecting angle should be kept greater than 45°.
C - A manhole should be located where ever a blockage is expected.
Out of the above facts, the correct requirement/s is/are
(1) B only. (2) A and B only. (3) A and C only.
(4) B and C only. (5) A, B, and C all.

17. Consider the following documents.
A - Query sheet
B - Profit/loss statement
C - Measurement sheet
Out of the above, document/s used by a quantity surveyor is/are
(1) A only. (2) B only. (3) A and C only.
(4) B and C only. (5) A, B, and C all.

18. Profit percentage stated in a BOQ is **not** depended on
(1) bank interest rates. (2) risks involved in the project.
(3) duration of the project. (4) political stability of the country.
(5) salary of labourers.

19. The direct distance between two cities is 48 km. If the distance between the cities on a map drawn to a scale is 9.6 cm, what is the scale of the map?
(1) 1:50 (2) 1:500 (3) 1:5,000 (4) 1:50,000 (5) 1:500,000

20. The following incomplete table is related to a levelling process.

Level Station	Back Sight Reading	Intermediate Sight Reading	Fore Sight Reading	Rise	Fall	Reduced Level	Remarks
1	A					B	
2		1.5			1.0	C	
3			1.0	0.5		100.0	

The suitable values for A and B places, in the table, respectively are
(1) 0.5 m and 99.5 m. (2) 0.5 m and 100.5 m. (3) 1.0 m and 100.5 m.
(4) 1.5 m and 99.5 m. (5) 1.5 m and 100.0 m.

21. Following are a few statements about land surveying and levelling.
A - In land surveying and levelling, measurements are taken to determine the absolute position of a place.
B - The effect of errors on a survey can be minimised by measuring from whole to part.
C - A levelling process must be started either from a bench mark or a temporary bench mark.
Out of the above statements, the correct statement/s is/are
(1) A only. (2) B only. (3) A and C only.
(4) B and C only. (5) A, B, and C all.

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22. Some measurements taken from a theodolite survey are shown below.

Survey Line	Bearing (Degrees)	Length (m)
AB	090	10
BC	000	10
CD	270	20

According to above measurements, with respect to point A, point D is situated,

(1) in the North direction.
(2) in between North and East direction.
(3) in between North and West direction.
(4) in between South and East direction.
(5) coincident with A.

23. Consider the following statements regarding an electrical circuit with a power factor equal to one (1).

A - The total power absorbed from the source is used for productive work.
B - The circuit could be a purely resistive.
C - Inductive and capacitive reactive powers could be equal.

Out of the above statements, the correct statement/s is/are

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

24. When installing domestic electrical wiring, Residual Current Circuit Breaker (RCCB) is used to

(1) protect electrical equipment from overloads.
(2) protect electrical equipment from overvoltages.
(3) protect users of the installation from electric shock.
(4) protect the installation from lightning.
(5) isolate the installation from the supply in case of a repair.

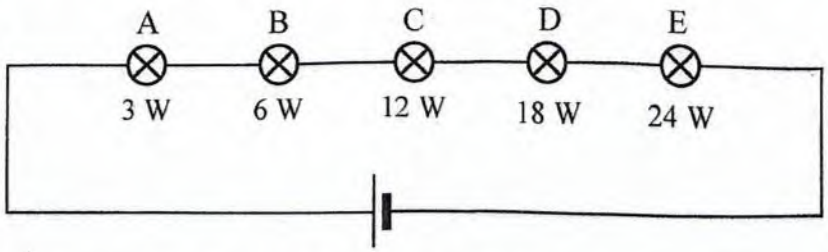
25. Consider following statements related to time constant (T) of a simple RC circuit.

A - Time constant is equal to the product of R and C.
B - Time constant represents the time taken for the capacitor to charge from zero (0) to 63% of the source voltage.
C - Time needed for the capacitor to get fully charged is equal to five (5) times the time constant.

Out of the above statements the correct statement/s is/are

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

26. Five incandescent bulbs A, B, C, D, and E having a rated voltage of 12 V and rated powers of 3 W, 6 W, 12 W, 18 W, and 24 W are connected to a 12 V DC source as shown in the circuit given below.



Out of the above bulbs, the bulb that glows with the highest brightness is

(1) A. (2) B. (3) C. (4) D. (5) E.

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27. An ideal transformer has 100 turns in the primary winding and 200 turns in the secondary winding. The input voltage of the transformer is 230 V.

Consider the following statements regarding the above transformer.

A - Output voltage of the transformer is 460 V.
B - Current in the primary and secondary windings are equal.
C - Power in the primary and secondary windings are not equal.

Out of the above statements, the correct statement/s is/are

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

28. 16 cells rated 3.2 V/100 Ah are connected in series to make a battery to be used in an off-grid solar panel system.

Consider the following statements regarding the above battery.

A - Voltage of the battery is 51.2 V.
B - Maximum capacity that can be stored in the battery is 100 Ah.
C - Maximum power that can be drawn from the battery is 5.12 kW.

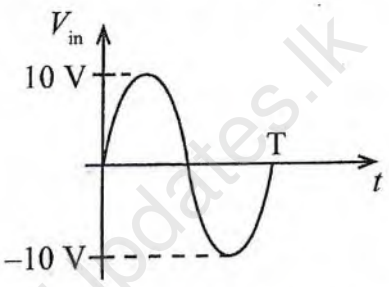
Out of the above statements, the correct statement/s is/are

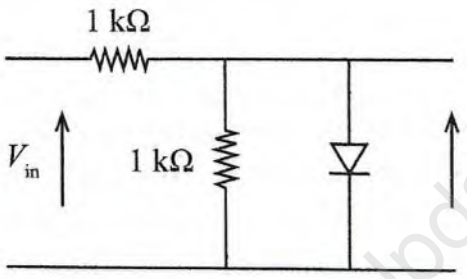
(1) A only. (2) B only. (3) A and B only.
(4) A and C only. (5) A, B, and C all.

29. A motor is to be selected for a conveyor system that works at a constant speed with a low load. The most suitable DC motor for this application is a

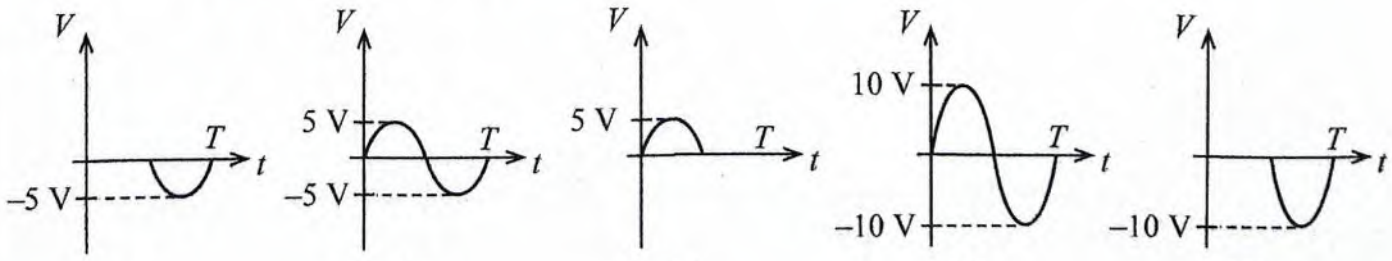
(1) series motor.
(2) shunt motor.
(3) compound motor.
(4) squirrel cage motor.
(5) wound motor.

30. Consider the following input signal (V_{in}) and the circuit with an ideal diode.





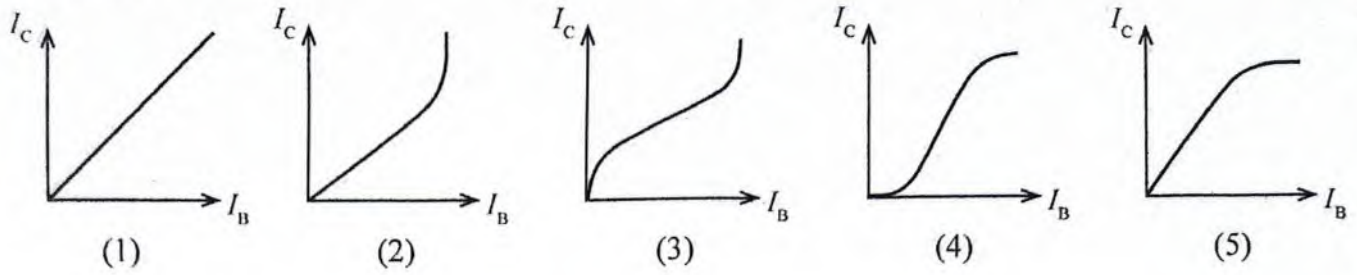
Which figure shows its output signal (V_{out})?



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

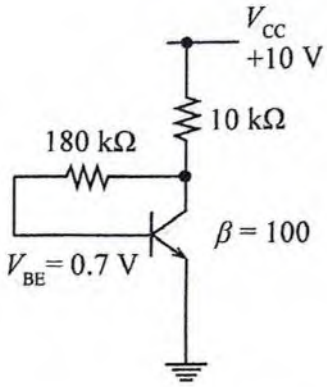
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31. What is the most appropriate graph which represents the relationship between I_B and I_C of a transistor?



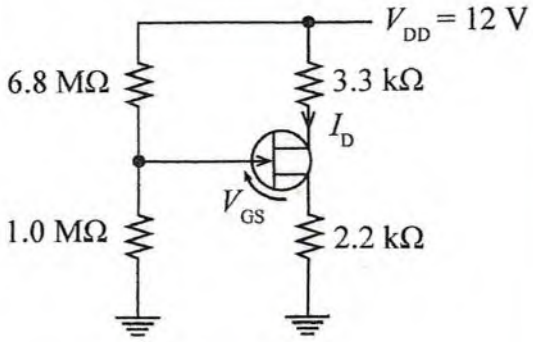
(1) (2) (3) (4) (5)

32. In the transistor amplifier circuit shown in the figure, at the Q point, the base current (I_{BQ}), collector current (I_{CQ}) and the voltage across the collector and emittor (V_{CEQ}) respectively are,



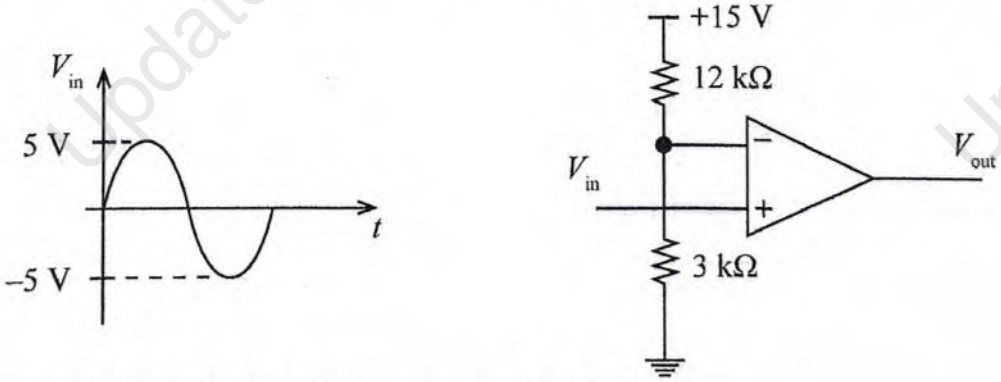
(1) 7.81 μA, 0.78 mA, and 2.11 V.
(2) 7.81 μA, 0.78 mA, and 5 V.
(3) 23.8 μA, 2.3 mA, and 2.11 V.
(4) 23.8 μA, 2.3 mA, and 5 V.
(5) 51.7 μA, 5.1 mA, and 5 V.

33. The circuit shows a situation where a junction field effect transistor (JFET) is used as an amplifier. If the drain voltage (V_D) is 7 V, drain current (I_D) and gate-source voltage (V_{GS}) are respectively

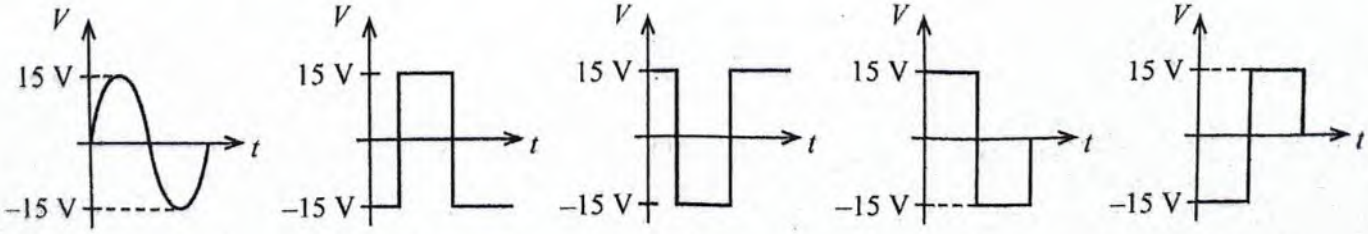


(1) 1.52 mA and –3.47 V.
(2) 1.52 mA and –1.8 V.
(3) 1.52 mA and 1.8 V.
(4) 2.27 mA and –3.47 V.
(5) 2.27 mA and 3.47 V.

34. Consider the input signal (V_{in}) and operational amplifier circuit shown in the figure.



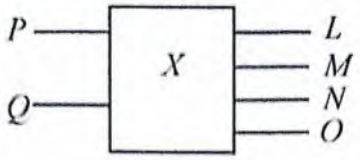
What is the figure showing the output signal (V_{out})?



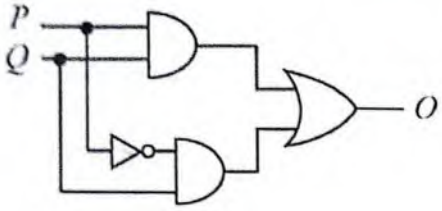
(1) (2) (3) (4) (5)

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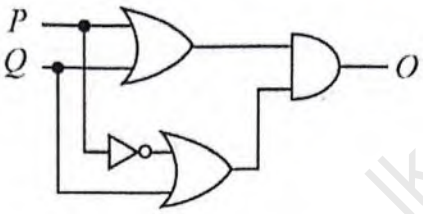
35. X is a digital electronic circuit. P and Q, are its inputs and L, M, N, and O are outputs. $LMNO$ represents the square of the number represented by PQ. P is the most significant number of the binary number PQ while L is the most significant number of the binary number $LMNO$.



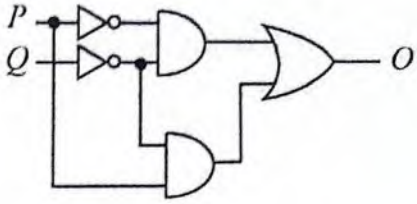
A, B and C are three proposed circuits for output O.



(A)



(B)

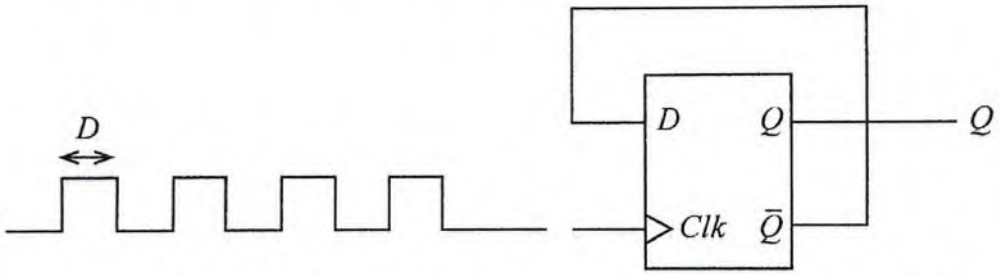


(C)

Out of the circuits A, B, and C, the circuit/s suitable for output O is/are

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

36. The figure shows a digital electronic circuit with a D-type flip-flop

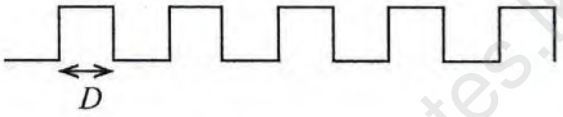


What is the most suitable figure which represents the output signal of Q?

(1)



(2)



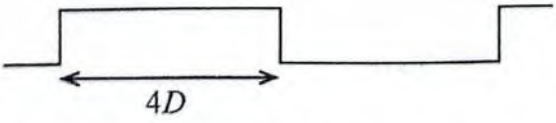
(3)



(4)



(5)



37. When a wrench with a 15 cm long shank is used to tighten a bolt, a 100 N of force should be applied at the end of the shank. If a wrench with a 45 cm long shank is used for this, how much force should be applied at the end of its shank?

(1) $100 \times \frac{15}{45}$ N (2) $100 \times \frac{45}{15}$ N

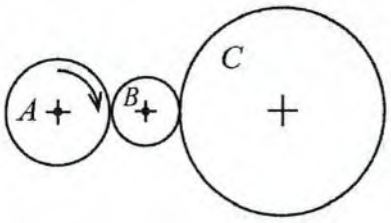
(3) $100 \times \left(\frac{(45+15)}{15}\right)$ N (4) $100 \times \left(\frac{(45+15)}{45}\right)$ N

(5) $100 \times \left(\frac{45}{(45+15)}\right)$ N

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38. The figure shows a portion of a spur gear drive. Here, A is driven by an electric motor rated 750 W/1200 rpm. The numbers of teeth on A, B, and C are 50, 20, and 100 respectively. The mechanical efficiency between a spur gear pair is 90%. The figure is not drawn to a scale. The rotating speed and power output of C are respectively

(1) 600 rpm and 607.5 W.
(2) 600 rpm and 675.0 W.
(3) 2400 rpm and 607.5 W.
(4) 2400 rpm and 675.0 W.
(5) 3000 rpm and 675.0 W.



39. Out of the pumps given below, which is **not** a rotary type pump?
(1) Centrifugal pump (2) Gear pump (3) Screw pump
(4) Piston pump (5) Vane pump

40. An internal combustion engine has a compression ratio of 11:1 and a clearance volume of 50 cm^3. What is the swept volume of the engine?
(1) 0.020 cm^3 (2) 0.022 cm^3 (3) 0.220 cm^3 (4) 500 cm^3 (5) 550 cm^3

41. Consider the following statements regarding the reactions occurring within a two-way catalytic converter.

A - Unburnt hydrocarbons are subjected to reaction
B - Carbon monoxide is subjected to reaction
C - Nitrogen oxides are subjected to reaction

Out of the above statements, the correct statement/s is/are
(1) A only. (2) C only. (3) A and B only.
(4) B and C only. (5) A, B, and C all.

42. Out of the following, which is **not** a liquid fuel?
(1) Propane (2) Petrol (3) Bio diesel (4) Kerosene (5) Ethanol

43. There is a motor vehicle that weighs 10,000 N on a 5,000 mm long 3,000 mm wide raft that has a flat bottom which is floating horizontally. If the weight of the raft is neglected, the pressure exerted on the bottom of it, in SI units, is
(1) 1.25. (2) 2. (3) 3.33. (4) 667. (5) 1,500.

44. The production process used to manufacture aluminium panels used for making window frames is
(1) Twisting. (2) Forging. (3) Rolling.
(4) Extrusion. (5) Material removal.

45. A metal piece is required to be cut using a computer numerically controlled (CNC) machine. For this, the required codes need to be prepared. Consider the following statements regarding this.

A - The machine has a keypad, and codes can be fed to the machine using it.
B - There are specialised software for writing codes, and codes can be automatically generated and fed to the machine.
C - Associated codes can be prepared using a computer, and the codes can be fed to the machine.

Out of the above statements, the correct statement/s is/are
(1) A only. (2) A and B only. (3) A and C only.
(4) B and C only. (5) A, B, and C all.

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46. Consider the following statements about measuring equipment.

A - Micrometer screw guage is a linear measuring equipment.
B - Conventional Ammeter is a measuring equipment with sensors and transducers.
C - The zero error must be always deducted from the reading to correct the zero error of a vernier calliper.

Out of the above statements, the correct statement/s is/are

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

47. Consider the following statements about the materials used for production activities.

A - Metals and non metals are commonly used in production of machine parts.
B - Due to inherent weaknesses of pure metals they are not used in machine parts.
C - Steel containing carbon cannot be classified as a ferous metal.

Out of the above statements, the correct statement/s is/are

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

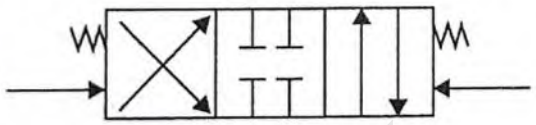
48. Consider the following statements regarding the usage of a 60:40 mixture of ethylene glycol and water in an automotive cooling system.

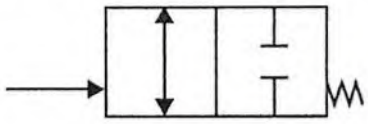
A - Freezing point can be brought down to a value below 0 °C.
B - Temperature of the coolant will not go above 60 °C.
C - Corrosion of the radiator can be minimised.

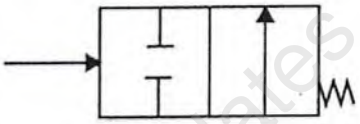
Out of the above statements, the correct statement/s is/are

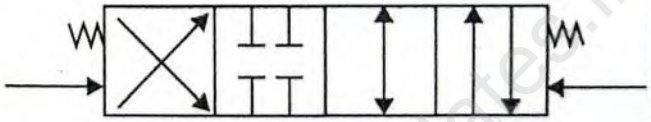
(1) A only. (2) B only. (3) A and C only.
(4) B and C only. (5) A, B, and C all.

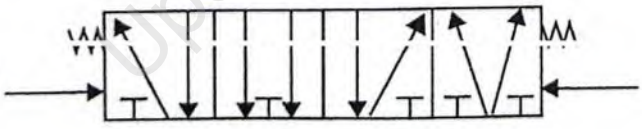
49. What is the figure showing a 4/3 direction control valve?

(1) 

(2) 

(3) 

(4) 

(5) 

50. Out of the following statements, which statement is **incorrect** regarding the maintenance of a 12 V lead-acid battery where the negative terminal is connected to the chassis?

(1) It is a must to regularly check and top up the electrolyte level with distilled water.
(2) It is a must to periodically check the battery's state of charge using a hydrometer.
(3) The typical charging voltage is approximately 14 V.
(4) Faulty batteries can be tested using a High-Rate Discharge Tester.
(5) When disconnecting the electrical cables, positive terminal should be disconnected first.

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