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

**08.08.2018 / 1300 – 1500**

| ඉංජිනේරු තාක්ෂණවේදය | I |
| பொறியியற் தொழினுட்பவியல் | I |
| **Engineering Technology** | I |

**65** **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 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 (×)** in accordance with the instructions given at the back of the answer sheet.
* Each question carries **03** marks totalling to **150**.
* **Use of calculators is not allowed.**

1. What are the correct units of measurement for the calorific value of fuels used in a vehicle?
   (1) kcal/kg and kcal/s  (2) kcal/s and km/l  (3) kJ/kg and kcal/kg
   (4) kJ/kg and kcal/s  (5) kJ/kg and km/l

2. A standard direct current (DC) voltage of 110 V was measured three times using each of the four voltmeters named as A, B, C and D in order to verify their reliability. Readings obtained are shown below.
   A - 107 V,  109 V,  111 V
   B - 107 V,  108 V,  109 V
   C - 108 V,  112 V,  116 V
   D - 104 V,  107 V,  110 V
   Out of the above voltmeters, two voltmeters that have the highest accuracy and the highest precision respectively are,
   (1) A and B.  (2) A and C.  (3) A and D.
   (4) B and C.  (5) C and D.

3. The isometric view of a solid object is shown in the figure. The correct views looking from the direction of arrow **A** and the direction of arrow **B** are, (Figures are not drawn to a scale.)
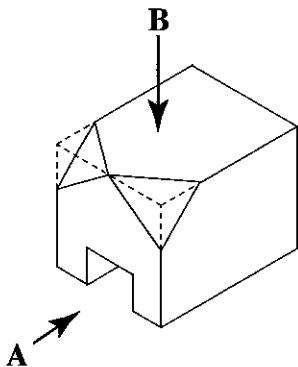


4. The correct sequence of four strokes of a four-stroke spark ignition engine is,
   (1) power, suction, exhaust and compression.
   (2) exhaust, power, compression and suction
   (3) exhaust, compression, power and suction.
   (4) suction, power, compression and exhaust.
   (5) suction, compression, power and exhaust.

5. Consider the following facts regarding the electric motor cars.

   A - Scarcity of spare parts
   B - Practical difficulties of recharging the batteries
   C - High cost per unit distance travelled

   Out of the above facts, the reason/s for the low popularity of electric motor cars in Sri Lanka is/are,

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

6. The possible behaviours of the supply curve of a product are shown in the figure.
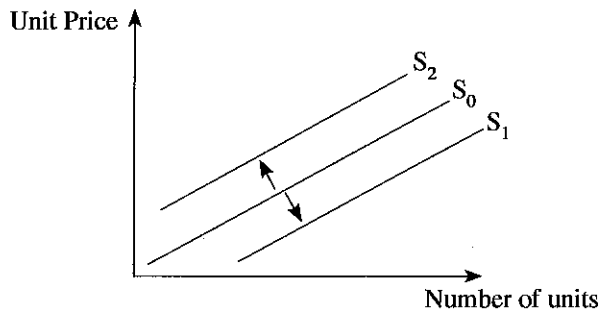


   A reason for the shifting of the supply curve from $S_0$ to $S_1$ and a reason for the shifting of supply curve from $S_0$ to $S_2$ respectively are,

   (1) application of a new technology and receipt of additional money for the suppliers for investing.
   (2) increase in the profit margin and increase in raw material prices.
   (3) increase in the production expenditure and decrease in the price of the product.
   (4) exit of competitors from the market and receiving of production subsidies.
   (5) creation of excess production capacity in the production plant and increasing the profit.

7. Consider the following objectives relevant to a study about the current market situation of a business.

   A - Controlling the existing situation in the market
   B - Deciding marketing strategies suitable to the market
   C - Identifying the marketing abilities of the business
   D - Identifying the customers' preferences

   Out of above objectives, two major objectives of studying the current market situation in preparing a market plan for the business are,

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

8. Consider the following statements regarding the walls built using solid cement blocks and cellular cement blocks.

   A - Cellular cement block walls are better insulators of sound and heat than solid cement block walls.
   B - Cellular cement block walls have lower self-weight than solid cement block walls.
   C - When using cellular cement blocks, openings of the cells are kept upwards in building walls.

   Which of the above statement/s is/are correct?

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

9. What is the correct graph that illustrates the variation of compressive strength of hand-compacted concrete (*y*) with respect to water cement ratio (*x*)?



  (1)            (2)            (3)            (4)            (5)
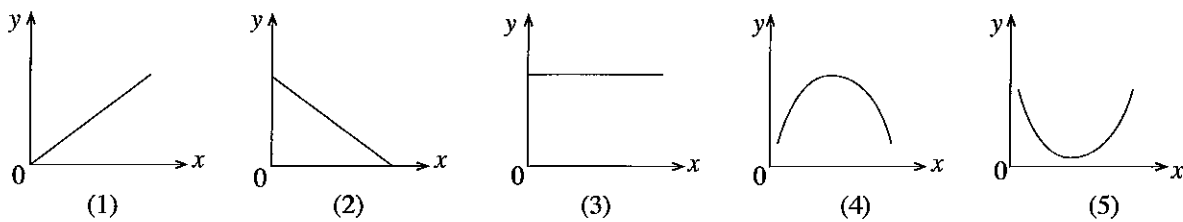
10. Consider the following parameters regarding a dwelling unit.
    A - Floor area of the kitchen of a dwelling unit
    B - Ventilation of a building
    C - Height of a dwelling unit
    D - Number of persons who can live in a room
The planning and building regulations of the Urban Development Authority (UDA) contained in the government gazette extraordinary dated 1986.03.10 controls,
(1) B and C only.          (2) A, B and C only.          (3) A, B and D only.
(4) A, C and D only.       (5) B, C and D only.

11. Consider the following statements regarding the roof of a building.
    A - Barge board facilitates the fixing of rain water gutters.
    B - Valance boards protect rafter ends from moisture.
    C - Reepers are fixed on the rafters to fix roofing covers.
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) B and C only.

12. What are the main functions of aeration during water purification process?
(1) Removal of volatile inclusions and disinfection
(2) Filtration of precipitated iron and manganese particles
(3) Disinfection and filtration
(4) Removal of volatile inclusions and precipitation of ferrous and manganese particles
(5) Flocculation and removal of microbial by products

13. The cross sectional view of a septic tank is shown in the figure.
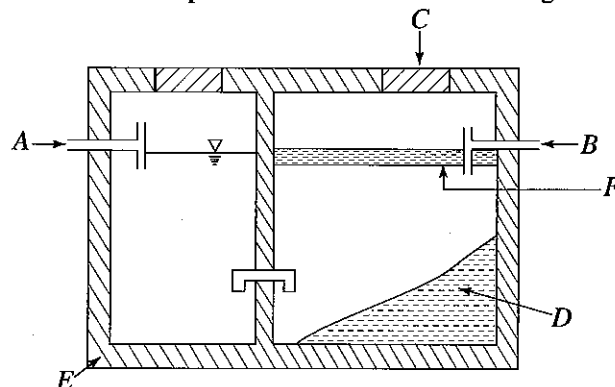


Which one of the following statement is true?
(1) *A* is connected to the sewer line of the toilet and *B* is connected to soakage pit.
(2) *C* allows to ventilate the septic tank.
(3) Anaerobic bacteria living in *D* digest waste.
(4) One of the function of *E* is to allow water to seep into ground safely.
(5) *F* allows for oxygen to dissolve into waste water.

14. Materials recommended for constructing household water supply systems are,
    (1) UPVC, CPVC, lead and copper.
    (2) Polybutylene, PVC, copper and brass.
    (3) Asbestos, lead, UPVC and polythene.
    (4) Cement, UPVC, polythene and Lead.
    (5) Asbestos, polybutylene, brass and UPVC.

15. Consider the following statements regarding the conditions that result from the hot forming of steel for the production of tools such as mammoty blades.
    A - Hardness caused by strain decreases.
    B - Ductility of the metal decreases.
    C - Forming becomes easy because of the decreased yield strength.
    D - Toughness of metal increases.
    Of the above, correct statements are,
    (1) A and B only.        (2) A and C only.        (3) B and C only.
    (4) A, C and D only.     (5) A, B and D only.

16. Before using bricks in wall constructions, it is required to soak them in water, in order to
    (1) remove the impurities in the bricks.
    (2) bond bricks well with cement mortar.
    (3) prevent water absorption from cement mortar by dry bricks.
    (4) test the porosity of bricks.
    (5) measure the water absorption rate of bricks.

17. A simple levelling procedure was conducted to set out a point with a reduced level of 100.30 m. If the staff reading on the Temporary Bench Mark (TBM) of a reduced level of 100.00 m, is 1.80 m, the staff reading on the point to be set out should be
    (1) 0.30 m.        (2) 0.60 m.        (3) 1.20 m.        (4) 1.50 m.        (5) 2.10 m.

18. The length of the longest survey line which was used in a chain surveying procedure was 100 m. The most suitable scale to be used to draw the plan using the measurement of the above survey on a A4 sized paper (210 mm × 297 mm) is,
    (1) 1 : 100        (2) 1 : 250        (3) 1 : 500        (4) 1 : 1000        (5) 1 : 2000

19. Consider the following statements regarding the errors that occur during land surveys.
    A - Control points are used to stop the accumulation of errors.
    B - Errors can be minimized by using a large number of survey stations.
    C - Oblique offset lines are used to determine the errors that occur in chain surveying.
    Of the above, the correct statement/s is/are,
    (1) A only.        (2) B only.        (3) C only.
    (4) A and B only.  (5) A and C only.

20. Consider the following statements regarding theodolite traverses.
    A - Temporary adjustments of a theodolite are done at the first survey station only.
    B - Parallel north lines at every survey station can be set out by transiting the telescope.
    C - Traverses should always be closed.
    Of the above, the correct statements is/are,
    (1) A only.        (2) B only.        (3) C only.
    (4) A and B only.  (5) B and C only.

21. Some statements regarding entering of dimensions to the dimension paper (TDS sheet) are given below.

       A - Dimensions are entered in metres and millimetres in the order of length × width × height.

       B - When the same dimension occurs repetitively, the number of repetitions should be stated in the timesing (T) column.

       C - When measuring a volume, three dimensions are stated in the dimension column.

Which of the above statements is/are correct?

(1) A only.               (2) B only.            (3) A and B only.

(4) B and C only.      (5) All A, B and C only.

22. What are cost items that should be included in calculating the net unit rate for concreting of a slab located in the second floor level of a building?

(1) Wage of supervisor, cost for concrete and rent for scaffoldings

(2) Cost for concrete, rent for concrete machinery and masons' wages

(3) Water cost, masons' wages and cost for concrete

(4) Site engineers' wages, masons' wages and cost for concrete

(5) Rent for concrete mixer, water cost, and rent for scaffoldings

23. Several reasons for the use of standards for products are given below.

       A - Assuring the quality of a product

       B - Precisely communicating the specifications of a product

       C - Reducing the cost of production process

Of the above A, B and C, the correct reason/s is/are,

(1) A only.               (2) A and B only.

(3) A and C only.       (4) B and C only.

(5) All A, B, and C.

24. Several properties of materials are given below.

       A - Ductility

       B - Malleability

       C - Toughness

       D - Brittleness

Two properties that should be possessed by raw materials used to produce a crane cable are,

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

25. The most suitable welding method for producing galvanized square wire mesh is,

(1) electric-arc welding.       (2) oxy-acetylene welding.

(3) arc-spot welding.          (4) TIG welding.

(5) MIG welding.

26. Which of the following statements is **incorrect** regarding diesel engines?

(1) The thermal efficiency of a diesel engine is greater than the thermal efficiency of a petrol engine at the same compression ratio.

(2) The compression ratios of diesel engines are generally greater than the compression ratios of petrol engines.

(3) In general, the diesel engines are heavier than petrol engines.

(4) Diesel engine, always, has a four-stroke operating cycle.

(5) The energy content of diesel per unit mass is less than that of petrol.

27. The valve timing diagram of a certain four-stroke spark ignition is shown in the figure. What is the time duration (in degrees) of inlet valve opening accordingly the diagram?

TDC
IVO    EVC
22.3°
19.9°

IVC
59.9°
62.3°
EVO
BDC
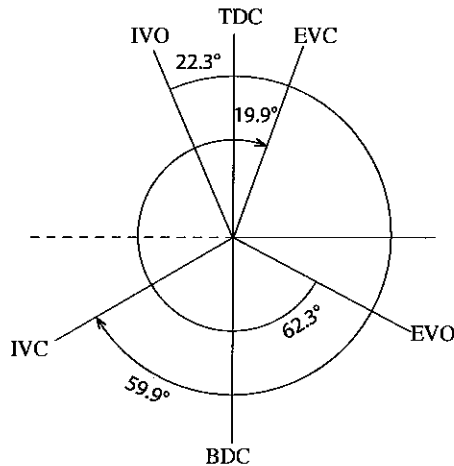
TDC  - Top Dead Centre
BDC  - Bottom Dead Centre
IVO   - Inlet Valve Opening
EVO  - Exhaust Valve Opening
IVC   - Inlet Valve Closing
EVC  - Exhaust Valve Closing

(1) 262.2    (2) 200.4    (3) 164.4    (4) 59.9    (5) 22.3

28. The compression ratio of a normal diesel engine is,
    (1) between 5:1 and 10:1    (2) between 8:1 and 12:1
    (3) between 10:1 and 15:1    (4) between 12:1 and 18:1
    (5) between 15:1 and 25:1

29. Turbo charger and super charger,
    (1) increase engine speed.
    (2) charge the battery.
    (3) improve lubrication.
    (4) increase fuel flow rate.
    (5) admit an increased amount of air to the engine.

30. Which statement is **incorrect** regarding engine valves of a motor car?
    (1) The diameters of the head of the intake valves are larger than those of exhaust valves.
    (2) There are at least 2-valves for an engine cylinder.
    (3) Always there is an even number of valves for a cylinder of an engine.
    (4) The body diameters of exhaust valves are larger than those of the intake valves.
    (5) The exhaust valve has a higher temperature than that of the intake valve.

31. The ratio ($x$ : $y$) between rotational speed ($x$) of camshaft and the rotational speed ($y$) of crankshaft of a four-stroke engine is,
    (1) 1:4    (2) 1:2    (3) 1:1    (4) 2:1    (5) 4:1

32. The crankshaft of 4-stroke engine rotates at 1500 times per minute. In this engine, how many power strokes occur per minute?
    (1) 375    (2) 750    (3) 1000    (4) 1500    (5) 3000

33. The most common type of compressor that is used in a domestic refrigerator is,
    (1) vane type open compressor.    (2) screw type semi-hermetic compressor.
    (3) piston type hermetic compressor.    (4) piston type semi-hermetic compressor.
    (5) piston type open compressor.

34. When air passes through the venturi of a carburettor,
    (1) speed of air increases and pressure decreases.
    (2) speed of air increases and pressure increases.
    (3) speed of air decreases and pressure decreases.
    (4) speed of air decreases and pressure increases.
    (5) speed and pressure remain constant.

35. In the gear system shown in the figure, there are 45 teeth on gear $A$, 10 teeth on gear $B$ and 15 teeth on gear $C$. If the rotational speed of gear $A$ is 450 rpm, what is the rotational speed of gear $C$?
    (1) 100 rpm      (2) 150 rpm      (3) 900 rpm
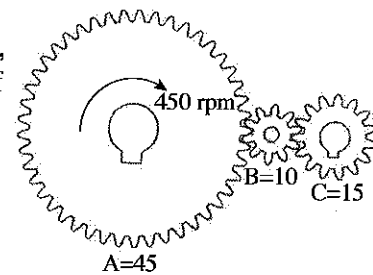
    (4) 1350 rpm      (5) 2025 rpm

36. For a diesel engine the swept volume and clearance volume are 1125 cm$^3$ and 75 cm$^3$ respectively. The compression ratio of the engine is,
    (1) 14:1      (2) 15:1      (3) 16:1      (4) 17:1      (5) 18:1

37. When the 3-phase load shown in the figure is connected to a 400 V, 50 Hz, 3-phase supply, the phase voltage and line current of the load respectively are,
    (1) 230 V and 4.3 A      (2) 400 V and 46 A
    (3) 230 V and 5 A        (4) 400 V and 5 A
    (5) 200 V and 5 A
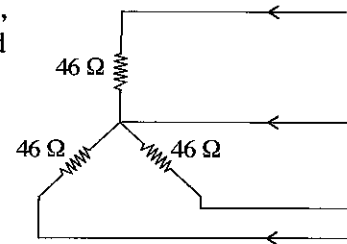
38. What is the reactance of a 100 µF capacitor which is connected across an alternative current supply of 50 Hz?
    (1) $\dfrac{2200}{7}$ Ω      (2) $\dfrac{22}{700}$ Ω      (3) $\dfrac{700}{22}$ Ω      (4) $\dfrac{7}{2200}$ Ω      (5) zero

39. What is mandatory to be there according to the regulations of the Institution of Electric Engineers (IEF), for the protection from leakage of an electric current?
    (1) Fuse                                          (2) Miniature Circuit Breaker (MCB)
    (3) Residual Current Circuit Breaker (RCCB)       (4) Isolator
    (5) Main switch

40. Synchronous motors are used,
    (1) when the starting current needs to be reduced.
    (2) when a high starting speed is required.
    (3) when the speed needs to be increased gradually.
    (4) when the speed needs to be maintained constant.
    (5) when the speed needs to be changed frequently.

41. Which graph contains the curves correctly indicating how the speed ($N$) and the torque ($T$) vary with respect to armature current ($I_a$) in a series wound motor?

    (1)      (2)      (3)      (4)      (5)
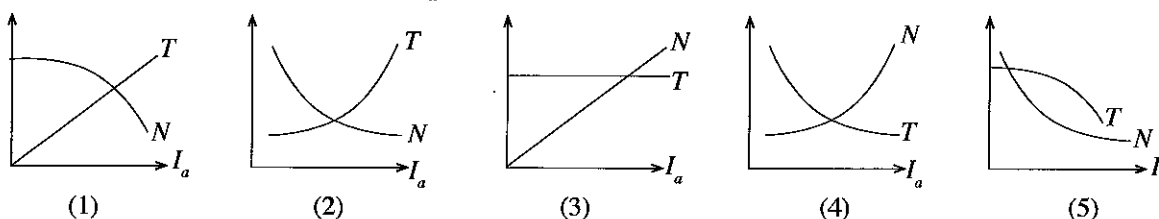
42. A rule related to the conversion of electrical energy to mechanical energy of an electric motor is,
    (1) Maxwell's cork-screw rule.      (2) Fleming's left hand rule.
    (3) Fleming's right hand rule.      (4) Faraday's law.
    (5) Lenz's law.

43. In relation to Field Effect Transistor (FET), which of the following statements is true?
    (1) Gate to Source PN junction is always reverse biased.
    (2) Gate to Source PN junction is always forward biased.
    (3) Gate and Source are connected together.
    (4) Drain is connected to ground.
    (5) Gate is connected with the drain.

**44.** If the drain current in the given circuit is increased, which of the following statements is true?
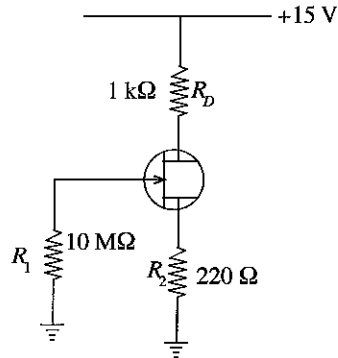


(1) Drain to Source voltage ($V_{DS}$) increases and Gate to Source voltage ($V_{GS}$) decreases.
(2) Both Drain to Source voltage ($V_{DS}$) and Gate to Source voltage ($V_{GS}$) will increase.
(3) Both Drain to Source voltage ($V_{DS}$) and Gate to Source voltage ($V_{GS}$) will decrease.
(4) Drain to Source voltage ($V_{DS}$) decreases and Gate to Source voltage ($V_{GS}$) increases.
(5) Both Drain to Source voltage ($V_{DS}$) and Gate to Source voltage ($V_{GS}$) will not change.

**45.** In relation to forward biased diode, which of the following statements is true?
(1) The only current is due to electrons.
(2) The only current is due to holes.
(3) The only current is produced by majority carriers.
(4) The current is produced by both holes and electrons.
(5) The current has no effect due to minority carriers.

**46.** Four digital circuits are shown below.



A B C D
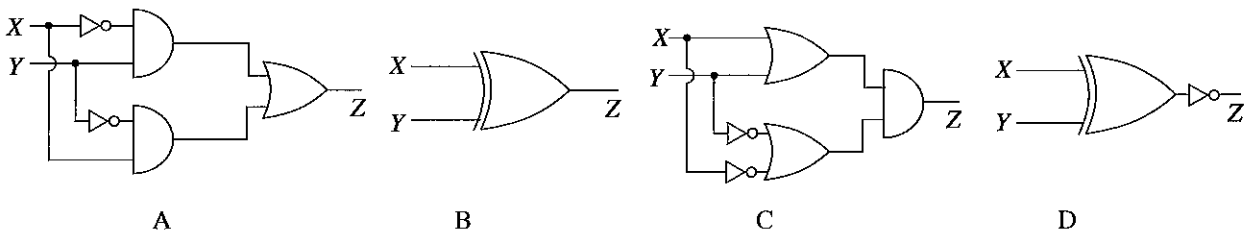
Which of the above digital circuits are equivalent?
(1) A and C only.
(2) C and D only.
(3) A, B and C only.
(4) A, B and D only.
(5) B, C and D only.

**47.** An operational amplifier circuit is shown in the figure.

$\dfrac{V_{out}}{V_{in}}$ relationship of the circuit is,



(1) $\dfrac{R_2}{R_3}$

(2) $1 + \dfrac{R_2}{R_1}$

(3) $\dfrac{R_2}{R_1}$

(4) $1 + \dfrac{R_2}{R_3}$

(5) $\dfrac{R_1}{R_2}$
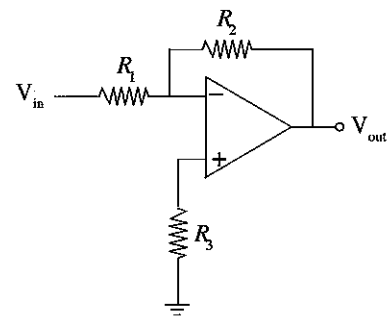
**48.** A voltage comparator which uses an operational amplifier is shown in the figure.
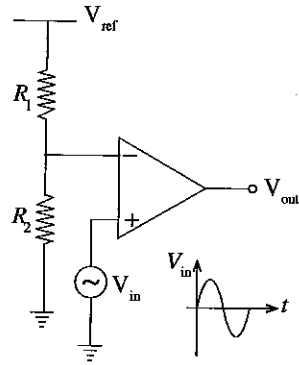


Which of the following shows the output ($V_{out}$) that corresponds to the given input ($V_{in}$)?



(1)          (2)          (3)          (4)          (5)
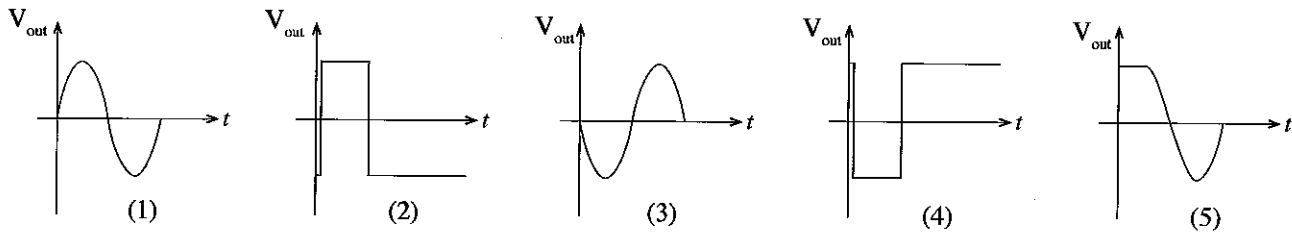
**49.** Select the circuit which shows the correct connection among the transmission line parameters.



(1)          (2)          (3)



(4)          (5)
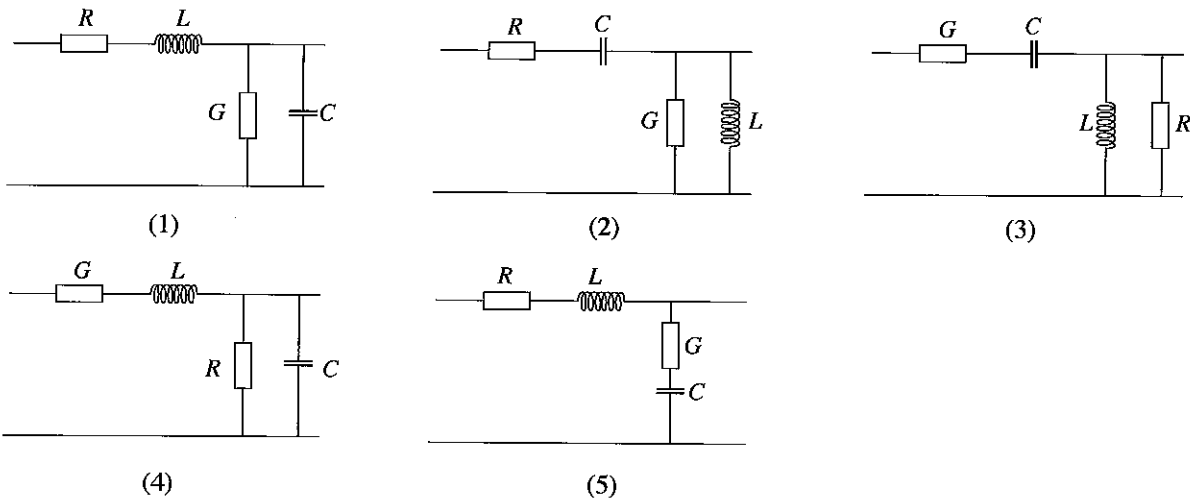
**50.** Out of the following sources of energy which one could be considered as a renewable source of energy for the generation of electricity?

(1) Uranium          (2) Diesel          (3) Coal          (4) Natural gas          (5) Biomass

* * *

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

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

| | | |
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| ඉංජිනේරු තාක්ෂණවේදය | **II** | |
| பொறியியல் தொழினுட்பவியல் | **II** | **65 E II** |
| **Engineering Technology** | **II** | **10.08.2018 / 1400 – 1710** |

| | | |
|---|---|---|
| පැය තුනයි | අමතර කියවීම් කාලය | මිනිත්තු 10 යි |
| மூன்று மணித்தியாலம் | மேலதிக வாசிப்பு நேரம் | 10 நிமிடங்கள் |
| **Three hours** | **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 comprises of **four** parts, **A**, **B**, **C** and **D**. The total time allotted for **all four parts** is **three hours**.*

* *Use of calculators is not allowed.*

**PART A — Structured Essay :**
( pages 2 - 9)

*Answer **all** the questions **on the question paper itself**. Write your answers in the space provided for each question. Note that the space provided is sufficient for the answers and that extensive answers are **not** expected.*

**PARTS B, C and D — Essay :**
( pages 10 - 14)

*Essay question paper contains **six** questions, Answer **four** questions selecting at least one question from each part. Use the papers supplied for this purpose. **Measurement (TDS) sheets are supplied.***

*At the end of the time allotted for this paper, tie the four parts **A**, **B**, **C** and **D** together as a single answer script so that Part **A** is on top and hand it over to the supervisor.*

**For Examiners' Use Only**

| 65 - Engineering Technology II | | |
|---|---|---|
| Part | Question Nos. | Marks Awarded |
| A | 1 | |
| | 2 | |
| | 3 | |
| | 4 | |
| B | 5 | |
| | 6 | |
| C | 7 | |
| | 8 | |
| D | 9 | |
| | 10 | |
| Total | | |
| Percentage | | |

**Final Marks**

| In numbers | |
|---|---|
| In words | |

**Code Numbers**

| Marking Examiner 1 | |
|---|---|
| Marking Examiner 2 | |
| Marks checked by | |
| Supervised by | |

**PART A — Structured Essay**

*Answer **all four** questions on this question paper itself.*
*(Marks allocated for each question is **60**.)*

**1.** The isometric view of a symmetrical machine part made out of mild steel is shown in the figure. According to the first angle projection using a scale of 1:1, draw in the grid supplied in the next page, the front view looking in the direction of arrow **A**, side view looking in the direction of arrow **B** and the plan. All dimensions are in millimetres. (The figure has not been drawn to scale.)
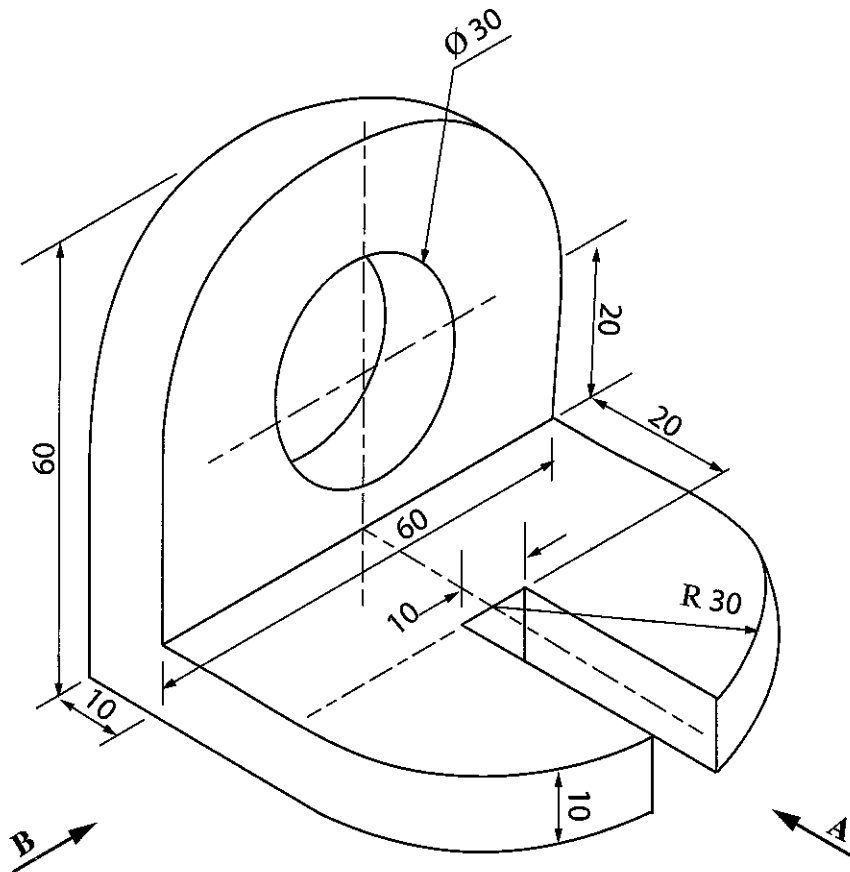


| For use by the examiners | Marks |
|---|---|
| Correct first angle projection | |
| Dimensioning according to the standard | |
| Drawing centre lines | |
| Front view | |
| Side view | |
| Plan | |
| Layout | |

(60 *marks*)

**Q. 1**

**60**
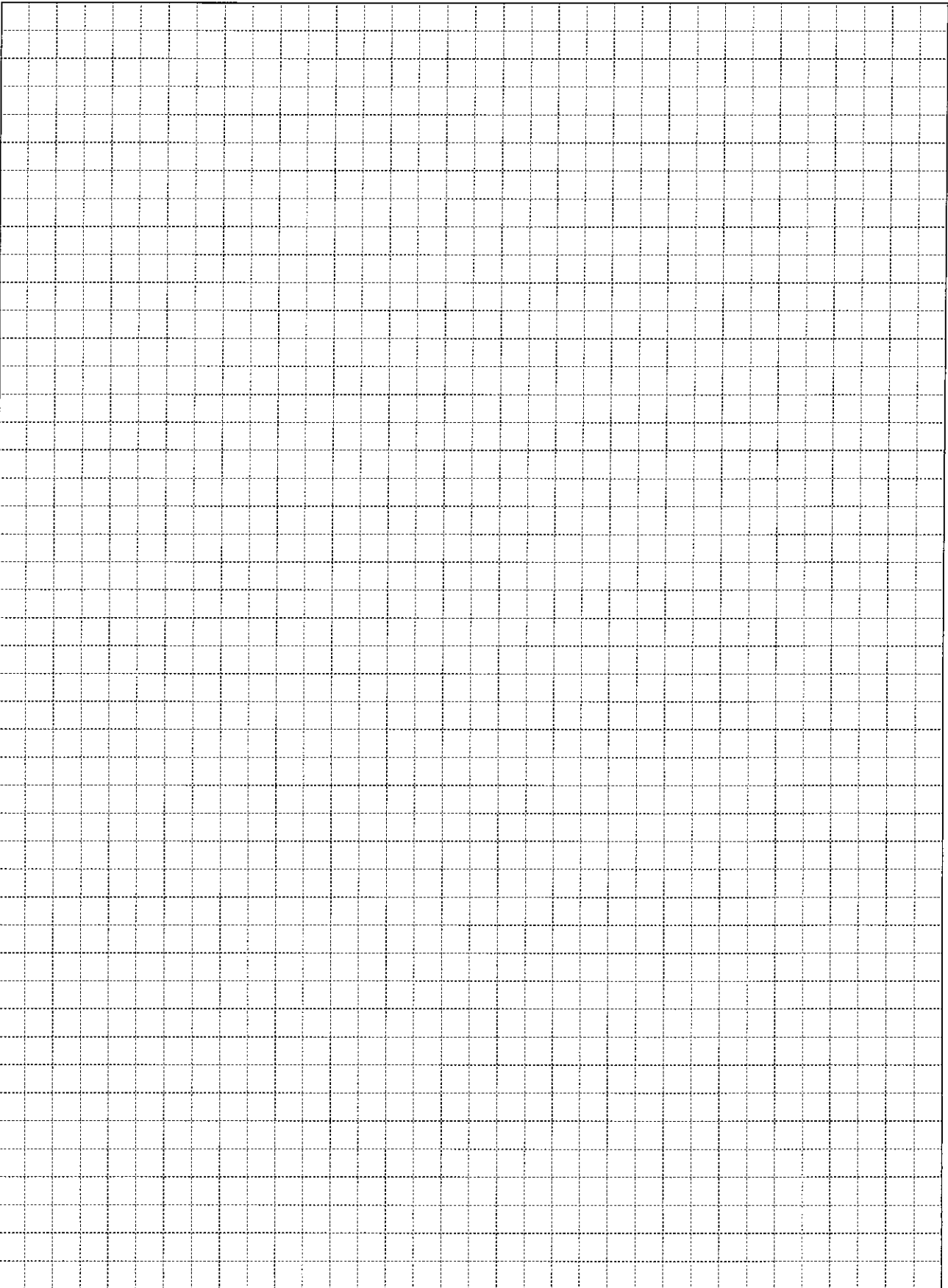
| MATERIAL:<br>MILD STEEL | | DATE | NAME | K & G MACHINE SHOP | |
|---|---|---|---|---|---|
| | DRAWN BY: | 10.08.2018 | KUMARI | | |
| | CHECKED BY: | 12.08.2018 | GANESHAN | | |
| SCALE :<br>1 : 1 | MILD STEEL BRACKET | | | DRWG NO.<br>ET/65/04 | |

2. Ms Kumari is planning to start a mechanical workshop for the production of machine spare parts. She hopes to use her small land with a gentle slope for the construction of this workshop. She expects to produce grill gates, machine spare parts etc.

(*a*) It is proposed to use theodolite surveying method to prepare the plan of the above land.

(i) Name **two** main equipment, except the theodolite for the above surveying work.

(1) ..............................................................................................................

(2) ..............................................................................................................

(02 × 2 = 04 *marks*)

(ii) If this survey is to be carried out using only one survey station, state **two** factors to be considered in selecting a suitable place for the survey station.

(1) ..............................................................................................................

(2) ..............................................................................................................

(04 × 2 = 08 *marks*)

(*b*) (i) State **two** actions to be taken to prevent flowing of rain water to the workshop due to the slope of the land.

(1) ..............................................................................................................

(2) ..............................................................................................................

(02 × 2 = 04 *marks*)

(ii) State an action to be taken when designing the floor of this workshop to be strong enough to withstand the weight of heavy machinery installed.

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

(04 *marks*)

(*c*) (i) Name **three** main plant and machinery which should essentially be there in such a multi-purpose mechanical workshop.

(1) ..............................................................................................................

(2) ..............................................................................................................

(3) ..............................................................................................................

(02 × 3 = 06 *marks*)

(ii) Name **four** personal protective equipment which should be used for the safety of the technical workers in the mechanical workshop.

(1) ..............................................................................................................

(2) ..............................................................................................................

(3) ..............................................................................................................

(4) ..............................................................................................................

(02 × 4 = 08 *marks*)

(iii) It is expected to use a 30 m deep well for obtaining water for the mechanical workshop.

I. Name the type of pump which should be used for pumping water and state one reason for selecting it.

Type of pump: ..............................................................................................

Reason : ..............................................................................................

(02 × 2 = 04 *marks*)

II. State **two** actions that can be taken in designing water pipe system for minimizing pressure drop in pumping water.

(1) ..............................................................................................................

(2) ..............................................................................................................

(02 × 2 = 04 *marks*)

*[see page five*

(d) (i) Name a type of three-phase induction motor that has a rotor which does not use windings and draw a labelled sketch of the construction of the rotor.

Type of motor: ..................................................................................................

(05 *marks*)

(ii) The rated power of a certain machine is 1500 W. It is used for 2 hours daily. By considering the electrical tariff as Rs. 25 per unit (kWh) of electricity, calculate the electricity bill for a month of 30 days.

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

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

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

(05 *marks*)

(iii) It is required to frequently switch on and off a switch of 230 V, 5 A in the washing area of the workshop. In order to prevent electrical hazards that may be caused when operating this switch by hand, it is proposed to use the electronic switch shown in the figure which is operated at a low voltage with a relay. Show in a circuit diagram how this circuit can be used to operate 230 V, 5 A accessory.
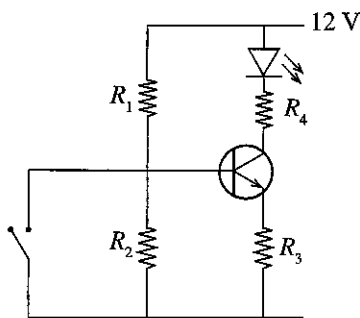


(08 *marks*)

**Q 2**

$\dfrac{}{60}$

3.(a) (i) State **three** factors that influenced the trend to use computer controlled machines such as Computer Numerically Controlled (CNC) machines instead of conventional machines in the production processes.

(1) ..................................................................................................

(2) ..................................................................................................

(3) ..................................................................................................

(02 × 3 = 06 *marks*)

(ii) State **three** causative factors that led to the wide use of cement block stones instead of bricks in the construction industry.

(1) ..................................................................................................

(2) ..................................................................................................

(3) ..................................................................................................

(02 × 3 = 06 *marks*)

Do not write in this column

 (iii) State **three** factors that led to large scale use of thermal energy as a percentage for electric power generation in Sri Lanka.

  (1) ....................................................................................................................

  (2) ....................................................................................................................

  (3) ....................................................................................................................

                 (2 × 03 = 06 *marks*)

(*b*) (i) State **three** accidents likely to be faced by the employees of a chemical production plant, which are specific to the production of chemicals and **one** precaution measure for each.

| | Accident | Precaution |
|---|---|---|
| (1) | .................................................... | .................................................... |
| (2) | .................................................... | .................................................... |
| (3) | .................................................... | .................................................... |

                 (02 × 6 = 12 *marks*)

 (ii) State **three** methods that can be used for discharging waste chemicals safely to the environment.

  (1) ....................................................................................................................

  (2) ....................................................................................................................

  (3) ....................................................................................................................

                 (02 × 3 = 06 *marks*)

(*c*) (i) Name **three** institutions that implement standards and recommendations for the prevention of hazards and accidents that take place in work sites.

  (1) ....................................................................................................................

  (2) ....................................................................................................................

  (3) ....................................................................................................................

                 (02 × 3 = 06 *marks*)

 (ii) State **three** benefits of using standard specifications for a business.

  (1) ....................................................................................................................

  (2) ....................................................................................................................

  (3) ....................................................................................................................

                 (02 × 3 = 06 *marks*)

 (iii) State **four** specifications to be considered when selecting a measuring instrument.

  (1) ....................................................................................................................

  (2) ....................................................................................................................

  (3) ....................................................................................................................

  (4) ....................................................................................................................

                 (01 × 4 = 04 *marks*)

 (iv) When measuring a length at a temperature of 30 °C using a steel instrument which has been calibrated at 20 °C, a percentage error of 2% occurs. It was used to measure at a temperature of 35 °C and the measurement observed was 75 mm. Calculate the correct measurement.

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

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

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

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

                 (08 *marks*)

Q 3

60

Do not write in this column

4. Messrs. Subodha and Sivanesan successfully run a business for importing and selling electrical appliances and accessories. After considering the purchasing capacity of the customers and tax relief given by the government, they expect to establish a new business division for assembling and selling domestic solar power systems imported from a foreign country. Since the technical knowledge they have on domestic solar power systems is limited, it has been proposed to recruit new employees with the technical knowledge and also to purchase several small lorries for transportation. Though the business presently is in a financially viable position, it is estimated that a large sum of money has to be invested for the new business division.

(a) (i) State **two** characteristics from the above passage in order to consider Messrs. Subodha and Sivanesan as entrepreneurs.

(1) ................................................................................................................

(2) ................................................................................................................

(02 × 2 = 04 *marks*)

(ii) State **two** management functions that are important in order to manage the starting stage of the new business division and state **one** reason for the importance of each function.

| Management function | | Reason for the importance |
|---|---|---|
| (1) | ...................... | ................................................................................ |
| | | ................................................................................ |
| (2) | ...................... | ................................................................................ |
| | ...................... | ................................................................................ |

(01 × 4 = 04 *marks*)

(iii) State **two** benefits of preparing a plan for additional financial provisions required for the new business division.

(1) ................................................................................................................

(2) ................................................................................................................

(02 × 2 = 04 *marks*)

(iv) Referring to the above passage, state **two** factors each for micro and macro environments relevant to domestic solar power systems.

Macro environmental factors

(1) ................................................................................................................

(2) ................................................................................................................

Micro environmental factors

(1) ................................................................................................................

(2) ................................................................................................................

(02 × 4 = 08 *marks*)

(b) (i) Name **three** factors to be considered in deciding on the quantity of domestic solar power systems supplied to the market by the business.

(1) ................................................................................................................

(2) ................................................................................................................

(3) ................................................................................................................

(02 × 3 = 06 *marks*)

(ii) High initial cost to be born by the consumer has been identified as a main problem in marketing domestic solar power systems. State **two** marketing strategies to minimize this negative impact.

(1) ................................................................................................................

(2) ................................................................................................................

(02 × 2 = 04 *marks*)

(iii) State **one** way in which the business can contribute to corporate social responsibility.

.................................................................................................................
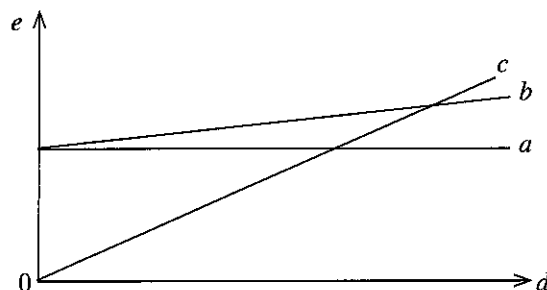
(02 *marks*)

(iv) State **two** steps to be followed in preparing a marketing plan for domestic solar systems and **one** main factor to be considered in each step.

| Steps | Factor to be considered |
|---|---|
| (1) ................................................ ................................................ | ................................................ ................................................ |
| (2) ................................................ ................................................ | ................................................ ................................................ |

(02 × 4 = 08 *marks*)

(c) (i) The graph which was used to calculate the break-even point for domestic solar power systems is shown in the figure.



Name *a, b, c,* and *d.*

a – ................................. b – .................................

c – ................................. d – .................................

(02 × 4 = 08 *marks*)

(d) Financial information relevant for the selling of domestic solar power systems is given below:

| | | |
|---|---|---|
| Expected annual number of sales units | | 80 |
| Expected selling price per unit | Rs. | 500,000 |
| Purchasing cost per unit | Rs. | 352,000 |
| Other direct import cost per unit | Rs. | 3,000 |
| Direct cost for assembling one unit | Rs. | 2,000 |
| Transport cost per unit | Rs. | 2,000 |
| Selling cost per unit | Rs. | 1,000 |
| Annual fixed cost | Rs. | 2,400,000 |

(i) Calculate the annual gross profit of the business.

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

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

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

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

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

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

(04 *marks*)

Do not write in this column

(ii) Calculate showing steps, the contribution to be earned from one unit of solar power system in order to obtain break-even point at 50 units.

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

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

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

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

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

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

(04 *marks*)

(iii) Messrs. Subhoda and Sivanesan expect to recruit Mr. Mohamed as a new partner, change existing administrative rules of the business and register the business under a new name.   State **two** legislations that are relevant to the above situation.

(1) For the changing of administrative rules of the business : ....................................

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

(2) For the registration of a name : ...............................................................

Q. 4

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

60

(02 × 2 = 04 *marks*)

✳ ✳

**Question  No. : 10  (a)**                                    **Index  No. :** .........................................

| T | D | S | Description | T | D | S | Description |
|---|---|---|---|---|---|---|---|
|   |   |   |             |   |   |   |             |

**Question No. : 10 (a)**     **Index No. : ...................................**

| T | D | S | Description | T | D | S | Description |
|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |

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

| ඉංජිනේරු තාක්ෂණවේදය | **II** |
| பொறியியற் தொழினுட்பவியல் | **II** |
| **Engineering Technology** | **II** |

**65 E II**

**Instructions:**
 ＊ Answer **four** questions only selecting at least **one** question each from parts **B**, **C** and **D**.
 ＊ Marks allocated for each question is **90**.

## Part B - Essay (Electrical and Electronic Technology)

5. (a) (i) Explain by using a sketch of its internal circuit, how a residual current circuit breaker automatically operates to protect a person from damage due to a leakage current.
   (15 *marks*)

   (ii) State the importance of the earth conductor of a domestic electrical circuit.   (05 *marks*)

   (iii) Write down **three** factors which influence the nature and extent of damage caused by an electrical shock to a person.
   (15 *marks*)

   (b) (i) Write **three** advantages of using 'Star-Delta Starters' for electrical motors used in factories.
   (15 *marks*)

   (ii) Sketch the way in which the windings are connected in compound wound motors.
   (10 *marks*)

   (c) (i) State **four** advantages of transmitting electricity at high voltage.   (20 *marks*)

   (ii) Calculate the number of turns required in the secondary winding of a step down transformer for obtaining an output of 220 V when its primary winding has 2000 turns and has been connected to a 11,000 V, 50 Hz supply voltage.
   (10 *marks*)

6. (a) A power supply circuit is shown in the figure.
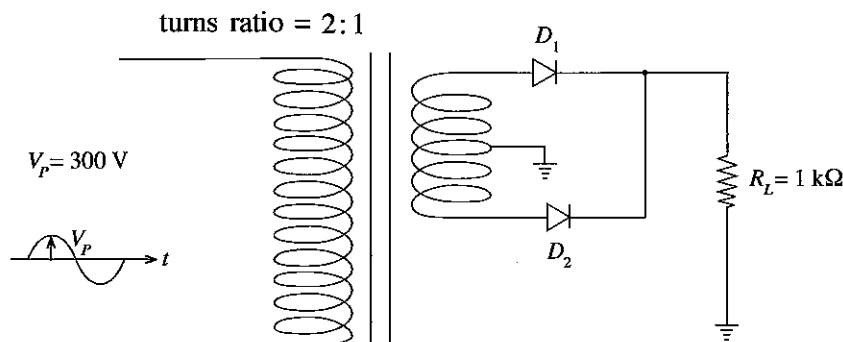


   (i) Draw the voltage waveform across $R_L$.   (05 *marks*)

   (ii) What is the type of rectification performed by the above circuit?   (05 *marks*)

   (iii) Calculate the maximum current flowing through diode $D_1$. (All diodes are Silicon (Si) diodes.)
   (10 *marks*)

(iv) You have been provided several diodes having different Peak Inverse Voltage (PIV) as in the table below. Select and write **all** diodes that can be used in the above circuit.

(05 *marks*)

| Diode | PIV |
|-------|-----|
| $D_A$ | 50 V |
| $D_B$ | 100 V |
| $D_C$ | 140 V |
| $D_D$ | 200 V |
| $D_E$ | 250 V |
| $D_F$ | 300 V |

(b)  (i) Explain using a diagram, how to identify a transistor as either PNP or NPN using a multi-meter if collector, base and emitter terminals were identified.   (06 *marks*)

(ii) Mark the operating regions of a transistor on $I_C$ vs $I_B$ curve.   (04 *marks*)

(iii) Write a mathematical expression for the relationship between $I_B$ and $I_C$ for each operational region.   (06 *marks*)

(iv) Compare the heat dissipation in each operating region of a transistor.   (04 *marks*)

(c) A heat sensitive switch for a fire alarm is shown in the figure. A thermistor which is a heat sensitive resistor, has been used in it and its resistance decreases when the temperature increases. The transistor used is silicon type.
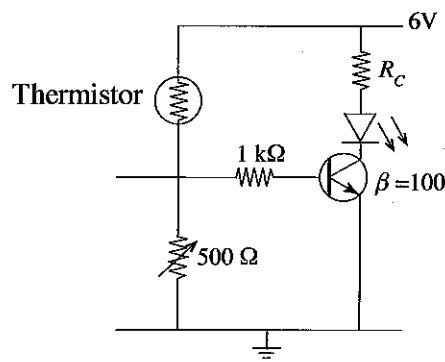


(i) What are the different operating regions of the transistor which correspond to different temperature levels of the thermistor?   (15 *marks*)

(ii) Explain how to check using a multimeter, when the transistor is operating in each of the above mentioned operating regions.   (10 *marks*)

(iii) The above transistor gets into saturated state when the current through the Light Emitting Diode (LED) becomes 20 mA. Calculate the value of $R_C$ taking the voltage across the LED as 2.1 V.   (10 *marks*)

(iv) Calculate the minimum base current which brings the transistor to saturation in part (iii) above.   (10 *marks*)

## Part C - Essay (Mechanical Technology)

7. An order has been received by you to produce a batch of pulleys as shown in figure. Aluminium rods with diameter 120 mm and lengths 1 m have been supplied as raw material for this.
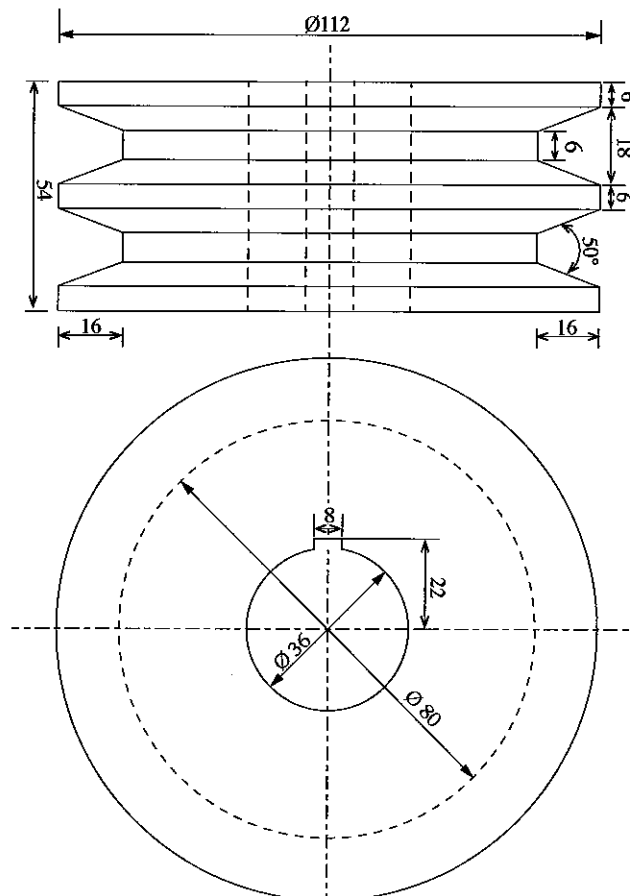


(All dimensions are in millimetres)

(a) State **three** machines that should be used in the machine shop for producing these pulleys.

(06 *marks*)

(b) Explain, how to separate the workpiece of used to make a pulley from the aluminium rods.

(15 *marks*)

(c) Stating the machine, tools and accessories used, describe step by step, using diagrams, how the flat end-faces of the pulleys are machined.

(15 *marks*)

(d) Stating the machine, tools and accessories used, describe step by step, using diagrams, how the v-grooves on the curved surface are machined.

(15 *marks*)

(e) Stating the machine, tool and accessories used, describe step by step, using diagrams, how the center hole of the pulley is machined.

(15 *marks*)

(f) Stating the machine, tools and accessories used, describe step by step, using diagrams, how the keyway of the pulley is machined.

(15 *marks*)

(g) If only one pulley is required to be produced, briefly explain, how this can be done using only one machine.

(09 *marks*)

8. (a) The function of the carburettor is to supply fuel to the engine by changing air fuel ratio according to the various running conditions. The air fuel ratio of a petrol engine for complete combustion is considered as 14.5 : 1. It is known as stoichiometric ratio.

(i) What is a 'rich mixture'?

(04 *marks*)

(ii) Under what condition is a 'rich mixture' required to be supplied to a vehicle engine?

(04 *marks*)

(iii) What is a 'lean mixture'?

(04 *marks*)

(iv) Under what condition is a 'lean mixture' required to be supplied to a vehicle engine?

(04 *marks*)

(v) State **two** advantages of using fuel injection instead of carburettor in motor vehicles.

(04 *marks*)

(*b*) For the fuel supply system of a motor car using carburettor, name all the components from the fuel tank to the engine along the fuel supply system in the correct order, and give **one** function performed by each of the components. (12 *marks*)

(*c*) Drum and disc brakes are major types of brakes used in motor vehicles.

   (i) Describe with sketches, how drum and disk brakes work. (08 *marks*)

   (ii) State **two** methods used for the operation of disc brakes. (08 *marks*)

   (iii) State **two** situations where hand brakes are used. (08 *marks*)

   (iv) Give **two** faults that can be commonly found in hand brakes and give remedial actions required. (08 *marks*)

   (v) Explain the advantage of using Anti-locking Braking System (ABS) which is used in modern motor vehicles. (08 *marks*)

(*d*) Name **five** methods that are used for the safety of passengers in a motor vehicle which is moving and explain the methods of action of **two** of them.

(02 × 5 + 04 × 2 = 18 *marks*)

## Part D - Essay (Civil Technology)

9.(*a*)  (i) Describe **two** natural processes in a river which lead to natural purification of water. (10 *marks*)

   (ii) List **five** factors need to be considered, when designing a pumping system for a house to pump water from a well to an overhead tank. (10 *marks*)

   (iii) List **five** components and accessories required for the construction of the pumping system stated in (ii) above. (10 *marks*)

   (iv) Explain the function of solvent cement, when it is used to join two PVC components. (05 *marks*)

(*b*) A single storeyed building is proposed to be constructed with brick walls having English bond and a closed coupled double pitched clay tile roof, having pitch angle 30° and wall height to wall plate 3,000 mm from Damp Proof Course (DPC).



D 3000 × 2000
W 3000 × 1500

——— walls
- - - - roofs

(All dimensions are in millimetres)
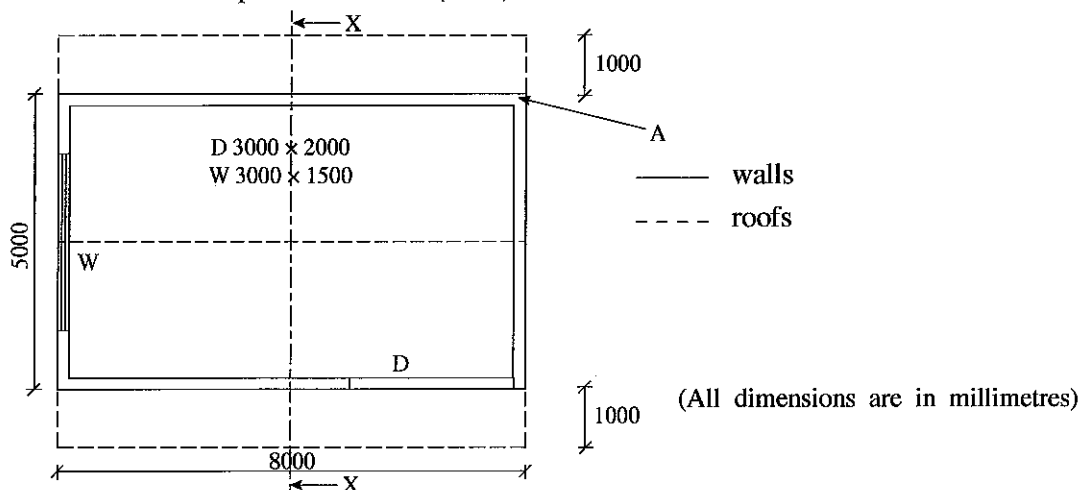
   (i) Draw an annotated and dimensioned cross section in the cross-sectional plane X—X of the building as seen in the direction of arrow **X**. (15 *marks*)

   (ii) Draw **two** consecutive courses of the brick laying pattern needed to form the corner plane "A" with 4 bricks in each side. (10 *marks*)

   (iii) Name **two** alternative materials each that can be used for roof cover and members of roof frame. (12 *marks*)

   (iv) 3.5 m long lintel is to be placed symmetrically over the window opening. Name the loads acting on the lintel and show in a sketch the way they act on the lintel. (12 *marks*)

(*c*) Strip foundation was not recommended as the soil on the site was too weak. Name **two** suitable foundation types. (06 *marks*)

*[see page fourteen*

**10.** (*a*) Answer the given questions, using the TDS sheets supplied referring to the following floor plan and cross sections of the foundations. (Taking-off should comply with SLS 573)



W : 1200 × 1500
D : 1000 × 2000

(All dimensions are in millimetres)
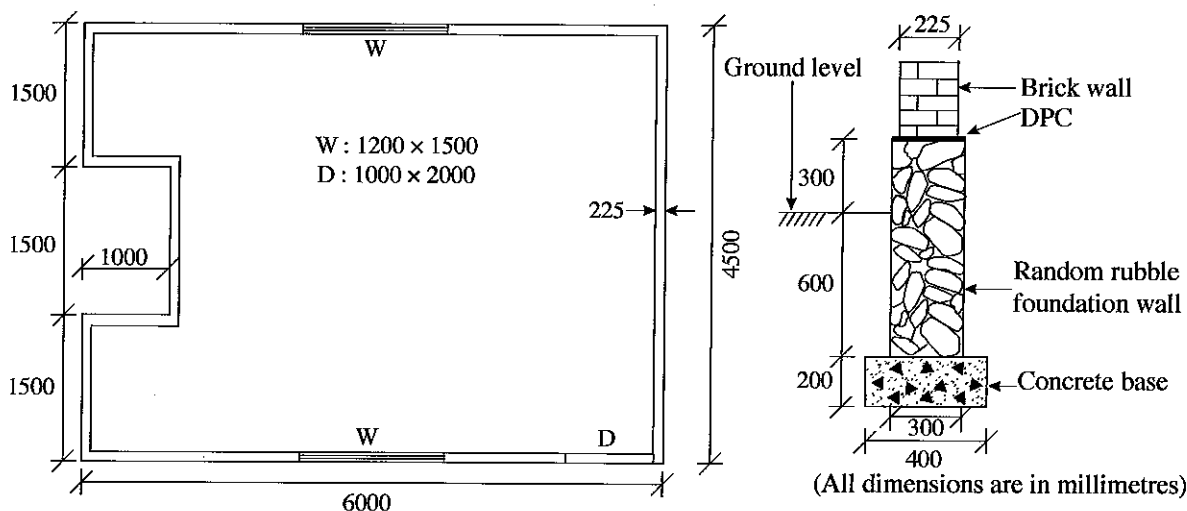
   (i) Calculate the centreline girth of the walls of building.         (15 *marks*)

  (ii) Take off the quantities for concrete in the base of the foundation.     (05 *marks*)

 (iii) Take off the quantities for the random rubble wall of foundation up to Damp Proof Course (DPC).         (05 *marks*)

 (iv) Height of brick wall from DPC to flat roof is 3 m. Take off the quantities for the brick wall from DPC to flat roof showing the deductions for doors and windows.     (10 *marks*)

(*b*) Calculate the net unit rate for the 225 mm brick wall referring to the given information.
        (15 *marks*)

- All in rates for labour
  For a skilled labourer                 Rs. 3000.00 per day
  For an unskilled labourer          Rs. 1500.00 per day

- All in rates for materials
  One Brick                         Rs.    30.00
  50 kg cement bag                Rs. 1000.00
  Sand 1 m$^3$ (approximately equivalent to 100 pans)   Rs. 5000.00

- Assume that a team of one skilled worker and two unskilled workers builds 3 m$^2$ of 225 mm thick brick wall in a day including mixing of mortar.
- Raw material requirement for 1 m$^2$ of 225 mm thick brick wall are as follows:
  bricks 120 nos
  cement $^2/_5$ bags (including shrinkage allowance)
  sand 16 pans (including shrinkage allowance)

(*c*) It was proposed to take measurements to draw the plan of a small land with a house using only one survey line.

   (i) With figures describe **two** methods which can be used to take measurements relative to the line for a point located outside the line?     (10 *marks*)

  (ii) State **two** difficulties faced, when surveying a land with only one survey line. (10 *marks*)

 (iii) A levelling procedure was carried out to determine the difference between reduced levels of 2 points on the above land. In this, two instrument stations were used and the levelling staff readings were 2.43 m, 1.48 m, 2.92 m and 0.72 m respectively. Calculate the height difference between the above 2 points using a table or a diagram.
        (20 *marks*)

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