අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

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 annual electricity consumption in Sri Lanka is 15.76 billion kilowatt hours. What is the correct representation of this value?

(1) 15.76 TWh (2) 15.76 MWh (3) 15.76 GWh (4) 15.76 pWh (5) 15.76 nWh

2. In order to prevent the reduction of price of tea leaves, a small tea estate holder cooperative was established. Three proposals forwarded by members of this are given below.

A - Producing a tea-based bottled drink and marketing it.
B - Marketing tea leaves in bulk.
C - Producing made tea and marketing it.

Out of the above proposals, the proposal/proposals that can be used to minimize the effects of price drop in tea leaves is/are,

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

3. Consider the following statements.

A - Computer-related knowledge obtained through school education will be an immense boost to the emergence of engineering technology.
B - With the advancement of internet facilities, the local manufacturing sector will be able to directly connect with the manufacturing industry processes in various countries.
C - By correctly utilizing artificial intelligence (AI), the manufacturing sector in this country will be directed towards a novel path.

Out of the above statements, the correct statement/statements relevant to the progression of the manufacturing sector in Sri Lanka is/are,

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

[See page two

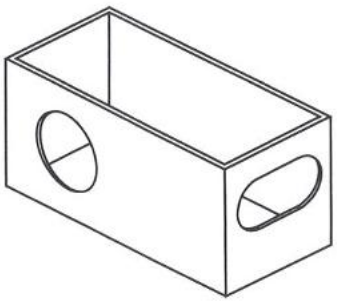
4. Several symbols marked on an engineering drawing are shown by A, B and C.

A B C

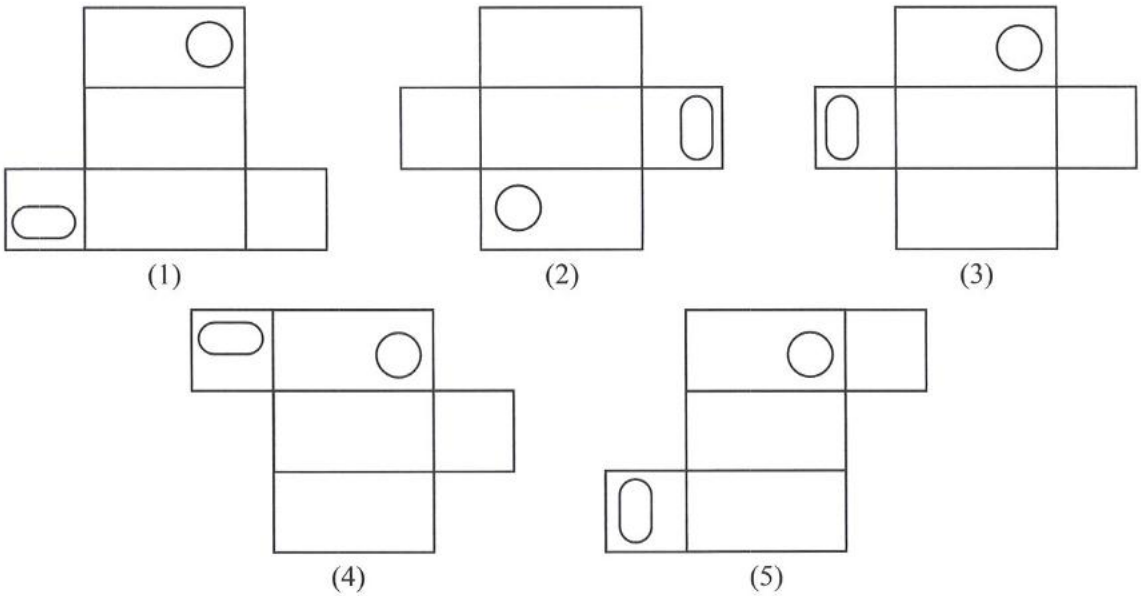
Out of the above symbols, the symbol/symbols that is/are relevant to depicting a weld is/are

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

5. Figure shows a three-dimensional drawing of a lid-less hollow box made of a steel sheet.



Which is **not** a correct development drawing of it?



(1) (2) (3)

(4) (5)

6. Which option includes a hazard that can take place at a worksite and the suitable strategy to minimize the harm caused by it?

(1) Falling from a height – wearing a safety helmet
(2) Slipping on the floor – wearing safety shoes
(3) Exposing to chemicals – wearing ear covers
(4) Getting cut due to sharp edges – wearing a safety waist belt
(5) Getting exposed to a dusty environment – wearing a safety jacket

[*See page three*

7. Consider the following statements related to a business.

A - According to the marketing plan, after a certain period, the profit need to be calculated from the transactions of the business.

B - The basis of a marketing plan should be a SWOT analysis related to the business.

C - The marketing plan can be used to check whether the business is functioning properly.

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

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

8. In a profit and loss statement related to a production organization,
(1) 'bad debt' is a financial expenditure.
(2) 'water bill' is an administrative expenditure.
(3) 'advertising cost' is a financial expenditure.
(4) 'vehicle leasing installment' is a distribution expenditure.
(5) 'dishonoured cheque penalty' is an administrative expenditure.

9. Which is **not** a component of a sewer pipe network?
(1) Water trap (2) Man-hole
(3) Non-return valve (4) Pump
(5) Sanitary fittings

10. Which is **not** a method of value-addition for solid waste?
(1) Recycling (2) Reusing
(3) Composting (4) Open burning
(5) Producing bio-gas

11. The main role of coarse aggregates used in concrete is,
(1) speeding up the hydration of concrete.
(2) reducing the shrinkage of concrete and maintaining the volumetric stability.
(3) acting as a lubricant in fresh concrete.
(4) improving the workability of concrete.
(5) maintaining the consistency of concrete.

12. Which is **not** an advantage of using post tensioning concrete when designing buildings?
(1) Ability to use a minimum number of columns
(2) Ability to use slabs with long spans
(3) Ability to use slabs with low thickness
(4) Ability to easily incorporate changes after construction
(5) Ability to maintain a high value for the stability of the concrete

13. Which is the property that should **not** be present in fresh concrete?
(1) Uniformity
(2) Workability
(3) Fluidity
(4) Consistency
(5) Compressibility

14. In an English bonded brick wall, the horizontal overlap is a,
(1) half bat. (2) king closer.
(3) three quarter. (4) queen closer.
(5) bevelled bat.

[*See page four*

15. An advantage of pile foundations is,
(1) making the construction process easy.
(2) being able to construct with low cost.
(3) directing the loads to the stronger soil layers located in depths.
(4) being able to equally distribute the loads through the soil layers.
(5) increasing the bearing capacity of the soil.

16. A pump has been used for about one year to pump water from a sump to an overhead tank. It was suddenly observed that the water does not get pumped to the overhead tank although there was water in the sump and the pump was working. The reason for this is,
(1) the suction pipe being full with water.
(2) having a fault in the float valve.
(3) the discharge pipe being full of water.
(4) the discharge pipe being full with air.
(5) having a fault in the foot valve.

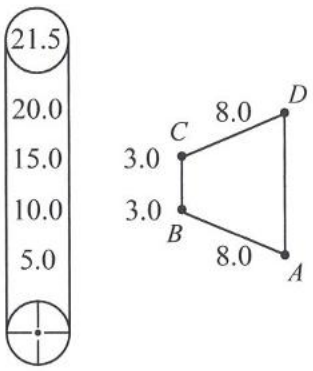
17. Which is **not** used when calculating unit rates?
(1) BSR (2) SMM7
(3) Unit cost of material (4) Unit cost of plant
(5) Overheads

18. Which is **not** an organisation that implements building regulations?
(1) Urban Development Authority
(2) Local Government Authority
(3) Central Environment Authority
(4) Water Supply and Drainage Board
(5) Road Development Authority

19. The slope distance between two locations *A* and *B* is 20.00 m. The reduced levels of *A* and *B* are, respectively, 100.00 m and 103.00 m. The distance between *A* and *B* points on a survey plan drawn to a scale 1:1000 is,
(1) 14.45 mm. (2) 19.77 mm. (3) 20.00 mm. (4) 20.22 mm. (5) 25.55 mm.

20. Consider the following statements.
A - Theodolite can be used to measure vertical and horizontal angles.
B - Prismatic compass can be used to measure vertical angles.
C - Clinometer can only be used to measure angles in the horizontal plane.
Out of the above statements, the correct statement/statements is/are,
(1) A only. (2) C only. (3) A and B only.
(4) B and C only. (5) A, B and C all.

21. The figure shows the field book note taken during a chain surveying exercise.



According to the given information, what is the area of land feature *ABCD*?
(1) 24 m^2 (2) 48 m^2 (3) 50 m^2 (4) 100 m^2 (5) 121 m^2

[*See page five*

22. Readings taken during a levelling exercise conducted to find the reduced levels of *A*, *B* and *C* places using two instrument stations are given below.

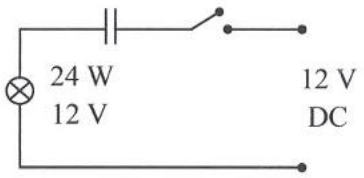
Back sight reading at *A* - 1.6 m
Fore sight reading at *C* - 1.4 m

If reduced levels of *A*, *B* and *C* places are respectively 100.0 m, 100.8 m and 100.0 m, fore sight and back sight readings obtained at *B* are respectively,

(1) 0.6 m and 0.8 m. (2) 0.6 m and 1.0 m. (3) 0.8 m and 0.6 m.
(4) 1.0 m and 0.6 m. (5) 1.0 m and 0.8 m.

23. A 24 W, 12 V direct current filament bulb, an ideal capacitor, and a switch are connected to a 12 V direct current supply as shown in the figure. The capacitor is fully discharged when connecting. When the switch is turned on,

(1) the bulb keeps lighting up to its maximum brightness.
(2) the bulb lights up at its maximum brightness and then goes off completely.
(3) the bulb does not light up.
(4) the bulb keeps lighting up continuously at low brightness.
(5) the bulb lights up and goes off at a constant frequency.



24. What is the renewable energy which is currently **not** being used commercially to generate electricity in Sri Lanka?

(1) Solar energy (2) Wind energy (3) Biomass energy
(4) Sea wave energy (5) Hydro energy

25. It was observed that a self excited direct current generator does not generate electricity. Which is **not** a reason for this?

(1) Having a low value for the residual magnetism
(2) Incorrect connection of the field winding
(3) Rotating at a lower speed than the recommended speed
(4) Having a high resistance in the field winding
(5) Armature winding being short circuited

26. Consider a situation where a person experiencing an electric shock. A student stated that the severity of the accident depends on the following facts.

A - The amount of electric current flow across the body
B - The path of the electric current flow across the body
C - The time duration of the electric current flow across the body

Out of the above facts, the correct fact/facts 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.

27. An unidentified component of a motor control circuit was tested as follows.

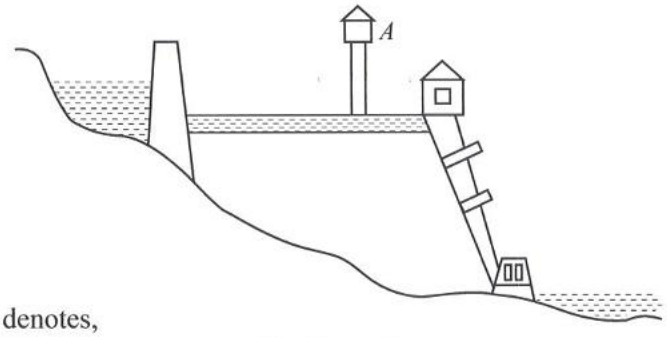
- When it was connected to a direct current (DC) supply through a serially connected resistor, a current flowed initially, and then it became zero.
- When it was connected to a variable frequency alternative current (AC) supply through a serially connected resistor, and when the frequency of the supply was changed, the current peaked at one frequency and then the current gradually decreased as the frequency was further increased.

What is likely to be present inside the component?

(1) An inductor
(2) A capacitor
(3) A resistor and a capacitor connected in series
(4) An inductor and a resistor connected in series
(5) An inductor and a capacitor connected in series

[See page six

28. Shown in the figure is a schematic of a hydro power station.

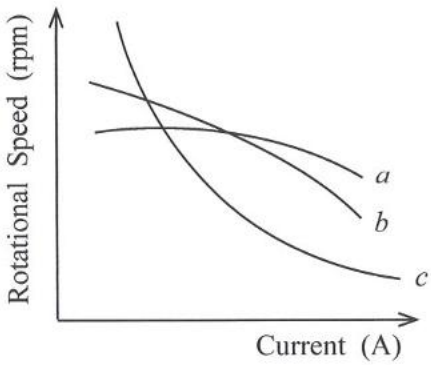


Here, the letter *A* denotes,

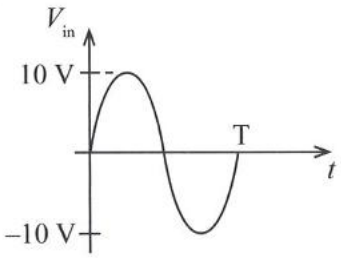
(1) the surge chamber. (2) the valve. (3) the penstock.
(4) the power house. (5) the control room.

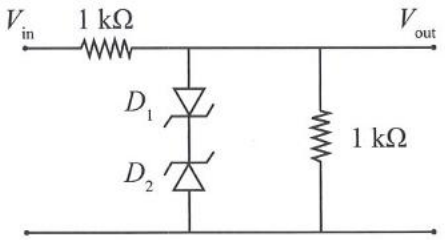
29. The figure shows how the speed varies according to the current in three types of direct current motors. The curves *a*, *b* and *c* represent respectively,

(1) series, compound and shunt motors.
(2) compound, shunt and series motors.
(3) shunt, compound and series motors.
(4) shunt, series and compound motors.
(5) compound, series and shunt motors.

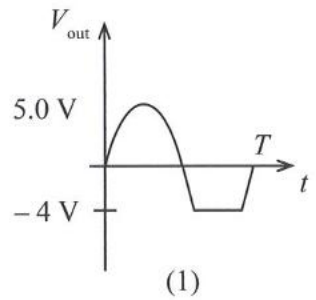


30. The figure shows an electronic circuit and its input signal (V_{in}). The forward bias voltages of the two Zener diodes D_1 and D_2 in the circuit are 0.7 V, and the Zener voltages are 3.3 V and 5.1 V respectively.

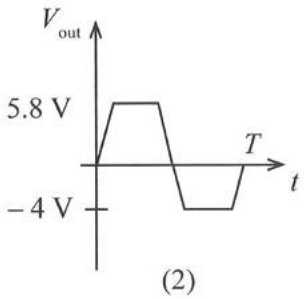




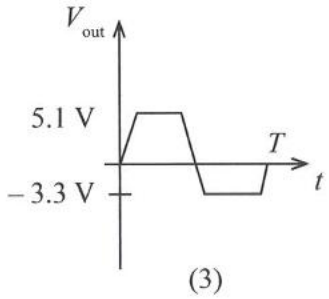
What is the figure that shows its output signal (V_{out})?



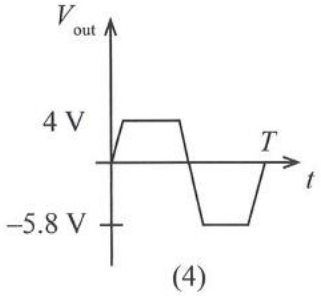
(1)



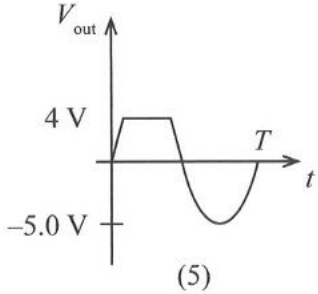
(2)



(3)



(4)



(5)

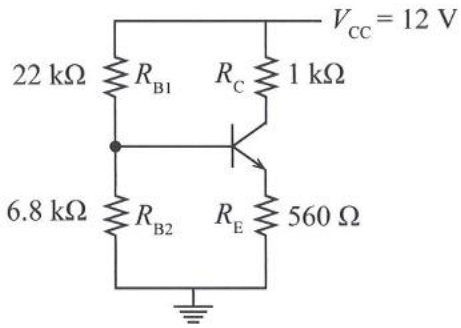
[See page seven

31. The figure shows a transistor amplifier circuit. When the operation of the circuit was tested, it was observed defective. The measured voltages during this test are as follows.

$V_E = 0$ V, $V_C = 12$ V, and $V_B = 2.83$ V

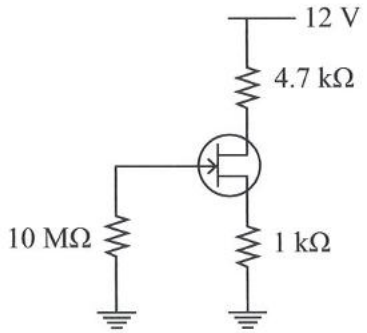
The defect is,

(1) open base emitter junction.
(2) open collector emitter junction.
(3) short circuited base emitter junction.
(4) short circuited collector resistance.
(5) short circuited emitter resistance.

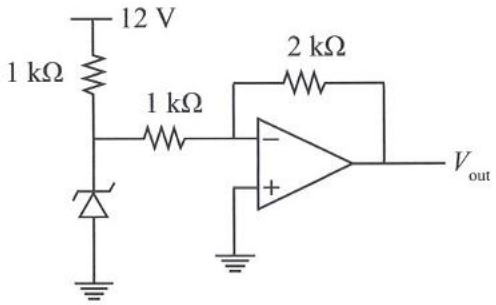


32. The circuit shown in the figure is an application in which a Junction Field Effect Transistor (JFET) is used as an amplifier. If the drain current is 1 mA, the drain voltage (V_D) and the voltage between gate and the source (V_{GS}) are respectively,

(1) 6.3 V and –1 V.
(2) 6.3 V and 1 V.
(3) 7.3 V and –1 V.
(4) 7.3 V and 1 V.
(5) 11 V and –1 V.



33. Consider the operational amplifier circuit shown in the figure. The Zener voltage of the Zener diode is 5.1 V.

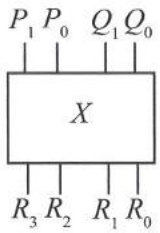


What is the voltage V_{out}?

(1) 2.55 V (2) 5.1 V (3) 6 V (4) 10.2 V (5) 12 V

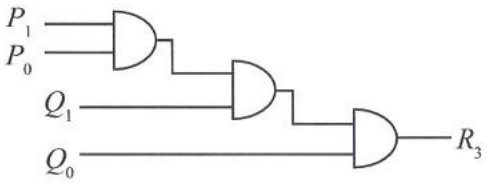
[See page eight

34. X is a digital electronic circuit. Here, P_1, P_0, Q_1 and Q_0 are inputs, and R_3, R_2, R_1 and R_0 are outputs. In this circuit, $R_3R_2R_1R_0$ represents the product of the numbers represented by P_1P_0 and Q_1Q_0. P_1, Q_1 and R_3 are the most significant values of P_1P_0, Q_1Q_0 and $R_3R_2R_1R_0$ binary numbers respectively.

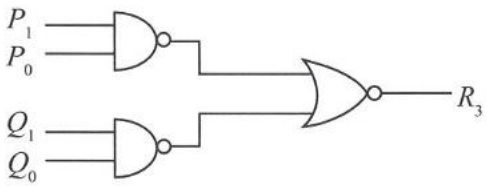


Three proposed circuits for the output R_3 are shown by A, B and C.

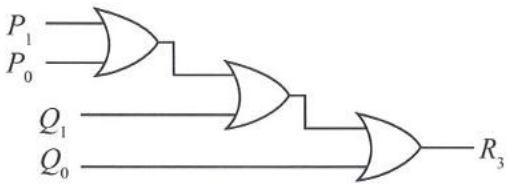
(A)



(B)



(C)

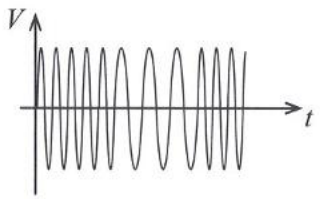


Out of A, B and C circuits, the suitable circuit/circuits for the output R_3 is/are,

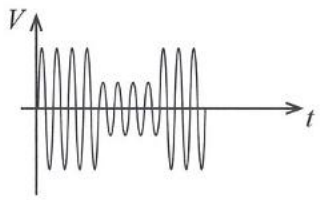
(1) A only. (2) B only. (3) C only.
(4) A and B only. (5) A, B, and C all.

35. Consider the following modulated signals.

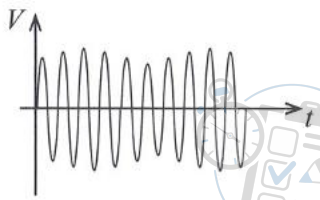
(A)



(B)



(C)

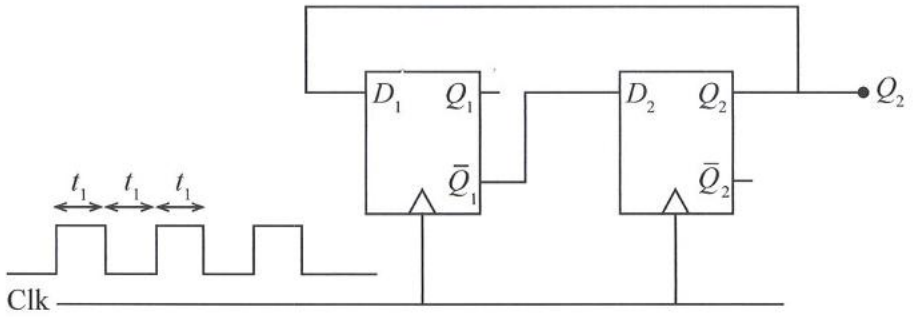


From the above signals, amplitude modulation is represented by,

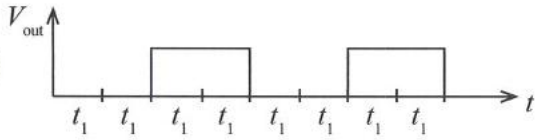
(1) A only. (2) A and B only. (3) A and C only.
(4) B and C only. (5) A, B and C all.

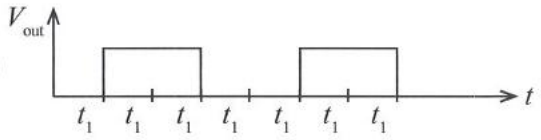
[See page nine

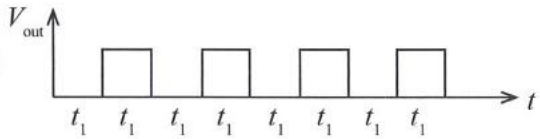
36. The figure shows a digital electronic circuit which consists of two D type flip-flops.

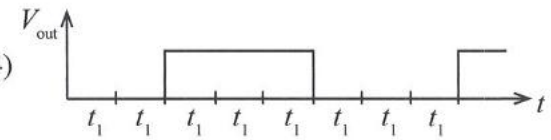


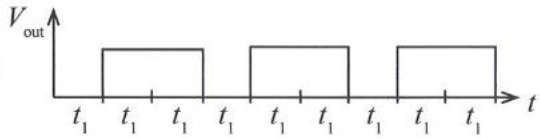
What is the figure that best represents the Q_2 output signal, if $Q_1 = 1$ and $Q_2 = 0$ at the start?

(1)


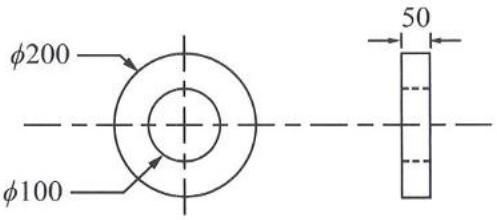
(2)


(3)


(4)


(5)


37. In order to manufacture a wheel with the dimensions shown in the figure, a cylindrical mild steel workpiece of diameter 300 mm and thickness 40 mm has been supplied.



(All dimensions are in millimetres)

What is the manufacturing process that can be used in order to make this wheel?

(1) hot forging → facing → simple turning → drilling → grinding
(2) drilling → hot forging → facing → simple turning → grinding
(3) hot forging → extruding → simple turning → drilling → grinding
(4) extruding → facing → simple turning → drilling → grinding
(5) shaping → facing → simple turning → boring → grinding

[*See page ten*

38. What is the material properties/manufacturing method associated with the given manufacturing process?

(1) Forging ↔ Malleability
Casting ↔ Melting point
Permanent joint ↔ Welding

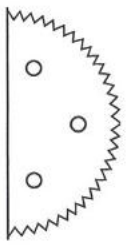
(2) Forging ↔ Toughness
Casting ↔ Malleability
Permanent joint ↔ Soldering

(3) Forging ↔ Ductility
Casting ↔ Malleability
Permanent joint ↔ Riveting

(4) Forging ↔ Plasticity
Casting ↔ Elasticity
Permanent joint ↔ Soldering

(5) Forging ↔ Elasticity
Casting ↔ Melting point
Permanent joint ↔ Welding

39. The figure shows a blade of a coconut scraper with sharp teeth made of sheet steel. In order to make them in large quantities using forming, a 10 mm thick die needs to be made. The manufacturing machine that is most suitable to make this die is,



(1) CNC electro-discharge machine (EDM).
(2) CNC lathe machine.
(3) CNC punch press.
(4) CNC milling machine.
(5) CNC grinding machine.

40. Which is **not** lubricated by the motor vehicle lubrication system?
(1) Piston (2) Camshaft (3) Spark plug (4) Crankshaft (5) Rocker arm

41. Which component gets directly engaged with the pinion of the starter motor when starting a motor vehicle?
(1) Solenoid (2) Battery (3) Alternator (4) Drive belt (5) Flywheel

42. In a four-stroke engine, valve overlap occurs when the piston is,
(1) leaving the top dead center in the suction stroke.
(2) reaching the bottom dead center in the suction stroke.
(3) changing between the compression stroke and the power stroke.
(4) leaving the bottom dead center in the exhaust stroke.
(5) reaching the top dead center in the exhaust stroke.

43. Consider the following statements regarding safety strategies used in motor vehicles.

A - Front of the vehicle being covered by a windscreen.
B - Inside of the vehicle being well-illuminated when driving at night.
C - Doors being fixed on both left and right sides of the body of the buses seen in Sri Lanka.

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

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

44. Consider the following statements regarding hybrid vehicles.

A - Instead of an internal combustion engine, a special electric motor is used as the power source.
B - An electric motor is used to start the vehicle.
C - A high-voltage battery pack made of Nickel-Metal Hydride (NiMH) or Lithium-ion (Li-ion) cells is used to store energy.

Out of the above statements, the correct statement/statements 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.

[*See page eleven*

45. What is the component that is used to store energy in mechanical systems?
(1) Flywheel (2) Clutch (3) Ratchet (4) Coupling (5) Bearing

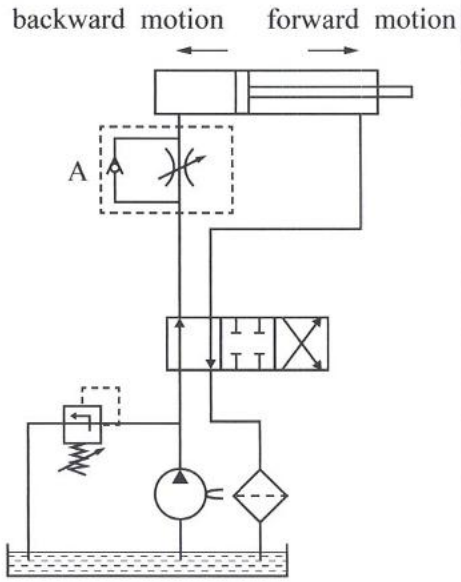
46. Power transmission strategy that can accomplish the highest torque translation in a single stage is, the
(1) belt drive. (2) chain drive.
(3) spur gear drive. (4) helical gear drive.
(5) worm and wheel drive.

47. Consider the following statements regarding fluids and components used in fluid machinery.

A - Fluids can be used for power transmission.
B - Safety valves are used to maintain the pressure needed for the operation of fluid machinery.
C - In a venturi, the pressure increases when the cross-sectional area reduces.

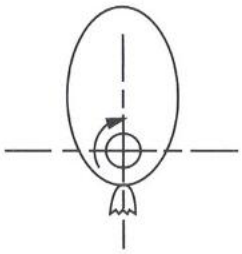
Out of the above statements, the correct statement/statements is/are,
(1) A only. (2) A and B only. (3) A and C only.
(4) B and C only. (5) A, B and C all.

48. In the given fluid power transmission system, the role of the component shown by A within dashed lines is,
(1) ensuring the safety of the piston.
(2) controlling the speed of the forward motion of the piston.
(3) controlling the speed of the backward motion of the piston.
(4) controlling the speed of the forward and backward motions of the piston.
(5) controlling the pressure within the cylinder.

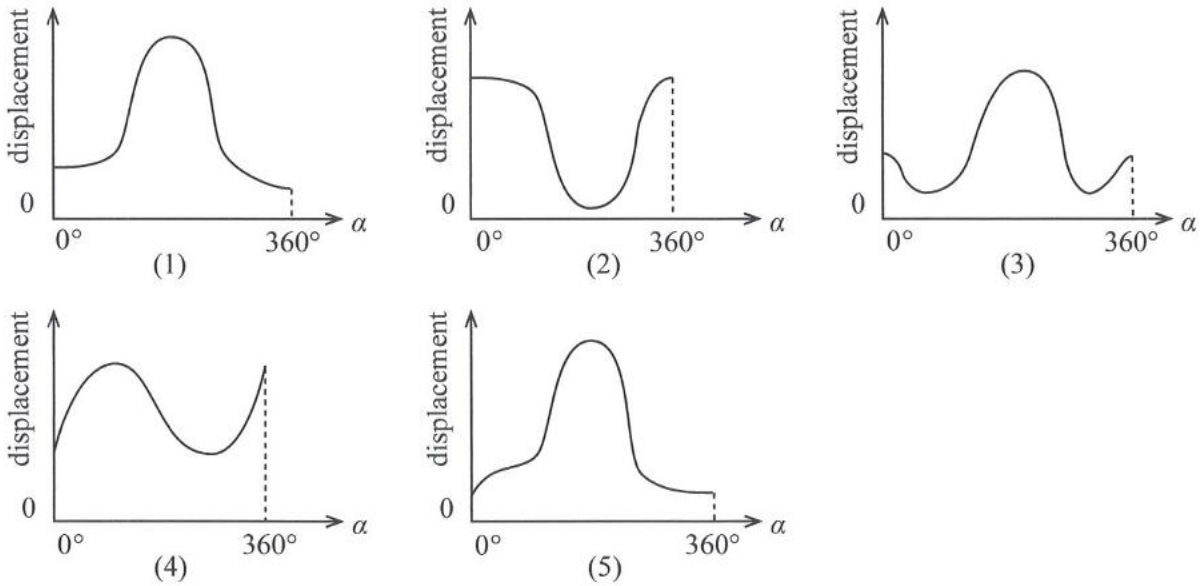


[See page twelve

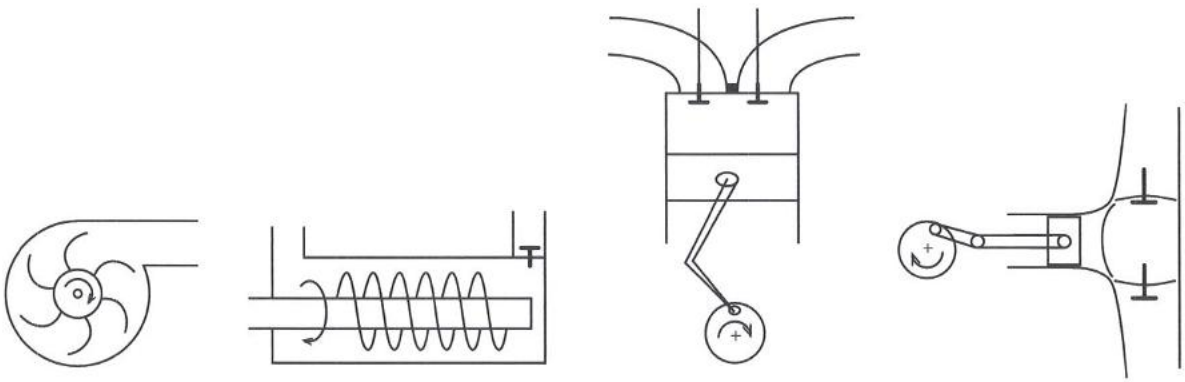
49. The figure shows a cam that is used to displace a component in a mechanism.



What is the graph that shows the corresponding displacement of the machine part relevant to the cam, when the cam rotates one complete revolution?



50. Following figures show four commonly used pump types in the industrial sector.



What is the correct statement regarding the pump types shown in above figures?

(1) A, B, C and D all are reciprocating compressors.
(2) A and B are rotary compressors while C and D are reciprocating compressors.
(3) A and B are used to compress air while C and D are used to compress liquids.
(4) A and B are used to compress liquids while C and D are used to compress air.
(5) A, B, C and D all are rotary compressors.

* * *

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

ඉංජිනේරු තාක්ෂණවේදය II பொறியியற் தொழினுட்பவியல் II **Engineering Technology II**	**65 E II**

පැය තුනයි மூன்று மணித்தியாலம் ***Three hours***	අමතර කියවීම් කාලය - මිනිත්තු 10 යි மேலதிக வாசிப்பு நேரம் - 10 நிமிடங்கள் **Additional Reading Time - 10 minutes**

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will prioritise.

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 non-programmable calculators is allowed.***

PART A — Structured Essay :
(pages 2 - 8)

*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 9 - 14)

*Essay question paper contains **six** questions, Answer **four** questions only selecting at least one question from each part. Use the papers supplied for this purpose.*

*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		

Total

In numbers	
In words	

Code Number and Signature

Marking Examiner 1	
Marking Examiner 2	
Marks checked by	
Supervised by	

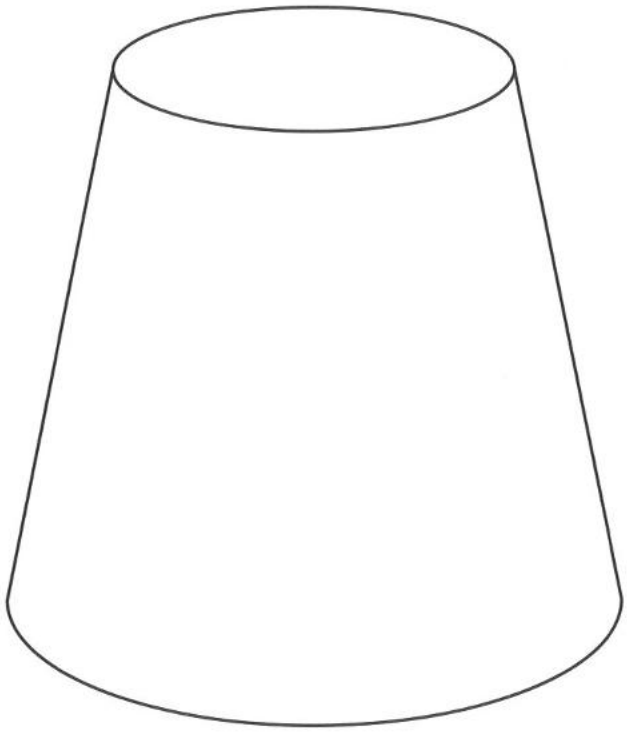
[see page two

PART A — Structured Essay

*Answer **all four** questions on **this question paper itself**.*
*(Marks allocated for each question is **75**.)*

Do not write in this column

1. Shown below is a three dimensional technical drawing of a top and bottom-less truncated cone made of 1 mm thick galvanized steel sheet. The first steps required to draw the development of this cone are shown in the grid sheet. To fabricate the above truncated cone according to the dimensions denoted in the front elevation, draw the plan and the development on the grid sheet, using the geometric instrument set. The scale to be used is 1:1. On the given grid sheet, consider one small square is 5 mm × 5 mm. Use the center point *O* to draw the plan. Divide the circumference of the plan into 12 equal parts. Use the reference line *EZ* to draw the development. All dimensions are in millimetres. Ignore the bending allowances and bond allowances.



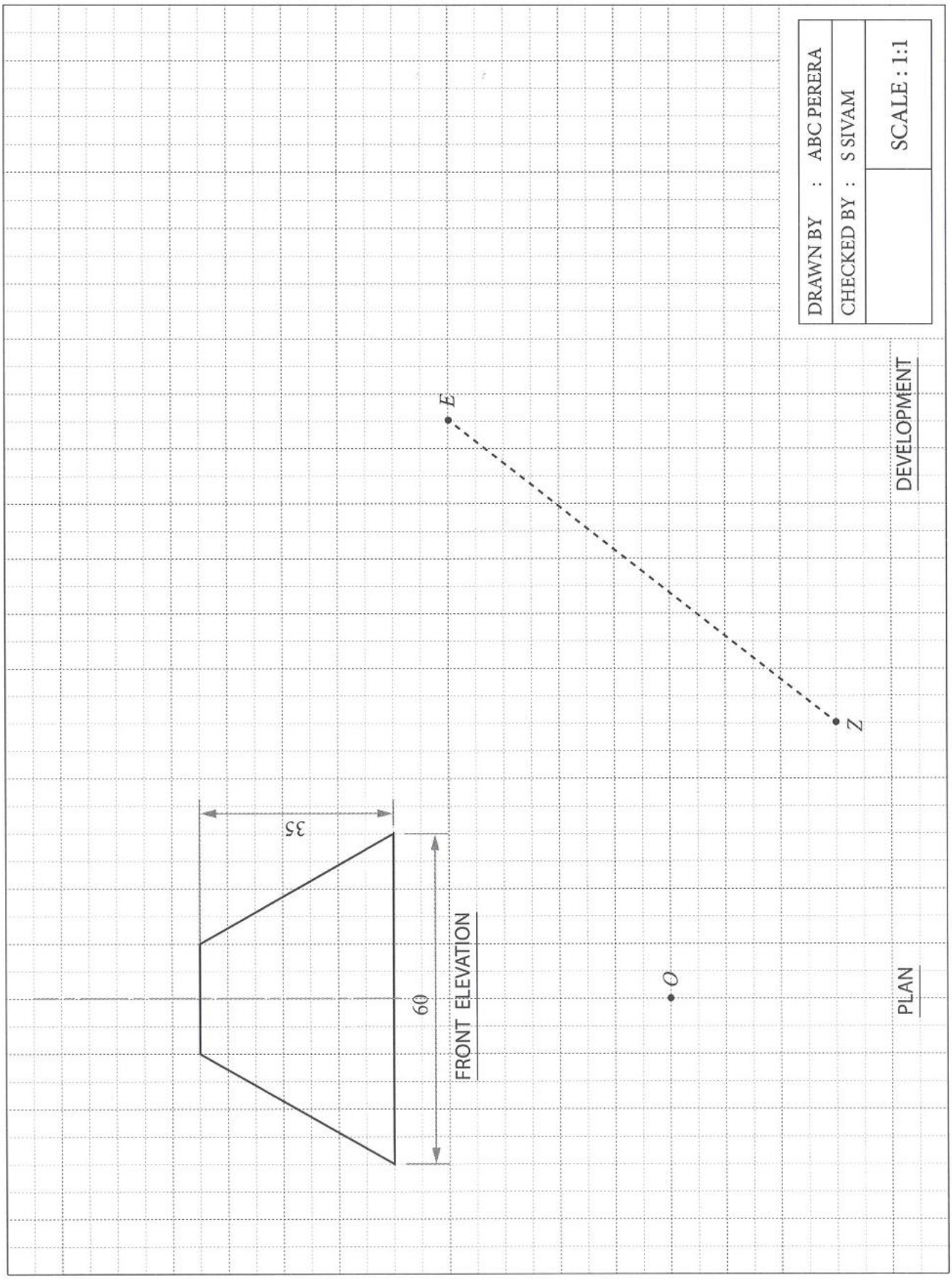
(This figure is not drawn to scale)

Q. 1

75

(75 *marks*)

[*see page three*



[see page four

Do not write in this column

2. In a factory, the cold room is operated by a vapour compression refrigerator system.

(*a*) (i) Mention the function of the condenser of a vapour compression refrigerator system.

.....

.....

(05 *marks*)

(ii) The compressors being used in vapour compression refrigerators are categorised as hermetic, semi-hermetic, and open types. Out of these, state in brief how hermatic and open types can be identified.

(1) Hermatic : .....

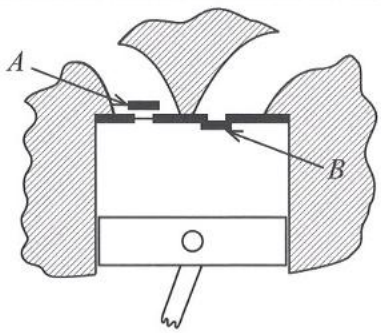
.....

(2) Open : .....

.....

(05 × 2 = 10 *marks*)

(iii) This refrigerator system has a reciprocating type compressor. A rough cross-sectional sketch of such a compressor is shown below. Mention the functions of *A* and *B* valves in this.



A : .....

.....

B : .....

.....

(05 × 2 = 10 *marks*)

(iv) It is required to rotate the crank shaft of this compressor at 800 revolutions per minute. For this, a 2 kW single phase electric motor rotating at 3 600 revolutions per minute is being deployed. The motor and the crank shaft are coupled using a 'V' belt drive. Calculate the mechanical advantage of this drive.

.....

.....

.....

(10 *marks*)

(v) If the power loss due to the belt drive mentioned in (iv) above is 5%, calculate the power transmitted to the compressor.

.....

.....

(10 *marks*)

(vi) Mention the main reason for power loss in a fault-free belt drive.

.....

(05 *marks*)

[*see page five*

Do not write in this column

(*b*) (i) The single phase motor present in (*a*)(iv) above is a capacitor start capacitor run induction motor. How should these capacitors be connected at the start of the motor?

.....

(05 *marks*)

(ii) The capacitance of the starting capacitor of this motor is 100 μF. If the motor is connected to a 230 V, 50 Hz alternating current supply, calculate the capacitive reactance of this capacitor.

.....

.....

(05 *marks*)

(iii) Mention an advantage of using a starting capacitor in this motor.

.....

(05 *marks*)

(iv) Mention **two** impacts, if the starting capacitor of this motor does **not** get disconnected after this motor reaches a certain rotational speed.

(1) .....

(2) .....

(05 × 2 = 10 *marks*)

Q. 2

75

3. It is proposed to construct a 15 m × 8 m single storeyed hall with a double roof to practise dancing in an Arts Centre. It has been agreed to add traditional features by using wood for the columns and the roof of this hall.

(*a*) Even though a 'couple roof' was requested by the administration of the Arts Centre, the engineer has given approval to build it as a 'trussed roof'.

(i) Mention a reason for the engineer to **not** recommend the 'couple roof'.

.....

(05 *marks*)

(ii) What is the type of load acting on the lowest element of the trussed roof, when loads are borne by the roof?

.....

(05 *marks*)

(iii) Sketch a trussed roof suitable for the above roof and indicate on it how its load acts on the lowest element. (It is not necessary to draw to scale.)

(15 *marks*)

[*see page six*

Do not write in this column

(*b*) This roof needs 1 500 roof tiles. The mass of one roof tile is 2 kg. If the angle of the roof to the horizontal is 30°, calculate the total force exerted by the tiles along the roof. (Consider the gravitational acceleration as 10 m s^{-2}.)

.....

.....

(10 *marks*)

(*c*) The land which is used to build the above proposed hall was surveyed using a closed traverse.

(i) Mention an instrument related error that can exist when measuring angles in this closed traverse.

.....

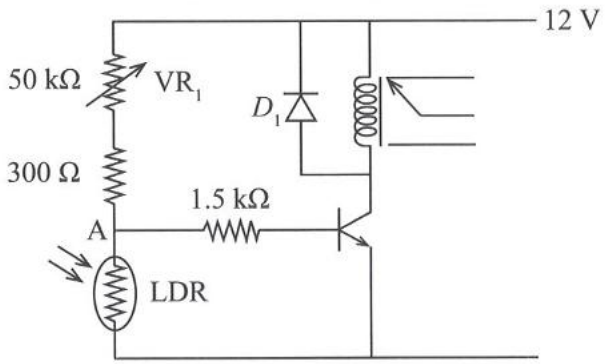
(05 *marks*)

(ii) Mention an advantage of employing a closed traverse for the above surveying process.

.....

(05 *marks*)

(*d*) In order to fix an electric bulb in the above Arts Centre, which should light up only during the night, the following circuit was proposed.



The resistance of the LDR used here decreases as the light intensity increases.

(i) Briefly describe the operation of the transistor when the resistance VR_1 is gradually adjusted to a high value from a low value.

.....

.....

(05 *marks*)

(ii) Mention the function of the 1.5 kΩ resistor.

.....

(05 *marks*)

(iii) Mention the function of the diode D_1.

.....

(05 *marks*)

(iv) Mention the importance of the 300 Ω resistor.

.....

(05 *marks*)

(v) Taking $V_A = 6$ V and $V_{BE} = 0.8$ V, calculate the base current (I_B).

.....

.....

(10 *marks*)

Q. 3

75

[*see page seven*

Do not write in this column

4. Four students who followed engineering technology have decided to start an instant food processing business together. After a market survey, they have taken steps to establish this business close to a town, having parking space for 10 motor vehicles at a time, facing a main road, and naming it as 'Lanka Bojun'.

(*a*) (i) According to the steps taken to establish the business as above, how could be the expected characteristics of its customers according to the categories mentioned below?

(1) Ability to purchase goods and services : .....
.....

(2) Social status : .....
.....

(05 × 2 = 10 *marks*)

(ii) Mention **two** advantages of starting these types of businesses, to the economy of the country.

(1) .....

(2) .....

(05 × 2 = 10 *marks*)

(iii) It is important to adhere to HACCP standard certification when operating these kinds of food processing organizations. State an advantage it brings about to the organization.

.....

(05 *marks*)

(iv) When maintaining this kind of businesses, they should adhere to the Factories Ordinance of 1942 No. 45. Mention an advantage it brings about to the employees.

.....

(05 *marks*)

(*b*) (i) Mention **two** advantages that can be obtained by this business by registering the brand name.

(1) .....

(2) .....

(05 × 2 = 10 *marks*)

(ii) Mention **three** advantages that can be obtained by insuring this business.

(1) .....

(2) .....

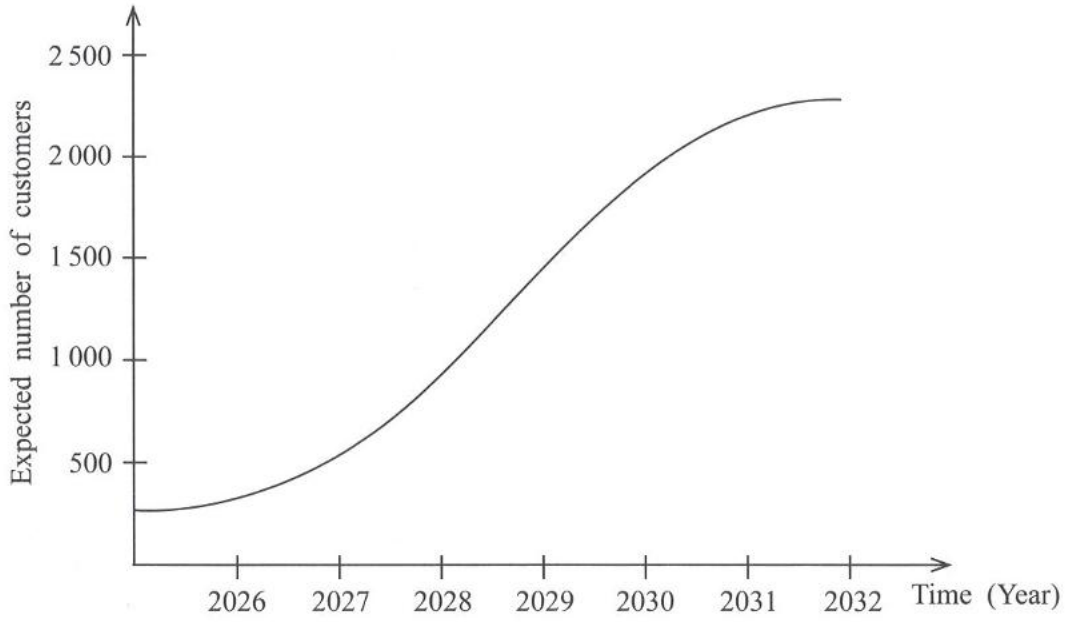
(3) .....

(05 × 3 = 15 *marks*)

[*see page eight*

Do not write in this column

(*c*) (i) It is planned to open a new branch when the number of customers coming per day for this food processing business exceeds the 2 000 limit. The expected number of customers for this business is graphically recorded as shown below during its market analysis. Determine the expected time to start the new branch using the data given in the graph.



.....

(10 *marks*)

(ii) Write **two** negative factors outside the control of the entrepreneurs, which can affect towards reduction of the number of expected customers shown in (*c*) (i) above.

(1) .....

(2) .....

(05 × 2 = 10 *marks*)

Q. 4

75

* *

[*see page nine*

625

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2025
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2025
General Certificate of Education (Adv. Level) Examination, 2025

ඉංජිනේරු තාක්ෂණවේදය II
பொறியியற் தொழினுட்பவியல் II
Engineering Technology II

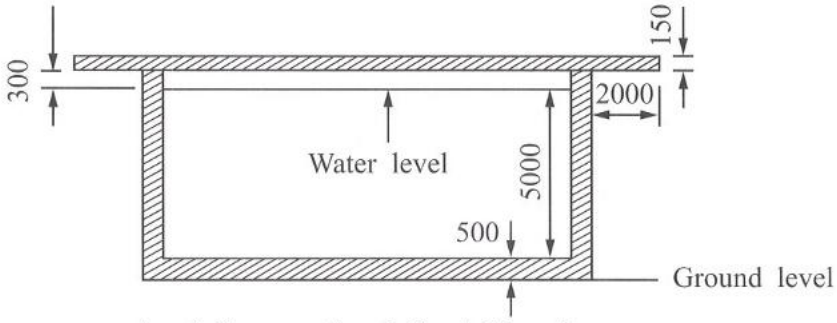
65 E II

Instructions:

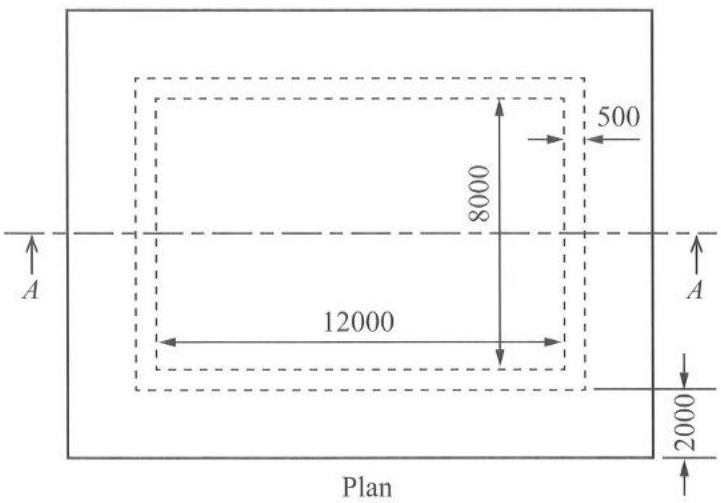
* *Answer* ***four*** *questions only selecting at least* ***one*** *question each from parts* **B**, **C** *and* **D**.
* *Marks allocated for each question is* **100**.

Part B - Essay (Civil Technology)

5. A cross-section and the plan of a water storage tank constructed on an elevated land for a community water distribution project in a rural area are shown below. The thickness of its side walls and bottom is 500 mm and the thickness of the lid is 150 mm. In this tank, water is filled up to its maximum limit of 5000 mm. Consider that the density of water is 1000 kg m^{-3}, gravitational acceleration is 10 m s^{-2} and the unit weight of reinforced concrete is 25 kN m^{-3}. Following diagrams are not drawn to scale.



$A - A$ Cross-sectional Front Elevation



Plan

(all dimensions are in millimetres)

(*a*) (i) Take quantities according to SLS 573 for the required concrete for this water storage tank. (40 *marks*)

(ii) Calculate the force exerted from this tank on a 1 m^2 of the ground where it is located when it is filled to its maximum limit as illustrated above. (20 marks)

[*see page ten*

(*b*) Illustrate by drawing a cross section, how the tension reinforcements must be employed in a wall of this water tank. (10 *marks*)

(*c*) (i) If the daily per capita water consumption is 120 *l*, calculate the maximum number of consumers to which water can be provided by this water tank. (10 *marks*)

(ii) When the water is supplied under gravity, the water pressure for the farthest water consumer of this tank must be 150 kN m^{-2}. For this, calculate the minimum vertical height that needs to be maintained between the bottom of the water tank and the farthest water consumer location. Assume that any energy loss do not occur during transmission of water. (20 *marks*)

6. In a particular office, the number of workers working during the day time is 250 and the number of workers working during the night time is 25. This office provides services to 1500 customers a day.

(*a*) The mean quantities of human sewage discharge per person per day in this office is given in the table below.

Category	Mean human sewage discharge per person, per day (*l*)
Night time workers	50
Day time workers	30
Customers	5

(i) Calculate the expected total human sewage discharge per day in this office. (20 *marks*)

(ii) The minimum and maximum capacities of a septic tank is respectively 1 m^3 and 12 m^3. If the duration for complete digestion of sewage discharge in the septic tank is two days, calculate the minimum number of septic tanks required for this office. (20 *marks*)

(*b*) Explain how the solid waste generated in the above office can be managed using **two** technological facts. (10 *marks*)

(*c*) The following is a part of a table that includes the readings taken during the levelling process of the access road to this office, to draw its longitudinal section.

Level station	Back Sight reading	Intermediate Sight reading	Fore Sight reading	Remarks
1	0.82			0+000
2		1.03		0+020
3		1.21		0+040
4	2.04		1.05	0+060
5		2.15		0+080
6		2.19		0+100
7	0.53		2.15	0+120
8			0.42	0+140

(i) Calculate the reduced level of all levelled stations using a table prepared according to the rise-fall method. Consider that the reduced level at station 0+000 is 100.00 m.(30 *marks*)

(ii) Explain how the arithmetic errors occurred during the above process are identified. (10 *marks*)

(iii) Describe **two** strategies that are used to minimize human errors during a levelling process. (10 *marks*)

[see page eleven

Part C - Essay (Electrical and Electronic Technology)

7. It is needed to install a new three-phase industrial heater and a three-phase induction motor for a factory. You, as an engineering technologist working in that factory, have been instructed to select the required miniature circuit breakers for this. The data pertinent to these two loads are given below.

ELECTRIC HEATER

Serial No. XW241900563

Model	LS-W6-WIQH-M
Power Supply	415 V~, 50 Hz
Rated Power	18 kW
Made in Sri Lanka	

Intk
3189533
Conforms to UL STD. 1278
Certified to CSA STD. C22.2 NO. 46

ABC ELECTRIC CO.,LTD

ABC

ORD.NO.	1LA02864SE41		IEC 60034 - 1 IS:REF 325		
DUTY	S1	IP 55	DATE	2025	SL.NO 2148
hp	7.5	VOLT 415 △	COOLING	IC611	P.F 0.9
AMP	52	ENCL ODP	PH	3	WEIGHT 140 Kg
RPM	1500	Hz 50	KVA CODE	G	
FRAME	286T	EFF 95 %	POLE	4	
CLASS INSUL	F	AMB. 50° C	SERVICE FACTOR	1.15	
GREASE : UNIREX - N3 RELUB Hrs. 5800		GREASE QTY	DE 90 Grm NDE 70 Grm	BRG :	DE 6312 ZZ NDE 6312ZZ

Made in Sri Lanka **AC Induction Motor** CE

(*a*) (i) If the industrial heater can be considered as a pure resistor, what is the power factor of it? (05 *marks*)

(ii) When only the industrial heater is connected to the supply, calculate the current passing through one phase conductor. (15 *marks*)

(*b*) (i) Relating to technological reasons, explain why a three-phase induction motor always operate with a slip. (30 *marks*)

(ii) When only the induction motor is connected to the supply, calculate the magnitude and phase angle of the current passing through one phase conductor. (1 hp = 746 W)(15 *marks*)

(iii) It was observed that this induction motor rotates in the counter clockwise direction when it is connected to the supply. Briefly explain using a diagram how the rotational direction of this motor can be made clockwise. (10 *marks*)

(*c*) When both loads are connected to the supply, calculate the magnitude of the total current passing through one phase conductor. (15 *marks*)

(*d*) Select the most suitable miniature circuit breakers to be used separately with the above industrial heater and the induction motor from the data given in the below table.

Rated voltage	3 pole – 415 V AC	1 pole – 240/415 V AC	4 pole – 415 V AC
Rated current (A)	6, 10, 16, 20, 25, 32, 40, 63	2, 6, 10, 16, 20, 25, 32, 40, 63	6, 10, 16, 20, 25, 32, 40, 63

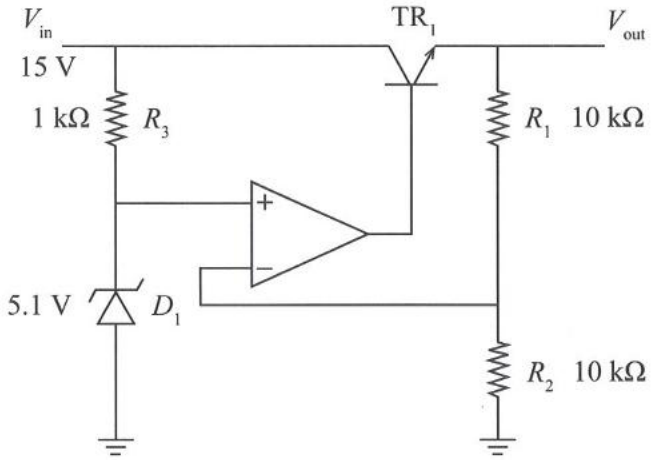
(10 *marks*)

[*see page twelve*

8. (*a*) (i) Draw the circuit diagram of a full-wave rectified, non-regulated, direct current, single power supply using a transformer. (10 *marks*)

(ii) When the load connected to the above circuit increases, it was observed that the output voltage ripples are increasing. What is the action that can be taken to minimise these ripples? (10 *marks*)

(*b*) It was proposed to use the circuit given below to stabilize the output voltage of the circuit in (*a*) above.



In this circuit,

(i) Explain the operation of the operational amplifier in relation to the above circuit. (05 *marks*)

(ii) What is the voltage of the non-inverting terminal of the operational amplifier? (05 *marks*)

(iii) Calculate the current across the Zener diode D_1. (10 *marks*)

(iv) What is the voltage across the resistor R_2? (05 *marks*)

(v) Calculate the voltage V_{out}. (10 *marks*)

(vi) Calculate the voltage V_{CE}. (10 *marks*)

(vii) What is the operating region of transistor TR_1? (05 *marks*)

(viii) Calculate the current I_E of TR_1 when a load is **not** connected. (10 *marks*)

(ix) Calculate the current I_B of TR_1 if current gain $\beta = 100$. (10 *marks*)

(x) Calculate the voltage V_{out} when the resistance of R_1 is increased to 12 kΩ. (10 *marks*)

[*see page thirteen*

Part D - Essay (Mechanical Technology)

9. (*a*) In a vehicle with a compression ignition engine, in order to keep the operation of the fuel supply system, the fuel filter is extremely important.

(i) Mention the type of fuel that is most commonly used in compression ignition engines. (05 *marks*)

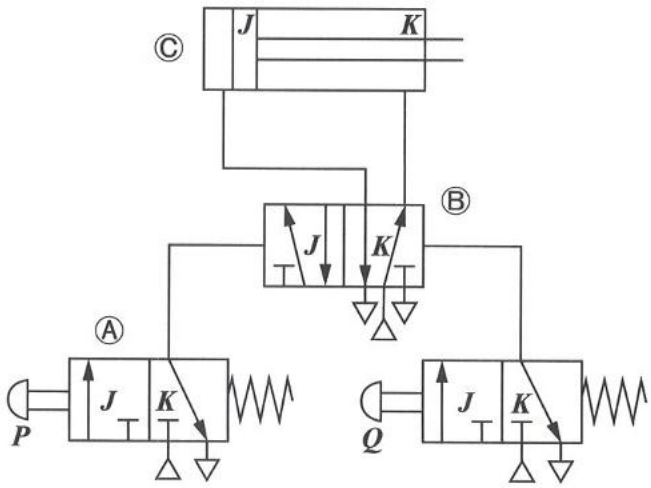
(ii) Explain how the water droplets, mixed with the fuel is evicted using the filter. (20 *marks*)

(iii) Apart from water droplets mention a matter evicted using the filter. (05 *marks*)

(iv) Giving reasons, explain a damage that can be caused to the fuel injector when the material mentioned in (iii) above is not correctly filtered. (10 *marks*)

(v) On the instrument panel of the motor vehicle, a fault notice stating 'water in the fuel filter' appeared suddenly. Mention **two** technological measures that must be taken to rectify this fault. (10 *marks*)

(*b*) A circuit diagram of a pneumatic system is shown below. Ⓐ, Ⓑ and Ⓒ are its components and ***J*** and ***K*** represent their positions. ***P*** and ***Q*** are push buttons.



(i) With the aid of the above circuit diagram, mention how the above system can be identified as a pneumatic power system. (05 *marks*)

(ii) Name the components depicted by Ⓐ, Ⓑ and Ⓒ above. (15 *marks*)

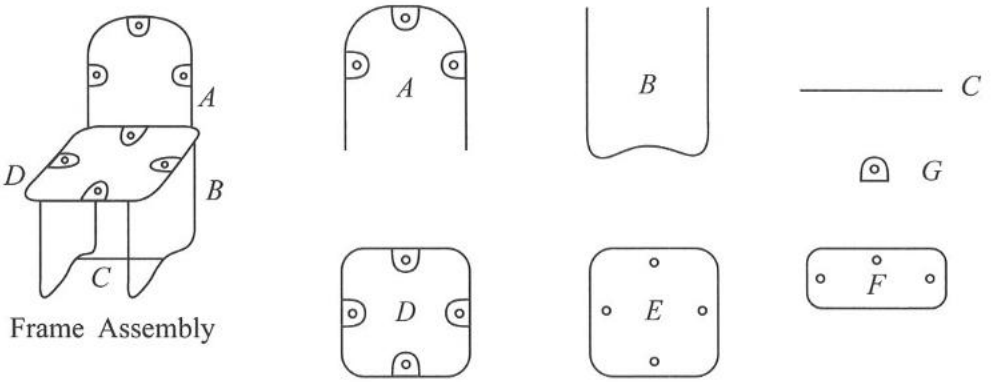
(iii) Explain the operation of the system when the button *P* is pressed and released in component Ⓐ. (20 *marks*)

(iv) What should be done to bring the system back to its previous status? (05 *marks*)

(v) Briefly describe a situation where the system which operates as shown by the phneumatic circuit above is practically employed. (05 *marks*)

[*see page fourteen*

10. (*a*) You have received an order to manufacture and supply 10 000 chairs for schools. As shown in the figure, '*E*' is the wooden platform to sit on and '*F*' is the wooden backrest. '*A*', '*B*', '*C*', '*D*' is a frame that is made using 8 mm mild steel wire. '*G*' represents mild steel plate bracket pieces that must be fixed at the required locations of the frames. One chair requires seven pieces of '*G*' as shown in the '*A*', '*B*', '*C*', '*D*' frame assembly.



As shown in the figure, for a chair, one component of '*A*', two components of '*B*', one component of '*C*', one component of '*D*', one component of '*E*', and one component of '*F*' are needed.

(i) Describe how one component of '*A*' is manufactured. (20 *marks*)

(ii) Describe the procedure to manufacture 10 000 units of component '*A*' maintaining the quality and uniformity of the chair. (30 *marks*)

(iii) Describe the manufacturing process that can be used to assemble 10 000 frames made of the above '*A*', '*B*', '*C*', '*D*' components. (10 *marks*)

(iv) Describe the manufacturing process that is needed to assemble the components '*E*' and '*F*' to the above '*A*', '*B*', '*C*', '*D*' frame assembly intact with '*G*' bracket pieces. (10 *marks*)

(*b*) In the above manufacturing process, describe **three** steps that can be taken to ensure personal safety based on unique ergonomic factors. (30 *marks*)

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