AL/2015/65/E-I

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

අධ්‍යයන පොදු සහතික පත්‍ර (උසස් පෙළ) විභාගය, 2015 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2015 ஓகஸ்ற
General Certificate of Education (Adv. Level) Examination, August 2015

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.
* 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 questions carries **03** marks totalling to **150**.
  Use of calculators is **not** allowed.

1. In using a steel ruler graduated in millimetres, for measuring lengths, the nearest value for taking a reading should be,
   (1) 1 mm.   (2) 0.5 mm.   (3) 0.25 mm.   (4) 0.1 mm.   (5) 0.05 mm.

2. A certain length measured using a meter rod was 5 m. Later, it was found that the real length of the meter rod was 0.05 m shorter. Accordingly, the real length of the measured length is,
   (1) 4.75 m.   (2) 4.95 m.   (3) 5.00 m.   (4) 5.05 m.   (5) 5.25 m.

3. The correct views of the following isometric object, if viewed from the directions of arrow A and arrow B respectively are (Diagrams are not to scale.),
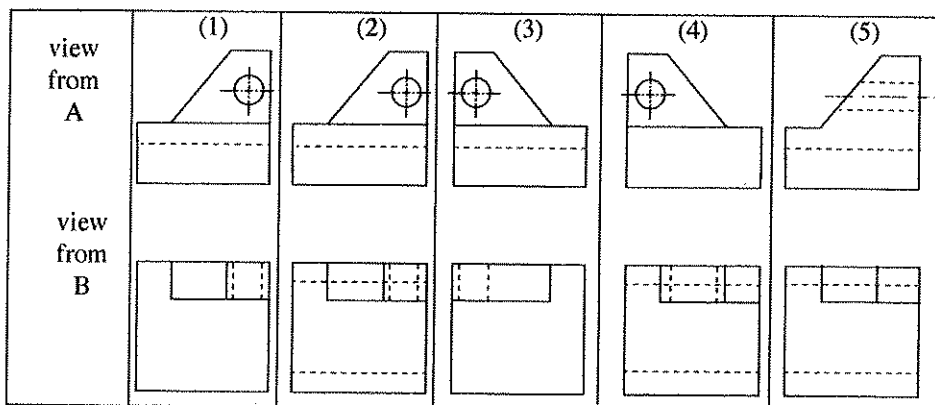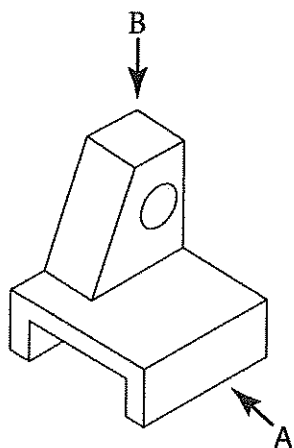
4. The strength of the arc in electric arc welding is controlled by
   (1) changing the type of welding rod.
   (2) changing the gap between the weldment and the rod.
   (3) changing the current supplied to the welding plant.
   (4) changing the voltage supplied to the welding plant.
   (5) applying lubricating oil on the weldment.

5. Which of the following is **not** a result of the technological development that took place during the period of industrial revolution?
   (1) Introducing machines to manual industries.
   (2) Mechanisation of land transportation.
   (3) Beginning to use charcoal as a fuel for machines.
   (4) Start of air transportation.
   (5) Utilisation of energy in water and steam.

6. When there is no agreement regarding sharing of profit among the partners, the profit of a partnership business should be shared according to,
   (1) the capital ratio prevailing at the time of profit distribution.
   (2) the ratio of capital invested by active partners.
   (3) equal ratio for all partners.
   (4) the ratio of capital invested by founder partners.
   (5) the ratio of contribution by each partner to earn profit.

7. Nimal is a small scale entrepreneur who manufactures exercise books. The graph shows the behaviour of demand curve (D) and supply curve (S) for his exercise books. A student has presented the following reasons for the shifting of D_0 curve to D_1.
   A. Increasing the price of Nimal's exercise books.
   B. Increase in the population of school children.
   C. Decrease in the income of Nimal's customers.
   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.
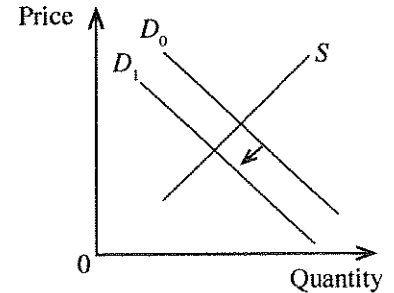
8. The following readings were taken from a levelling procedure. (All readings are in metres)

Level Station	Backsight Reading	Intermediate Sight Reading	Foresight Reading
1	2.41		
2		1.58	
3			2.67

   If the reduced level of the third level station is 52.63 m, then the reduced level of the first station is,
   (1) 51.54 m   (2) 52.37 m   (3) 52.89 m   (4) 53.46 m   (5) 53.72 m

9. When a pentagonal theodolite traverse was drawn in 1:1000 scale, the final error was 0.12 mm. If this error is distributed among the survey stations using the graphical method, by how much would the third survey station be shifted?
   (1) 0.024 mm   (2) 0.048 mm   (3) 0.072 mm   (4) 0.096 mm   (5) 0.120 mm

10. Which of the following is **not** a decision in a reconnaissance survey for a chain surveying work?
    (1) The number of survey stations.
    (2) The locations of survey lines.
    (3) The instruments required for the survey.
    (4) The methods to be used to collect the measurements for ground features.
    (5) The number of triangles used.

11. The following statements have been made by a student regarding the selection of main survey line (Base line) for a chain survey.
    A. It should be possible to measure the horizontal length of the line directly.
    B. All the triangles should be well-conditioned triangles.
    C. It should be possible to take many measurements for geographical features.
    D. It has to go close to a boundary of the land to be surveyed.
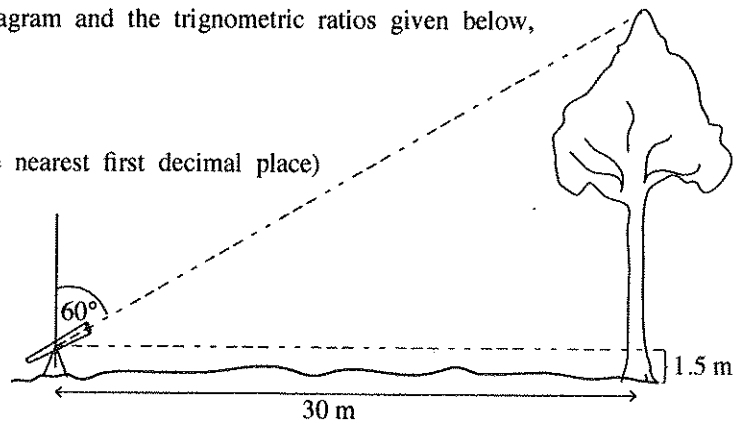   Of the above, the correct statements are
    (1) A and B only.   (2) A and D only.   (3) B and C only.
    (4) B and D only.   (5) C and D only.

12. Using the measurements given in the diagram and the trignometric ratios given below, determine the height of the tree.

Sin 60° = 0.9
Cos 60° = 0.5
Tan 60° = 1.7   (Rounded off to the nearest first decimal place)

60°

1.5 m

30 m

(1) 17.6 m   (2) 19.1 m   (3) 31.5 m   (4) 34.8 m   (5) 61.5 m

13. Some objectives of using wall finishes of a building are given below.
    A. To provide a smooth finish for the walls.
    B. To increase the strength of the wall.
    C. To cover up the errors occurred during the construction of the wall.
    D. To give a safer surface.
    Of the above, the correct objectives are,
    (1) A and B only   (2) B and C only   (3) C and D only
    (4) A and D only   (5) B and D only

14. In the diagram, the 'X' is a,
    (1) Hip rafter
    (2) Purlin
    (3) Common rafter
    (4) Jack rafter
    (5) Valley rafter

Ridge plate →

X

Wall plate →
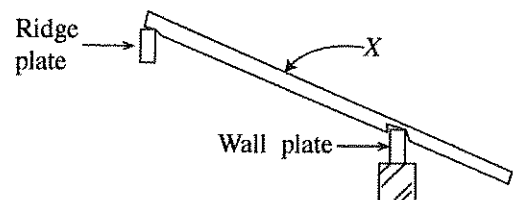
15. Out of the brick bonds shown below select the figure which shows the front elevation of a stretcher bond.

(1)   (2)   (3)

(4)   (5)
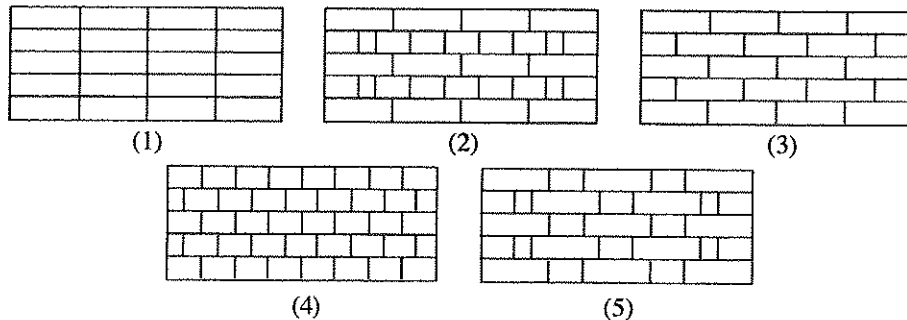
16. A longitudinal section of a reinforced concrete column is shown in the figure.
    A and B in the figure respectively, are
    (1) Lap, Clear cover
    (2) Clear cover, Lap
    (3) Stirrups, Main reinforcement
    (4) Main reinforcement, Stirrups
    (5) Stirrups, Lap

A →
B
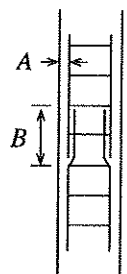
17. A feature that should be present in a brick wall constructed using an English bond is that,
    (1) the lap is quarter of a brick.
    (2) every course should end up with half a brick.
    (3) vertical joints must be aligned.
    (4) a queen closer should be placed at the header course.
    (5) minimum width of the wall should be half a brick.

18. Out of the following which figure shows the correct arrangement of reinforcement for tensile loads?

       (1)   (2)   (3)   (4)   (5)
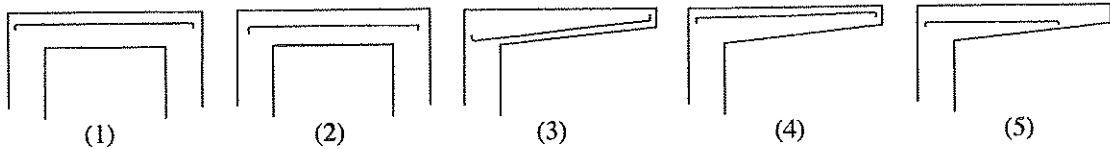
19. Several identified work items and their units of measurement are given below for preparing bill of quantities.
     A. Excavate foundation trenches   - Square meter
     B. Laying concrete for the foundation   - Square meter
     C. Construct brick wall   - Square meter
     D. Plastering walls   - Square meter
     Of the above, the correct units of measurement in accordance with SLS 573: 1999 standard are,
     (1) A and B   (2) A and C   (3) A and D   (4) B and C   (5) C and D

20. Select the correct statement regarding a waste disposal system.
     (1) A manhole is used when changing the direction of drain line.
     (2) The drain line always connects to the public sewerage.
     (3) The drain line always connects to a septic tank.
     (4) Separate drain lines should be provided for water bound waste and toilet waste.
     (5) Water traps or gulley traps should be placed at appropriate intervals of the drain line.

21. The elements considered in calculating the "all-in rates of material" to determine the unit cost of work items in a bill of quantity are,
     (1) Material cost, transport cost, wastage and unloading cost.
     (2) Material cost, transport cost, wastage and storage cost.
     (3) Material cost, transport cost, loading, unloading and storage cost.
     (4) Material cost, wastage, transport cost, loading and storage cost.
     (5) Material cost, wastage, loading, unloading and storage cost.

22. Distance between the soakage pit and the well in a household is stated as,
     (1) a regulation of a road line.   (2) a regulation of a lighting angle.
     (3) a regulation of drainage systems.   (4) a regulation of local government.
     (5) a regulation related to bank loans.

23. The standard colour used to indicate a carbon dioxide fire extinguisher is,
     (1) Red   (2) Yellow   (3) Black   (4) Blue   (5) Green

24. When a blunt mammoty blade is taken to the blacksmith for sharpening,
     A. The blacksmith heats up the mammoty initially to decrease its strength.
     B. The blacksmith is able to deform the mammoty because of the increase in malleability at high temperatures.
     C. After sharpening the mammoty, it is again heated up and quenched in water to increase its hardness.
     D. Once the sharpness and hardness are achieved the sharpness deteriorates in a short time.
     Of the above, the correct statement/s is/are,
     (1) A only.   (2) B only.   (3) A and D only.
     (4) B and C only.   (5) B, C and D only.

25. It is required to produce a cube using a 1 mm thick mild steel sheet with the least amount of weldments. What has to be done first?
     (1) Cut six pieces of square sections as necessary from the sheet.
     (2) Cut a segment of sheet metal adequate for cutting pieces.
     (3) Draw a plan.
     (4) Check whether the sheet of metal is sufficient.
     (5) Check how much sheet metal will be wasted.

26. The most suitable method of assembling a cabinet which is to be made using aluminium sheets is,
     (1) Forge welding. (2) Joining.   (3) Screwing.   (4) Riveting.   (5) Welding.

27. The speed of an engine is,
     (1) The rotational speed of the front wheels, when the vehicle is moving on a straight road.
     (2) The number of revolutions of the cam shaft per minute.
     (3) The number of revolutions of the crank shaft per minute.
     (4) The average speed of the pistons per minute.
     (5) The forward speed of the engine according to the vehicle speed.

28. In a four stroke overhead single cam engine,
    (1) there is no fixed ratio between speeds of the cam shaft and the crank shaft.
    (2) the cam shaft rotates at twice the speed of the crank shaft.
    (3) the cam shaft rotates at the same speed as the crank shaft.
    (4) the cam shaft rotates at about four times the speed of the crank shaft.
    (5) the cam shaft rotates at exactly half the speed of the crank shaft.

29. What is the correct statement regarding the functioning of a four stroke spark ignition engine?
    (1) The spark plug releases the spark towards the end of the compression stroke.
    (2) The correct order of four stroke is suction, power, compression and exhaust.
    (3) All valves remain open during the power stroke.
    (4) Exhaust valve remains closed during the valve overlap period.
    (5) Air-fuel mixture stored in the crank case is drawn into the engine during the suction stroke.

30. The correct statement with regard to automobile technology is,
    (1) The distributor keeps the position of the crankshaft unchanged according to the instance of spark release.
    (2) The carburettor supplies the right quantity of fuel according to the different performance requirements of the engine.
    (3) An inline injector pump supplies a constant quantity of fuel to the engine at all times.
    (4) In the petroil lubrication system, oil is supplied to the required places under elevated pressure using a pump.
    (5) The radiator cap keeps the pressure in the radiator below the atmospheric pressure.

31. In a power transmission system of an automobile,
    (1) Spur gears are not used in gear boxes.
    (2) Rotational speed reduction between crown wheel and pinion in the final drive is the largest.
    (3) A front wheel drive vehicle does not have a differential.
    (4) Lowest torque output from the gear box is obtained at the reverse gear.
    (5) Differential locks assist in negotiating bends at high speeds.

32. In an ignition system of a four cylinder engine,
    (1) The speed of rotation of the distributor and the crank shaft are equal.
    (2) The firing order cannot be 1-3-4-2.
    (3) It is not possible to change the power produced in the engine by advancing the spark timing.
    (4) The current flowing through the ignition system does not connect to the negative terminal of the battery.
    (5) The ignition coil acts as a step up transformer.

33. In a certain machine, a gear box is coupled to a motor using a flat belt. When transmitting power using this flat belt drive,
    A. A constant transmission ratio is maintained between the motor and the gear box.
    B. The belt reduces the risk of damage due to overload.
    C. Maximum power that can be transmitted by the belt can be increased by increasing the width of the belt.
    D. The belt drive does exactly the same function that a friction clutch performs.
    Of the above, the correct statements are,
    (1) A and B only.   (2) A and C only.   (3) A and D only.
    (4) B and C only.   (5) C and D only.

34. The main function of the expansion valve in the refrigeration cycle is,
    (1) high pressure refrigerant leaving the condenser is expanded and sent to the evaporator.
    (2) high pressure refrigerant leaving the evaporator is expanded and sent to the condenser.
    (3) low pressure refrigerant leaving the condenser is supplied to the evaporator at a low pressure.
    (4) low pressure refrigerant leaving the condenser is supplied to the evaporator at a high pressure.
    (5) low pressure refrigerant leaving the evaporator is supplied to the condenser at a high pressure.

35. Which one of the following motions is **not** considered as a primary motion?
    (1) Rotational   (2) Reciprocatory   (3) Linear
    (4) Three dimensional   (5) Oscillatory

36. The 'head' indicated in a centrifugal water pump is,
    (1) The maximum height to which any liquid can be pumped.
    (2) The maximum height to which water can be pumped.
    (3) The power that can be generated by the pump.
    (4) The amount of water that can be pumped in a minute.
    (5) The number of vanes in the impeller of the pump.

37. The phase voltage and the phase current of the delta connected 3-phase load shown in the circuit are respectively,
    (1) 230.9 V and 69.3 A.
    (2) 230.9 V and 40 A.
    (3) 400 V and 120 A.
    (4) 400 V and 69.3 A.
    (5) 400 V and 40 A.
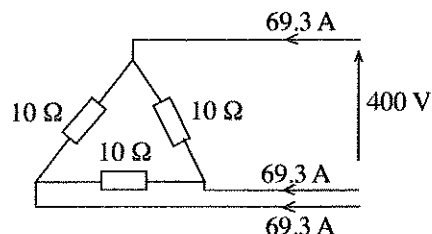
38. A person gets an electric shock due to a leakage while he is using an electric iron. Which of the protection equipment in the house electric circuit should operate first at this situation?
    (1) Service Fuse
    (2) Main Switch
    (3) Residual Current Circuit Breaker (RCCB)
    (4) Miniature Circuit Breaker (MCB)
    (5) Fuse

39. When the full scale deflection of a moving coil multimeter is set to 0 - 500 V dc, the reading when the two terminals are supplied with an alternating 240 V, 50 Hz sinusoidal voltage is,
    (1) Less than 240 V.
    (2) More than 240 V.
    (3) Exactly 240 V.
    (4) Zero.
    (5) Oscillates at 50 Hz around 240 V.

40. The potential difference across the capacitor of the single phase alternating current circuit shown in the figure is,
    (1) 48 V.
    (2) 60 V.
    (3) 64 V.
    (4) 120 V.
    (5) 144 V.
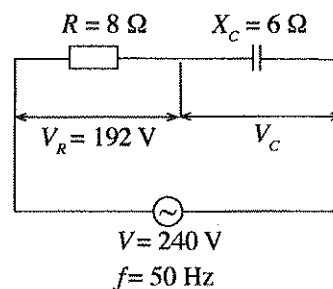
41. The correct graphical representation related to the variation of rotational speed (N) against the armature current (I_a) of a dc series wound motor is represented by,
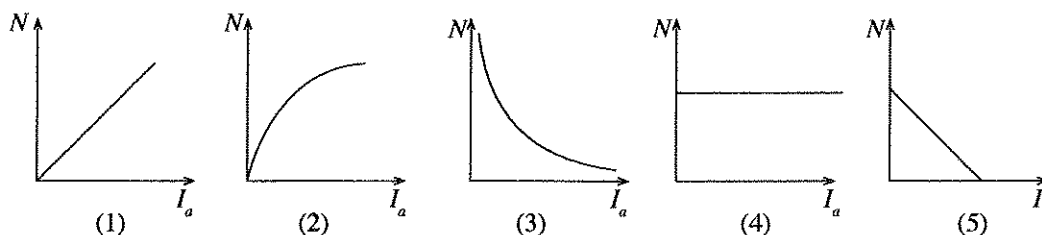
42. An electric hand drill, which operates out of a single phase alternating 240 V, 50 Hz mains supply is to be operated at a rotational speed of 6000 rpm. For this purpose, out of the following electric motors having the same rated voltage and same power capacity, the suitable motor is,
    (1) Capacitor start single phase motor.
    (2) Capacitor start and capacitor run motor.
    (3) Universal motor.
    (4) Shaded pole motor.
    (5) Split phase motor.

43. When the horizontal axis of the oscilloscope is set to $\dfrac{1\ ms}{div}$ and vertical axis is set to $\dfrac{2\ V}{div}$, the frequency and the root mean square values of the sinusoidal voltage shown on screen are,
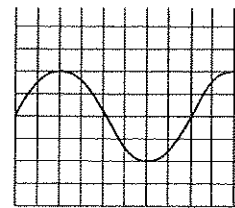
(1) 12.5 Hz, $\dfrac{4}{\sqrt{2}}$ V.   (2) 12.5 Hz, $4\sqrt{2}$ V.

(3) 125 Hz, $\dfrac{4}{\sqrt{2}}$ V.   (4) 125 Hz, 4 V.

(5) 125 Hz, $4\sqrt{2}$ V.

44. Which of the following truth table for the output of the given combinational logic circuit is correct?

(1) A	B	Z		(2) A	B	Z		(3) A	B	Z
0	0	1		0	0	1		0	0	1
0	1	0		0	1	0		0	1	1
1	0	0		1	0	1		1	0	0
1	1	1		1	1	1		1	1	1

(4) A	B	Z		(5) A	B	Z
0	0	0		0	0	1
0	1	1		0	1	1
1	0	1		1	0	0
1	1	1		1	1	0

45. When an alternating electric signal is transmitted through a transmission line, the governing primary coefficients are capacitance (C), Inductance (L), Resistance (R) and conductance (G). What is the correct theoretical representation of these coefficients when a portion of this transmission line is considered?

    (1)   (2)   (3)   (4)   (5)
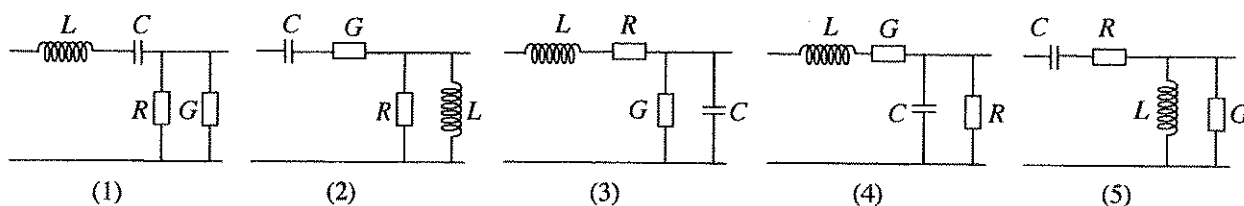
46. The figure shows a circuit with an operational amplifier. Which of the following statements regarding the circuit is correct?
   (1) It is an inverting amplifier and its output is 100 mV.
   (2) It is an inverting amplifier and its output is 10 mV.
   (3) It is a non-inverting amplifier and its output is 1 mV.
   (4) It is a non-inverting amplifier and its output is 100 mV.
   (5) It is an inverting amplifier and its output is 1 mV.
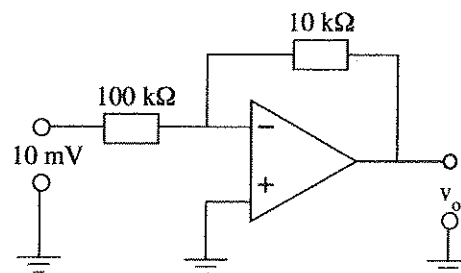
47. The following are five statements regarding an oscillator used in electronic circuits.
   A - It is an amplifier that gives an output signal without an input.
   B - It is an amplifier that gives an output signal when an input is given.
   C - It is an amplifier, where a part of the output signal is fedback in the same phase to the input .
   D - It is an amplifier, which gives an output voltage signal with constant frequency and constant shape.
   E - It is an amplifier, where a part of the output signal is fedback in the opposite phase to the input.
   Of the above, the correct statements are,
   (1) A, B and E.   (2) A, C and D.   (3) A, C and E.
   (4) A, D and E.   (5) A, B and C.

48. In the block diagram shown, when the input logic level is '0' in the control terminal, the output should have the same logic level as the input and when the logic level is '1' in the control terminal the output should have the inverted logic level as the input. What is the gate function of A required to achieve this?

(1) XOR   (2) NOR

(3) AND   (4) OR

(5) NAND
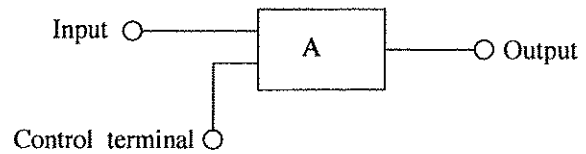
49. When a sinusoidal waveform as shown in Figure (a) is fed as the input to the amplifying circuit shown in Figure (b), which answer shows the waveforms that appear in A and B respectively in Figure (b)?
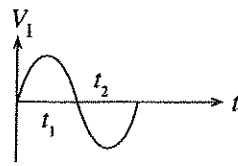
Figure (a)
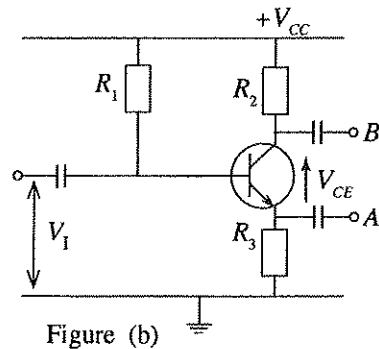
Figure (b)
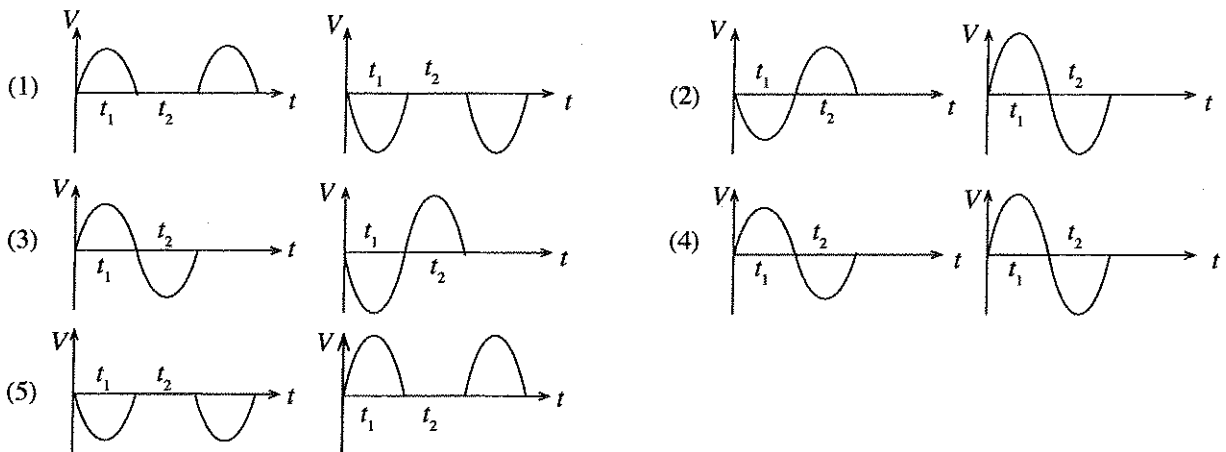
50. An alternating voltage V_1 as shown in Figure (a) is supplied to a rectifier circuit shown in Figure (b). When D_4 diode is disconnected in the circuit, what is the shape of the waveform that appears for V_0 with respect to the ground?

Figure (a)   Figure (b)

✳ ✳ ✳

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

Department of Examinations, Sri Lanka

අධ්‍යයන පොදු සහතික පතු (උසස් පෙළ) විභාගය, 2015 අගෝස්තු
கல்விப் பொதுத் தராதரப் பத்திர (உயர் தர)ப் பரீட்சை, 2015 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2015

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

| 65 | E | II |

පැය තුනයි
மூன்று மணித்தியாலம்
Three hours

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 02 - 10)

*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 11 - 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. **TDS sheets are provided.***

*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		
Part	**Question Nos.**	**Marks Awarded**
A	1	
	2	
	3	
	4	
B	5	
	6	
C	7	
	8	
D	9	
	10	
Total		

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 **paper** itself.*
*Marks allocated for each question is **60**.*

1. The isometric view of a mounting block made using mild steel is given below. According to the dimensions given, draw the front elevation in the direction of arrow A, side elevation and plan on the grid provided using the first angle projection method. Use the scale as 1 : 1. All measurements are in millimetres. Complete the data table assuming that this technical drawing was prepared by Sumith at the technical college on 05.08.2015 and checked by Ranjini on 08.08.2015 as drawing No. 01. Take one small square in the grid as 2 × 2 mm.

Q. 1

60
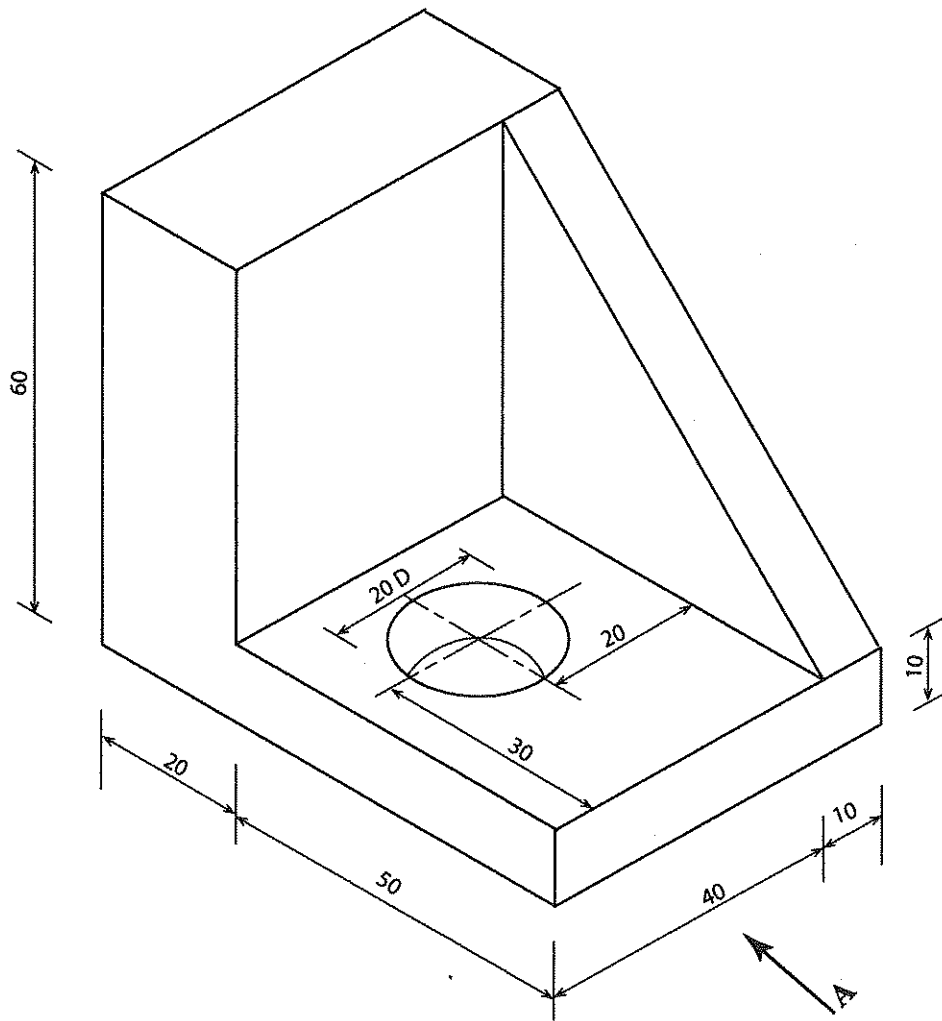
2. An entrepreneur needs to initiate a vehicle maintenance service centre on a bare flat land of about an acre facing a main road. The design and construction of this has been assigned to an engineer. A schematic diagram and a cross-sectional view of the proposed hydraulic hoist to be installed for lifting vehicles is shown below.

Plunger   Reinforced concrete base
Underground chamber
Hydraulic fluid
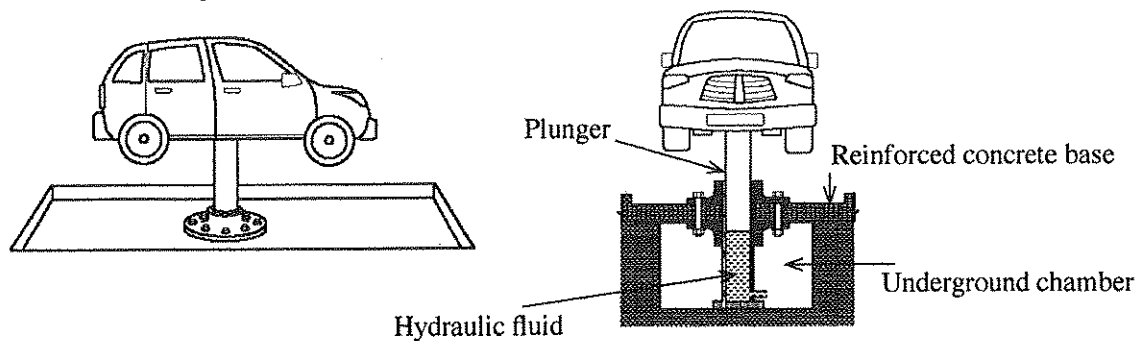
The following information is provided in relation to the proposed hoist and the hydraulic pump.

Hydraulic hoist	
Lifting capacity (kg)	4000
Plunger diameter (mm)	270
Maximum operating pressure (N/m^2)	1×10^6
Maximum lifting height (mm)	1500
Oil fill capacity (litre)	150
Rotary type hydraulic pump	
Discharge volume (litre/minute)	90
Displacement (mm)	10
Number of pistons	9
Maximum operating pressure (N/m^2)	1.5×10^6
Pump speed (rpm)	360
Motor power (kW/rpm)	3.5/1440
Swash plate	Fixed

(a) According to the specifications recommended by the manufacturer, the nuts used to fix the hoist to the base need to be tightened to a torque of 60 Nm. How is this correct torque applied practically?   (04 *marks*)

....

(b) The maximum mass of the vehicle that can be lifted is 4000 kg. What is the pressure of the hydraulic fluid that is needed to lift and maintain this weight at a height? Neglect the mass of the hoist and its components. Take gravitational acceleration as 10 ms^{-2}. (08 *marks*)

....

....

....

....

....

(c) The engineer has decided that the maximum mass of a vehicle to be lifted using this hoist as 3500 kg.

(i) Why has it been decided to keep the maximum mass to be lifted less than the lifting capacity of the hoist?   (04 *marks*)

....

....

0091

(ii) The manufacturer of the hydraulic system has incorporated several mechanisms in the hydraulic system in order to protect it from overloads. Name a component that can be used for this.

....

....

(04 *marks*)

(d) When operating this workplace, write down **one** precaution that needs to be taken during the design phase of the workplace for each of the risk factors mentioned below.

  (i) Leaking of hydraulic fluid ....

  (ii) Explosion of the hydraulic system ....

  (iii) Fire hazards ....

  (iv) Electric shock ....

(08 *marks*)

(e) Name **two** ways how air can enter the hydraulic power system.

  1. ....

  2. ....

(04 *marks*)

(f) This workplace is supplied with single phase electricity supply for its operations. In this regard, name the components that are required there to supply electricity from the main electricity to a socket for the hydraulic power system and indicate the sequence of connecting them.

....

....

....

....

....

(04 *marks*)

(g) The owner needs to fix a roof for this workplace. Name the **two** main components that must be present in any roof.

  1. ....

  2. ....

(04 *marks*)

(h) It has been decided to install a double roof made of wood for this workplace. Sketch a cross section of a double roof naming **three** main parts.

(08 *marks*)

(*i*)   A *V* belt drive is used to transmit power from the motor to the hydraulic pump. A specific tension must be maintained in such a belt drive. In this regard, state **one** consequence each for the following conditions.

If tension is lower than required ....

If tension is higher than required ....

(04 *marks*)

(j)   (i)   What is the type of concrete that must be used for the base of the hoist to withstand the tensile loads that act on the base?

....

(02 *marks*)

(ii)   What is the concrete mix recommended for the type of concrete mentioned above?

....

(02 *marks*)

(k)   It is expected to operate the maintenance service centre from 9.00 a.m. to 8.00 p.m. Propose **two** suitable methods for reducing the monthly electricity bill for lighting.

1. ....

2. ....

(04 *marks*)

Q. 2

60

3.   (a)   State **one** technological factor that helped in the evolution of the instruments mentioned below and **one** technological advantage of that development.

(i)   Use of integrated circuits instead of transistor circuits.

Technological factor: ....

Technological Advantage: ....

(ii)   Use of concrete structures instead of brick structures.

Technological factor: ....

Technological advantage: ....

(08 × 2 = 16 *marks*)

(b)   Write down **two** ergonomic risks due to the working postures associated with the job of each of the following professionals.

(i)   Mason

1. ....

2. ....

(ii)   Arc welder

1. ....

2. ....

(iii)   Carpenter

1. ....

2. ....

(iv)   Machine operator

1. ....

2. ....

(02 × 8 = 16 *marks*)

(c) Paying attention to the following signs, write down the meaning of each sign and **one** hazard each that can result if the sign is ignored.

	Meaning : Hazard :
	Meaning : Hazard :
	Meaning : Hazard :
	Meaning : Hazard :
	Meaning : Hazard :

(04 × 5 = 20 *marks*)

(d) (i) Write down **two** errors that may occur when taking measurements using a vernier caliper.

1. ....

2. ....

(04 *marks*)

(ii) Write down **two** advantages of using international standard units.

1. ....

2. ....

(04 *marks*)

Q. 3

60

Do not write in this column

4. (a) Suvimal is a Sri Lankan entrepreneur who has expertise in mechanical engineering technology. He has developed a sheet rubber rolling machine using scrap metal as the main raw material and launched in the Sri Lankan market under the brand name 'SR'. He has obtained 12% market share at present. Even though a similar machine imported from a Chinese company has currently become popular among small rubber estate owners, 'SR' machine is also becoming popular in the market. Suvimal has identified that there is a demand for these machines in the foreign markets as well, but he is delaying the introduction of his product to the foreign market owing to financial constraints.

While Suvimal is running his business, although his main competitor has put forward different challenges at several instances, he continues to maintain his business successfully. Suvimal believes that he could control the future of his business as desired by overcoming the challenges form external sources. He acts promptly on business matters and is confident about his skills and capabilities to succeed in business. In order to develop his business further, he has appointed a marketing consultant to prepare a marketing plan for his business.

(i) Briefly explain the following **two** management functions used in management.

Planning : ....

....

....

(02 *marks*)

Organising : ....

....

....

(02 *marks*)

(ii) Suvimal uses SWOT analysis in managing his business. Using the information given above, complete the following table by stating one strength, weakness, opportunity and threat each.

Strength	
Weakness	
Opportunity	
Threat	

(08 *marks*)

(iii) Based on the information in passage (a), identify **four** entrepreneurial personality characteristics of Suvimal and draw evidence from the above passage.

Characteristic	Evidence
1.	
2.	
3.	
4.	

(08 *marks*)

(iv) If Suvimal wishes to register his business, under which act should he register it?

....

(02 marks)

(v) Name **four** items that may be included in the documentary format of Suvimal's marketing plan for 'SR' machines?

1. ....

2. ....

3. ....

4. ....

(04 marks)

(vi) State **one** marketing objective that may be included in Mr. Suvimals' marketing plan for 'SR' machines.

....

....

(02 marks)

(vii) Name the **two** main types of costs used in computing the break-even point in the marketing plan for 'SR' Machines of Suvimal's business and give an example for each of them.

Type of cost	Example
1.	
2.	

(04 marks)

(viii) A set of micro and macro economic environment factors identified while preparing the marketing plan for 'SR' machines of Suvimal's business are listed in the table below. Use the table and classify these factors into micro and macro economic environment factors using ($\sqrt{}$) mark.

	Micro environment factors	Macro environment factors
(1) Other business institutions, which produce sheet rubber manufacturing machines		
(2) Scrap iron collection centres		
(3) Rubber prices in world market		
(4) Labourers' attitudes towards rubber tapping		
(5) Workers' problems of Suvimal's business		
(6) Climate with high temperature		

(06 marks)

(ix) While Suvimal further improves his business, he intends to fulfil corporate social responsibility as well. Suggest **two** ways he could contribute to it.

(1) ....

....

(2) ....

....

(04 marks)

(b) Information about production costs and sales of Mr. Suvimal's business are as follows:

Price of 1 kg of material   Rs. 100.00

Rate for labour per hour   Rs. 200.00

Cost per one unit of electricity   Rs.   20.00

60 kg of materials, 40 hours of labour and 300 units of electricity are needed to produce one machine. Sales price of one machine is Rs. 30,000.00 and annual fixed cost is Rs. 500,000.00. It has been estimated that 100 machines can be sold every month.

Answer the following questions using the information provided above.

(i) Calculate the expected annual income of Suvimal's business.

....

....

....

....

....

(02 *marks*)

(ii) Calculate the expected annual cost of Suvimal's business.

....

....

....

....

....

....

....

(06 *marks*)

(iii) Calculate break-even point of Suvimal's business showing the steps.

....

....

....

....

....

....

(04 *marks*)

(iv) Suggest **two** strategies that Suvimal can use to reduce the break-even point further, from the existing level.

1. ....

2. ....

(04 *marks*)

(v) If Suvimal decides to use internal sources of financing to fulfil his capital requirements, write down **two** advantages of his decision.

1. ....

2. ....

(02 *marks*)

* *

Q. 4

60

Instructions:

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

Part B - Essay (Civil Technology)

5. It is commonly observed in construction technology that brick walls are erected on a concrete foundation.

  (a) State the necessity of a foundation for a building. (06 *marks*)

  (b) When a concrete foundation is specified as $1:3:6(32)$ write down the meaning of $1:3:6(32)$ in the respective order. (12 *marks*)

  (c) Explain the measures to be taken during placing and compaction of concrete in order to produce a high quality concrete. (12 *marks*)

  (d) Draw the plan view of the layout of bricks of the 1st and 2nd course of a 225 mm wide 90° wall corner in an English bond. (12 *marks*)

  (e) Draw a front elevation of an English bond and mark the following elements in it.
      Vertical joints
      Horizontal joints (Bed Joints)
      Lap (15 *marks*)

  (f) (i) Explain the process to be followed for hard core filling of floor. (24 *marks*)

     (ii) State **three** types of finishes suitable for finishing a floor. (09 *marks*)

6. A floor plan of a building is shown in the figure below. All the measurements are given in millimetres. (figures are not to scale.)The thickness of the walls is 225 millimetres and the height of the walls is 3000 millimetres.

D - 900 X 2200
W - 1200 X 1500

Section A-A
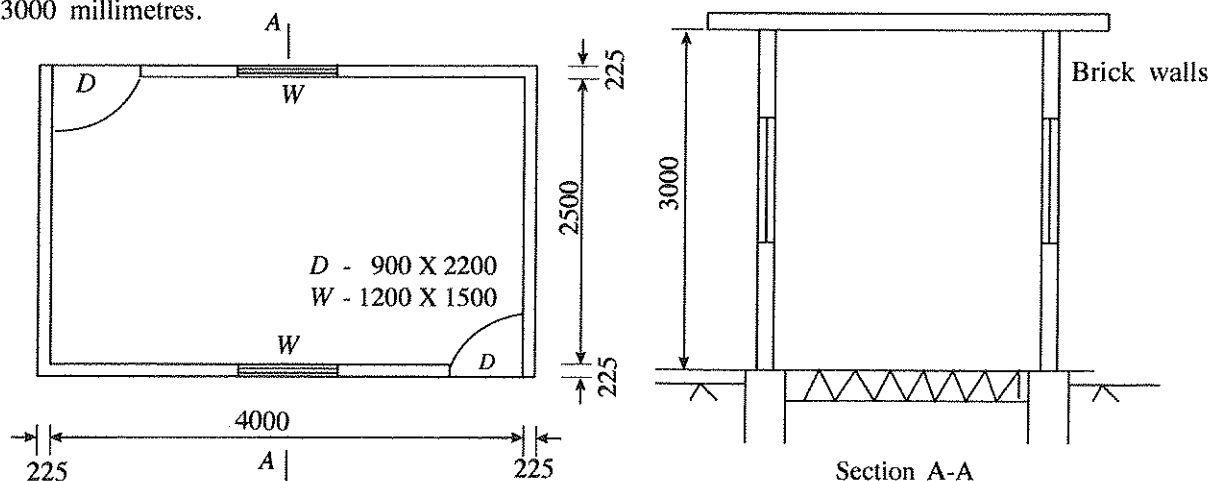
  (a) Calculate the centre line girth of the walls. (20 *marks*)

  (b) Take off quantities for the following work items in accordance with SLS 573 : 1999 using the TDS sheet provided. It is not necessary to square the quantities on measurement sheets.

    (i) Take off quantities for brick walls in square meters. (15 *marks*)

    (ii) Take off quantities for the voids D and W, which are to be deducted for brick walls in square metres. (10 *marks*)

    (iii) Take off quantities for internal plaster in square meters. (25 *marks*)

    (iv) Take off quantities for the deduction of internal plaster for D and W in square metres. Additions for openings are not required. (20 *marks*)

Part C - Essay (Mechanical Technology)

7. It is required to replace a defective flange coupling in a duct system used to distribute air in an air conditioned building. The coupling needs to be produced using sheet metal. Its schematic diagram (not drawn to scale) is shown below. All dimensions are in millimetres.
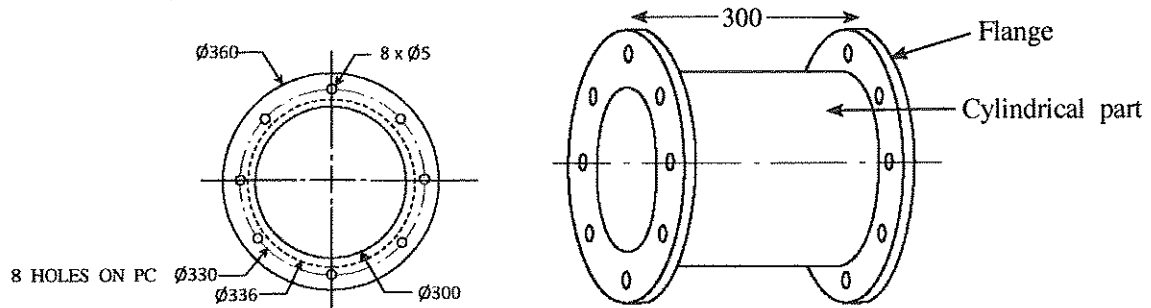

The thickness of the flange is 5 mm and the thickness of the sheet used for the cylindrical part is 3 mm.

(a) (i)   State **two** mechanical properties that need to be present in the metal used to produce this coupling.   (04 *marks*)

     (ii) Explain the importance of the above mentioned two mechanical properties in the production of the coupling.   (08 *marks*)

     (iii) State a metal that is suitable for producing this coupling.   (03 *marks*)

(b) Describe the sequence of steps in the production process that needs to be employed to produce the two flanges and the bolt holes.   (36 *marks*)

(c) Tabulate the equipment and tools needed for measuring, marking and production and mention in which stage of the production process they are used.   (21 *marks*)

(d) Describe the sequence of steps in the production process that needs to be followed to produce the cylindrical part of the coupling.   (18 *marks*)

8. (a)   Explain why it is necessary to produce power in different quantities for different requirements in the operation of a motor car.   (15 *marks*)

   (b)   In order to vary the power produced by the engine, it is required to change the quantity of fuel to be supplied to the engine. For this it is possible to use carburettors in petrol engines. Explain using the cross section of a simple carburettor, how this process takes place when the engine is idling.   (30 *marks*)

   (c)   Explain why splines are required for the sliding joint in a propeller shaft.   (15 *marks*)

   (d)   When a motor vehicle is in motion, toe-in and toe-out, and the castor angle are considered as important factors in order to maintain its stability. Explain the importance of each of these factors.   (30 *marks*)

Part D - Essay (Electrical and Electronic Technology)

9. The following single line diagram shows a part of an electric power grid.
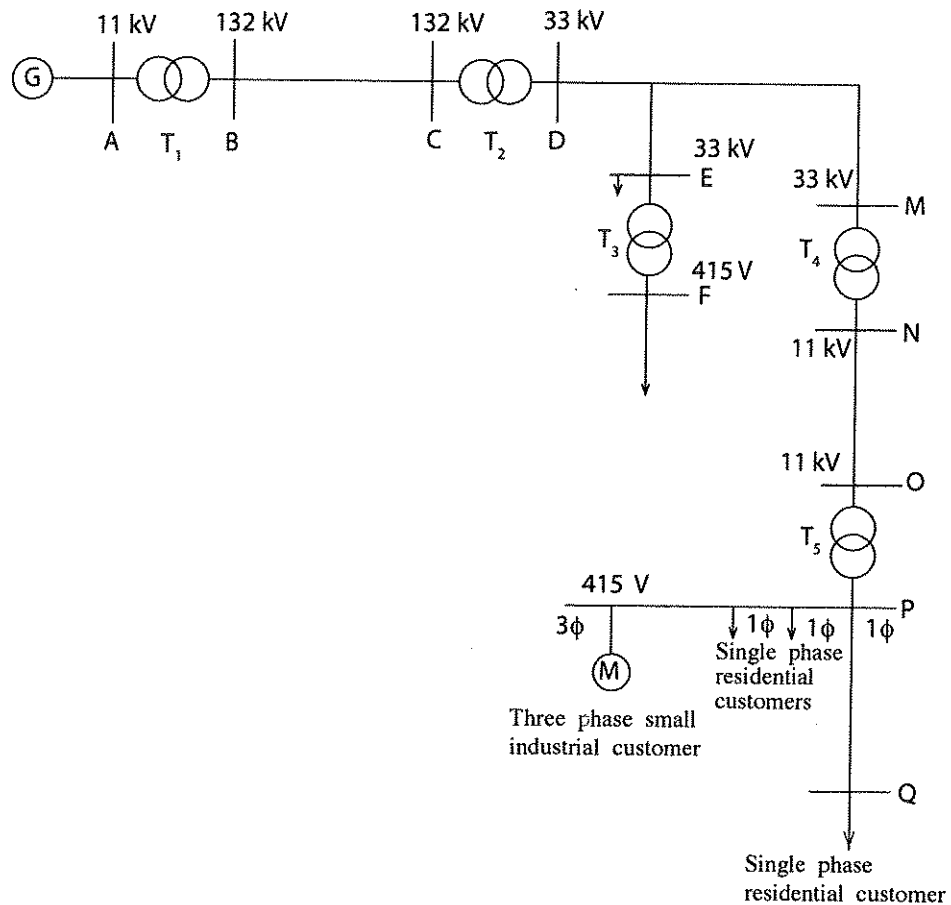
(a) (i) (G) in the above diagram represents the generator of a large scale hydro power station. Draw a basic schematic diagram of a hydro power station showing **five** main components on the path of water between the reservoir and the place where water is released from the power house and name those main components.   *(10 marks)*

   (ii) 'BC' in the above diagram represents electrical transmission lines. State **two** reasons for using high voltages for power transmission.   *(04 marks)*

(b) (i) T_1, T_2, T_3, T_4 and T_5 in the above diagram represent substations in the power grid. State the type of each substation.   *(10 marks)*

   (ii) Draw a named diagram showing the three phase winding connections of the transformer at T_5 substation.   *(12 marks)*

   (iii) One of the residential customers connected to T5 substation for obtaining single-phase power uses a 1kVA rated auto transformer to run a household electrical appliance. When that appliance is in use, if the secondary voltage of the auto transformer is 110 V and the corresponding number of secondary turns is 55, find the number of turns corresponding to the primary of the auto transformer.   *(10 marks)*

(c) In the above single line diagram, 'PQ' represents a single phase distribution line. Line 'PQ' has a unit resistance (R) of 0.3 Ω/km and a unit inductance (L) of 1 mH/km. Resistance and inductance of power lines are series connected. If the frequency of the supply (f) is 50 Hz and , if line 'PQ' is 10 km long, calculate the total impedance of the line 'PQ'.   *(20 marks)*

(d) (i) State **two** merits and **two** demerits of compact fluorescent lamps (CFL) compared with filament lamps.   (08 *marks*)

    (ii) The daily consumption of a residential customer is as follows:

       (1) 60 W each filament lamps 3 Nos for five (5) hours

       (2) 100 W small TV for four (4) hours

       If the charge is Rs. 2.50 for 1 unit of electricity and if there is a fixed monthly charge of Rs. 30, calculate the electricity bill for a month having 30 days.   (16 *marks*)

10. (a) (i) Draw the characteristic curve of a transistor for the change in the collector current (I_C) with the base current (I_B).   (06 *marks*)

    (ii) Draw the active regions on the above curve when the transistor acts as a switch. (05 *marks*)

    (iii) State the relationship between I_B and I_C in the above active regions.   (10 *marks*)

   (b) When a relay is used as the load of a transistor, using a circuit diagram indicate a method for preventing damage to the transistor caused by the back electro motive force of the relay.   (10 *marks*)

   (c) The circuit diagram illustrates a light sensitive switch that uses a transistor. The LED lights on when the light level is increased and LED goes off when the light level is decreased.
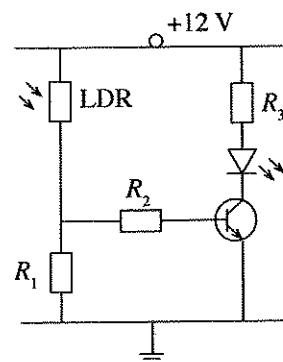
    (i) State **two** parameters connected with a transistor that should be considered when using the transistor as a switch.   (04 *marks*)

    (ii) Explain the actions of R_1, R_2, R_3, LDR and the transistor according to the circuit.   (10 *marks*)

    (iii) A current of 20 mA should flow through the LED which requires a potential difference of 2 V for lighting. Calculate the value of R_3 resistor required. (Consider the voltage between collector and emitter after the saturation of the transistor as zero.)   (15 *marks*)

    (iv) This LED in this circuit will switch on when a certain light level is reached. Describe a methodology using a circuit diagram for adjusting the light level at which the circuit will operate.   (10 *marks*)

    (v) Redraw the above circuit by modifying it as appropriate in order to light a street lamp automatically.   (20 *marks*)

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T	D	S	Description	T	D	S	Description

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