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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 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2015

යාන්ත්‍රික තාක්ෂණවේදය I
பொறிமுறைத் தொழினுட்பவியல் I
Mechanical Technology I

15 E I

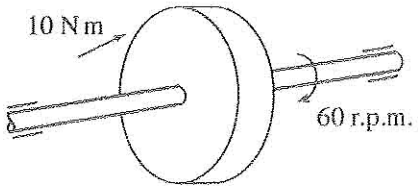
පැය දෙකයි
இரண்டு மணித்தியாலம்
Two hours

Instructions:

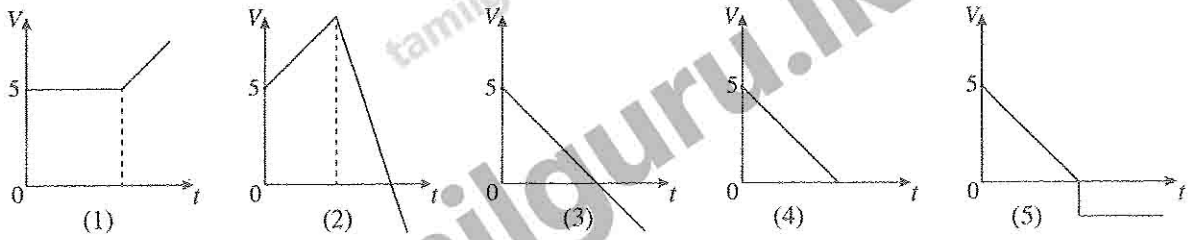
- *Answer **all** the questions.*
- *Write your **Index Number** in the space provided in the answer sheet.*
- *Use of calculators is not allowed.*
- *Instructions are given on the back of the answer sheet. Follow those carefully.*
- *In each of the questions **1** to **50**, pick one of the alternatives from (1), (2), (3), (4), (5) which is **correct** or **most appropriate** and **mark your response on the answer sheet with a cross** (×) in accordance with the instructions given in the back of the answer sheet.*

1. Power, using basic units is
   (1) $kgms^2$ (2) Nm (3) Js^{-1} (4) kgm^2s^{-3} (5) $kgm^{-1}s$

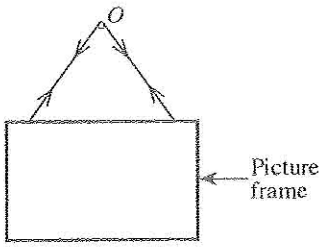
2. Figure shows a configuration of a rotor which is mounted on a shaft. The applied torque on the rotor is 10 Nm. The speed of rotation is 60 r.p.m. What is the power developed by the shaft?
   (1) (10π) W (2) (20π) W (3) (30π) W
   (4) (40π) W (5) (50π) W



3. A boy has projected an object by a velocity of 5 ms^{-1} from the height of 10 m. Which velocity-time graph represents the vertical motion of the object in air?



4. Figure shows a stable state of a picture frame which is hanging on a smooth point '*O*' by means of light string that passes through *O*.

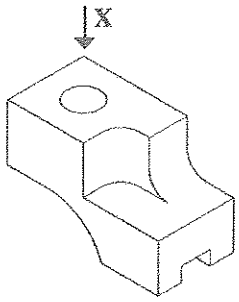


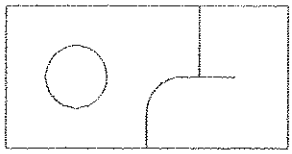
   Select the correct statement which describes the stable state.
   (1) The tension on both sides of the string is not same.
   (2) Sum of tensions on both sides of the string is equal to weight of the picture frame.
   (3) The moment of forces acting on frame about *O* is not zero.
   (4) The net resultant horizontal component of the tension on the frame is non zero.
   (5) The line of action of weight of the picture frame passes through point *O*.

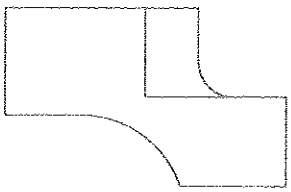
5. Solar energy is a combination of several types of energy. Some of those types are given below.
   A - Heat energy *B* - Magnetic energy
   C - Light energy *D* - Chemical energy
   Which of the above energy types are directly acquired from solar energy for **daily usage**?
   (1) *A* and *B* only (2) *A* and *C* only (3) *A* and *D* only (4) *B* and *C* only (5) *B* and *D* only

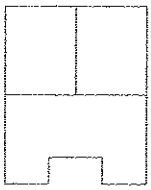
[See page two

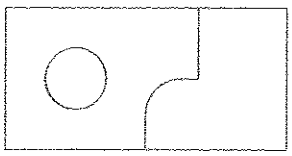
6. Isometric view of an object is given in figure below.
Which answer gives the correct view when looking from direction X?
(Ignore hidden lines)

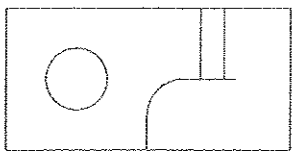



(1)

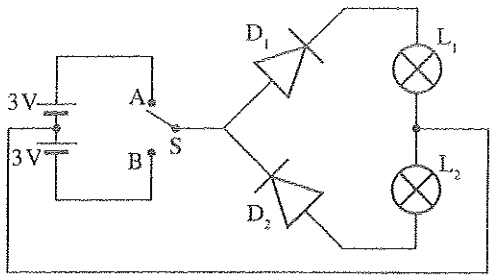

(2)


(3)

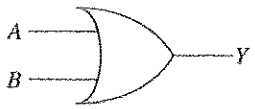

(4)

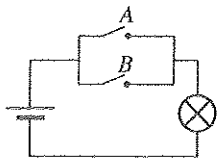

(5)

7. Figure shows a circuit used to switch on two lamps. When S switch is directed to A,
(1) only D_1 diode is forward biased and L_1 lamp is on.
(2) only D_2 diode is forward biased and L_2 lamp is on.
(3) both D_1 and D_2 diodes are forward biased and both L_1 and L_2 lamps are on.
(4) both D_1 and D_2 diodes are reversed biased and both L_1 and L_2 lamps are off.
(5) D_1 diode is forward biased and L_2 lamps is on.

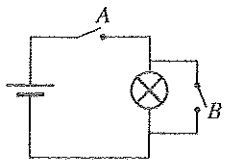


8. Select the correct circuit diagram that represents the operation of logic gate given in the Figure below.

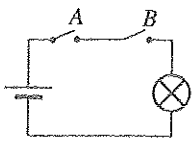




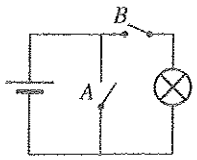
(1)



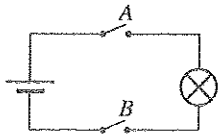
(2)



(3)

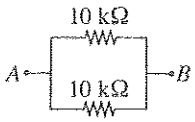


(4)

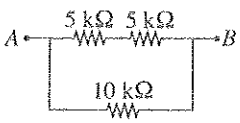


(5)

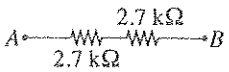
9. Which of the following resistor arrangements has the highest resistance between points *A* and *B*?



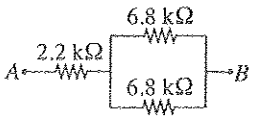
(1)



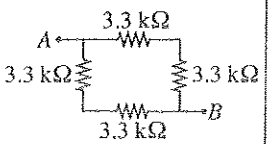
(2)



(3)

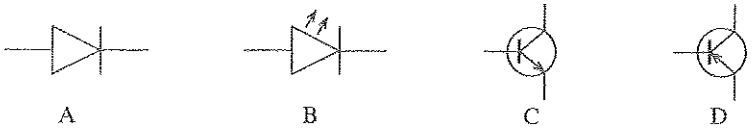


(4)



(5)

10. Select the answer which gives respectively the electronic component represented by the symbols given below.



(1) Rectifier diode, Light emitting diode, PNP transistor, NPN transistor
(2) Light emitting diode, Rectifier diode, NPN transistor, PNP transistor
(3) Rectifier diode, Light emitting diode, NPN transistor, PNP transistor
(4) Light emitting diode, Rectifier diode, PNP transistor, NPN transistor
(5) NOT gate, Light emitting diode, NPN transistor, PNP transistor

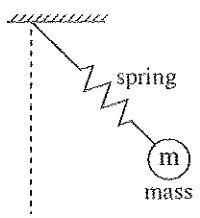
[See page three

11. Following statements are related to the use of a gas cooker in a kitchen in the early morning.
A - Before turning the gas cooker on open the window.
B - Make sure gas leakages are not present.
C - If smell of the gas is felt do not turn on the gas cooker.
D - Wait till the flame to come after ignition occurs.
Which statements are correct if safety aspects are considered?
(1) *A*, *B* and *C* only (2) *A*, *B* and *D* only (3) *A*, *C* and *D* only
(4) *B*, *C* and *D* only (5) *A*, *B*, *C* and *D* all

12. A coconut tree slanted towards a building has been tied up by a steel wire. What is the material property that should be considered to study the breaking of the wire?
(1) Malleability. (2) Ductility. (3) Tensile strength.
(4) Elasticity. (5) Compressive strength.

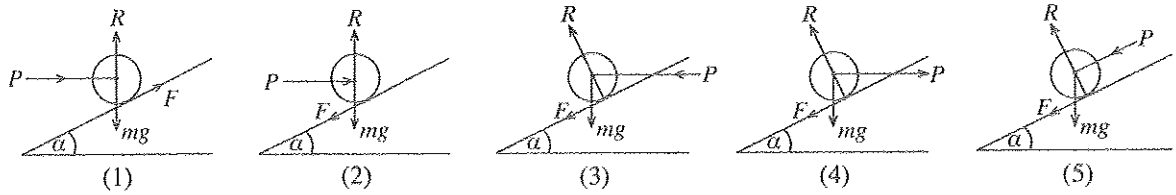
13. Frictional effect can be seen frequently in various day-to-day applications. Select the **inappropriate** statement about friction from the following statements.
(1) Friction force is proportional to the normal force.
(2) Friction is the force resisting the relative motion of two surfaces.
(3) Static and dynamic are two forms of friction.
(4) Friction force can be changed by altering surface finish.
(5) Friction always creates negative outcome for the expected result.

14. Figure shows a spring-mass system. One end of the spring is connected to a fixed point and mass m is attached at the other end. What forms of energy can be identified on the above system?
(1) Kinetic energy only.
(2) Kinetic and potential energy only.
(3) Potential and strain energy only.
(4) Kinetic, potential and gravitational energy only.
(5) Kinetic, potential and strain energy only.



15. What is the **incorrect** statement regarding mirrors and lenses?
(1) Magnifying glass is a convex lens which produces a magnified image of an object.
(2) Convex mirrors are used in side mirrors of cars to obtain narrow view of field.
(3) Concave mirrors reflect light inward to one focal point.
(4) Concave mirrors are used in vehicle headlights.
(5) Concave lenses diverge the light and always produce virtual image.

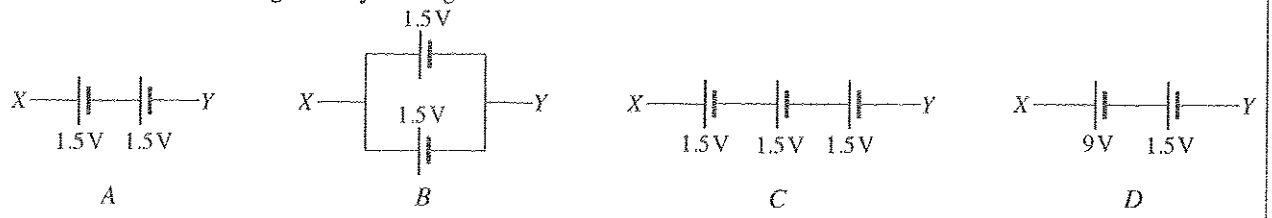
16. From the following figures, select the figure which represents the correct direction of forces, when the object tends to move in upward direction. Following notations are applied.
R: Reaction force, *P*: Effort, *mg*: Self weight, *F*: Friction force



17. Select the list which includes only the components used for house wiring circuits?
(1) Residual Current Circuit Breaker (RCCB), Miniature Circuit Breaker (MCB), Oscilloscope, Main Switch.
(2) Residual Current Circuit Breaker (RCCB), Miniature Circuit Breaker (MCB), Earth electrode and Earth wire, Main Switch.
(3) Earth electrode, Main switch, Lamp holders and Lamps, Oscilloscope.
(4) Main switch, Miniature Circuit Breaker (MCB), Multimeter, Oscilloscope.
(5) Residual Current Circuit Breaker (RCCB), Main switch, Socket outlets, Transistors.

[*See page four*

18. Consider the following battery arrangements.



Select the answer that gives the total voltage between XY of the circuit in ascending order.

(1) A, B, C, D (2) A, C, D, B (3) A, D, C, B (4) B, A, C, D (5) D, C, B, A

19. Which of the following statements are true about the density of a matter?

A - It depends on the concentration of its atoms. B - It does not change with pressure.
C - It changes with its phase. D - It changes with temperature.

Which of the above statements are true?

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

20. Which of the following statements correctly explains the centre of gravity of an object?

A - Centre of gravity of an object always lies within the object.
B - Stability of an object increases when centre of gravity goes down.
C - Centre of gravity of an object in neutral equilibrium does not change.
D - Centre of gravity of an object can be determined by hanging the object from its different locations.

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

21. Select the situation/s in which friction force becomes useful?

A - Applying brake in a moving vehicle.
B - Climbing a tree.
C - Skating on snow.

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

22. What are the correct statements about energy?

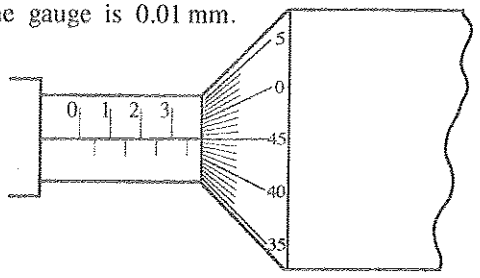
A - Energy can be stored in an object in the form of potential, kinetic or strain energy.
B - Potential energy is used in hydro power generation.
C - Kinetic energy is used in wind power generation.
D - Strain energy is used in leaf springs of vehicles.

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

23. Figure shows the measurement of a work piece measured from a micrometer screw gauge. The micrometer screw gauge has **no** zero error. The least count of the gauge is 0.01 mm.

Indicated reading is

(1) 3.45 mm.
(2) 3.40 mm.
(3) 3.30 mm.
(4) 3.95 mm.
(5) 4.00 mm.



24. You are standing in a bus which is moving at a certain speed. What is the force acting on your body, only when the bus is passing a bend?

(1) Centrifugal force (2) Centripetal force (3) Impact force
(4) Friction force (5) Gravitational force

25. An entrepreneur should

(1) always accept challenges.
(2) have minimum understanding of relevant market.
(3) make less attention to manage resources and time.
(4) not study about the business competitors.
(5) take minimum risk.

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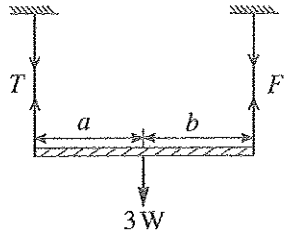
26. In a bicycle, in order to transmit power from pedal to rear wheel, a chain and sprocket wheels are used without using a v-belt drive (v-belts and v-pulleys). Four statements on the above usage are given below.
A - Slipping is more restricted in between the chain and sprocket wheel than in between v-belts and v-pulleys.
B - V-belt drive **cannot** be used in this purpose because the distance is too long between the pedal wheel and the rear wheel.
C - Slipping can occur in between the v-belt and v-pulleys.
D - Chain and sprocket has a higher wear resistance compared to a v-belt.
Select the correct statements.
(1) *A*, *B* and *C* only. (2) *A*, *B* and *D* only. (3) *A*, *C* and *D* only.
(4) *B*, *C* and *D* only. (5) *A*, *B* *C* and *D* all.

27. A radiator can be seen in a motor car. However, it is not included in a three-wheeler. Which answer best explains the reason for this?
(1) The three-wheeler does not have enough space to include a radiator.
(2) A motor car has an air conditioner whereas a three-wheeler does not have an air conditioner.
(3) The maximum speed of the motor car is higher than that of the three wheeler.
(4) A three-wheeler has an air cooling system whereas a motor car has a water cooling system.
(5) Most motor cars have good aerodynamic shape, but the three-wheeler does not have a proper aerodynamic shape.

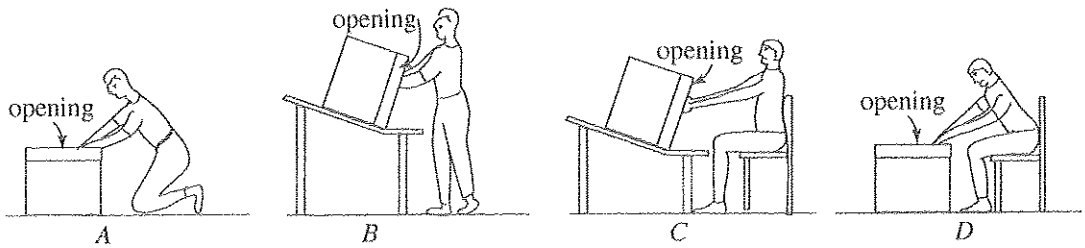
28. A rod is in static equilibrium as shown in the figure. Which answer gives the correct relationship between W and *T*, and *a* and *b* ($a \neq 0$, $b \neq 0$)?
(1) F = 2W, $a = 2b$
(2) F = 2W, $a = b$
(3) F = W, $a = 2b$
(4) F = W, $a = b$
(5) F = 3W, $a = b/2$



29. In Sri Lanka, during office hours, instead of traffic light system, traffic police officers often give required signals/directions to control intensity of traffic at junctions. Select the statement/s that explain the correct reasons for this.
A- Traffic light system does not use a feedback control method. Therefore, unnecessary traffic jams can occur at the junction.
B- Traffic police officers can develop a manual feedback control action to develop smooth traffic flow at the junction.
C- Controller of the traffic light system is not correctly configured to identify the real time traffic intensity at the junction.
What are the correct statements regarding the above usage?
(1) *A* only. (2) *A* and *B* only. (3) *A* and *C* only.
(4) *B* and *C* only. (5) *A*, *B* and *C* all.

30. A production line of an existing factory is to be redesigned considering ergonomic aspects. Consider the following activities.
A- Install sound absorbers/barriers to reduce the sound to a suitable level.
B- Redesign the lighting system to have a suitable illumination and to reduce the eye strain.
C- Eliminate/minimise the bottleneck of the production line
D- Redesign the production line to reduce unnecessary human motion.
Which activities have relationships to ergonomic aspects?
(1) *A*, *B* and *C* only. (2) *A*, *B* and *D* only. (3) *A*, *C* and *D* only.
(4) *B*, *C* and *D* only. (5) *A*, *B*, *C* and *D* all.

31.



Non-fragile items are to be removed from a box (carton) in which items are closely arranged (stacked). Possible methods are given in the above figures. Which methods are ergonomically more suitable?
(1) *A* and *B* only. (2) *A* and *C* only. (3) *A* and *D* only. (4) *B* and *C* only. (5) *A*, *B* and *C* only.

32. Which is the correct statement regarding pressure?
(1) Absolute pressure = Gauge pressure + Atmospheric pressure
(2) Gauge Pressure = Absolute pressure + Atmospheric pressure
(3) Atmospheric pressure = Absolute pressure + Gauge pressure
(4) Absolute pressure = Gauge pressure - Atmospheric pressure
(5) Absolute pressure = Atmosphere pressure - Gauge pressure

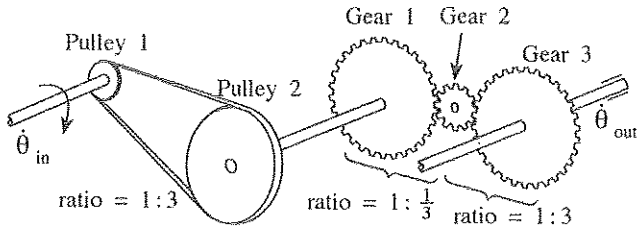
33. Which of the following statements represents the amount of heat that is needed to increase the temperature of a unit mass of a gas in one degree under a constant volume?
(1) specific heat under constant pressure
(2) specific heat under constant volume
(3) specific heat
(4) unit entropy
(5) unit Joule

34. What is the temperature represented by the absolute zero?
(1) -273° C (2) 273° C (3) 273° F (4) 0° C (5) 0° F

35. What is the methodology that is commonly used to correctly represent an engineering drawing of a symmetric mechanical component?
(1) Present the engineering drawing of 1/4 of the component.
(2) Present the engineering drawing of half (along symmetric line) of the component.
(3) Present the engineering drawing of the full component.
(4) Present only one elevation as the engineering drawing.
(5) Present only two elevations as the engineering drawing.

36. Which answer gives the view that is **not** commonly used in an Engineering drawing?
(1) Front view (2) End view (3) Isometric view
(4) Plan view (5) Projection

● A power transmission system is shown in the figure given below. Use the figure to answer question **37** and **38**.



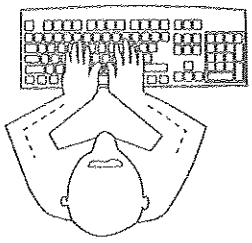
37. What is the correct statement regarding the system?

	Output shaft rotation direction	Relationship of $\dot{\theta}_{in}$ and $\dot{\theta}_{out}$
(1)	Clockwise	$\dot{\theta}_{in} = \dot{\theta}_{out}$
(2)	Clockwise	$\dot{\theta}_{in} > \dot{\theta}_{out}$
(3)	Anti-clockwise	$\dot{\theta}_{in} \leq \dot{\theta}_{out}$
(4)	Clockwise	$\dot{\theta}_{in} < \dot{\theta}_{out}$
(5)	Anti-clockwise	$\dot{\theta}_{in} < \dot{\theta}_{out}$

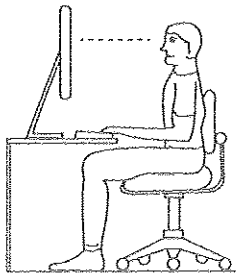
38. When the input shaft angular velocity is ω what is the angular velocity of gear 2?
(1) $\omega \times \frac{2}{3} \times \frac{1}{3}$ (2) $\omega \times 3 \times \frac{3}{2}$ (3) $\omega \frac{1}{3} \times \frac{1}{3}$
(4) $\omega \times 3 \times 3$ (5) $\omega \times 3 \times \frac{1}{3}$

[See page seven

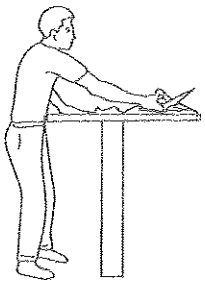
39. Following figures illustrate hands, arms, limbs and body postures/positions for the given tasks.



A - While operating a computer key board



B - While using a computer in a seated position



C - While carrying out work on working table

D - While lifting an object

Which figures/figure show/s ergonomically efficient working postures/positions?

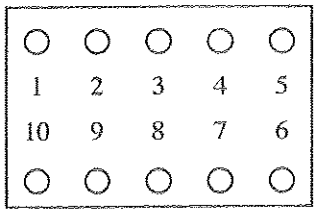
(1) *A*, *B* and *C* only. (2) *A*, *B* and *D* only. (3) *A*, *C* and *D* only.
(4) *B*, *C* and *D* only. (5) *A*, *B*, *C* and *D* all.

40. Power transmission of a clutch occurs as a result of,
(1) pressure developed on the surfaces of fly wheel and the clutch plate
(2) thrust developed on the surfaces of flywheel and clutch plate.
(3) friction between the surfaces of flywheel and the clutch plate.
(4) friction between the surfaces of pressure plate and clutch plate.
(5) friction between the surfaces of pressure plate and flywheel.

41. Thick continuous lines are used in Engineering Drawing to show
(1) centre lines. (2) hidden lines. (3) section lines.
(4) dimension lines. (5) out lines (visible lines).

42. Several loads that act on the chassis of a motor vehicle are given below.
A - Weight of the body of vehicle, passengers and goods
B - Forces exerted when vehicle passes through bumps
C - Forces exerted by impacts
D - Forces exerted by vibrations of engine
Select the correct statements.
(1) *A* and *B* only. (2) *A* and *D* only. (3) *A*, *B* and *D* only.
(4) *A*, *B* and *C* only. (5) *A*, *B*, *C* and *D* all.

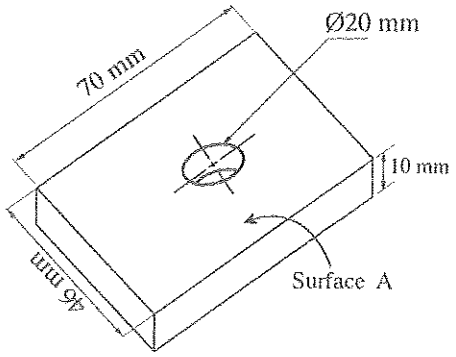
43. Figure shows the stud locations of an engine head. Select most appropriate way of removing studs.
(1) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
(2) 5, 10, 1, 6, 8, 3, 9, 2, 7, 4
(3) 3, 8, 2, 9, 4, 7, 1, 10, 5, 6
(4) 8, 3, 7, 1, 9, 2, 6, 5, 10, 4
(5) 1, 6, 5, 10, 2, 7, 4, 9, 3, 8



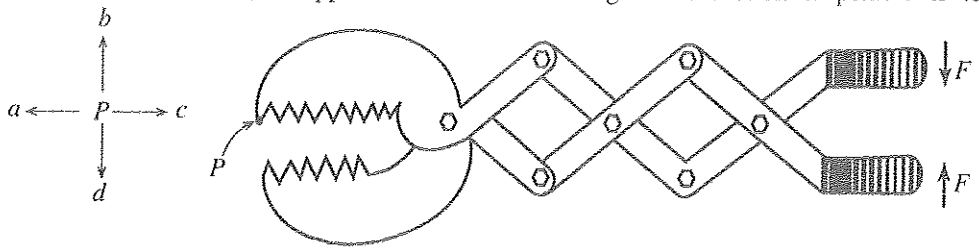
44. Following statements describe valve overlap of a four stroke Engine. Select the correct answer.
(1) Intake valve is open and exhaust valve is near to close.
(2) Both intake valve and exhaust values are closed.
(3) Intake valve is near to close and exhaust valve is near to open.
(4) Both intake and exhaust valves are near to close.
(5) Both intake and exhaust valves are near to open.

[*See page eight*

45. Select the most suitable machine/machines that can be used to finish surface A of the given part and to drill the hole.
(1) Shaping machine and drilling machine
(2) Lathe machine and drilling machine
(3) Lathe machine only
(4) Shaping machine only
(5) Drilling machine only



46. The device shown in the figure below can be used to grip an object in a place which is not accessible by the hand. When a force (F) is applied as shown in the figure the motion of point P is to

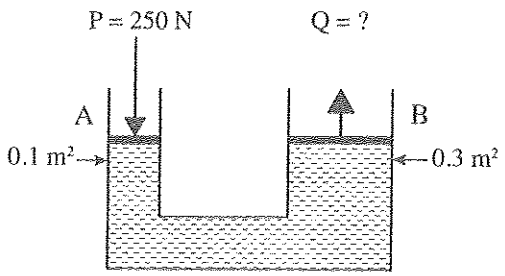


(1) the direction of a only. (2) the direction of d only. (3) the directions of a and b.
(4) the directions of a and d. (5) the directions of b and c.

47. Main components of a refrigerator and their functions are given below.
A - Compressor : Increases the pressure of refrigerant.
B - Condenser : Removes heat from the refrigerant.
C - Expansion value : Reduces the pressure of refrigerant.
D - Evaporator : Extracts heat into refrigerant.
Which statements are correct?
(1) A, B and C only. (2) A, B and D only. (3) A, C and D only.
(4) B, C and D only. (5) A, B, C, D all.

48. Pneumatic and hydraulic systems are used in industrial applications. Select the correct statement about the use of pneumatic and hydraulics in the industry.
(1) A compressor is an essential component in a pneumatic system as well as in a hydraulic system.
(2) A pump is not required to a hydraulic system.
(3) Compressed air should be filtered before input to the pneumatic system.
(4) Pneumatic system has very high chance of fire compared to hydraulic system.
(5) Pneumatic as well as hydraulic systems use relatively incompressible fluids.

49. Figure shows a balancing mechanism of a hydraulic lift. Cross-sectional area of side A is 0.1 m^2 and cross sectional area of side B is 0.3 m^2. If force, P is 250 N, select the value of Q.
(1) 250 N (2) 150 N (3) 750 N
(4) 200 N (5) 300 N



50. Galvanized Iron (GI) buckets are to be manufactured from 0.7 mm GI sheets. Following assembling methods are to be used for this purpose.
A - Riveting B - Hard soldering
C - Joining D - Gas welding
What are the suitable methods for manufacturing the GI bucket?
(1) A and B only (2) B and C only (3) C and D only (4) A and C only (5) B and D only

* * *

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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 ஓகஸ்ற்
General Certificate of Education (Adv. Level) Examination, August 2015

යාන්ත්‍රික තාක්ෂණවේදය II பொறிமுறைத் தொழினுட்பவியல் II **Mechanical Technology II**	**15 E II**	පැය තුනයි மூன்று மணித்தியாலம் ***Three hours***

Index No. : .....

Important :

- *This question paper consists of **10** pages.*
- *This question paper comprises **Parts A, B and C**. The time allotted for **all parts** is **three hours**. (Use of calculators is **not** allowed.)*

Part A - Structured Essay (07 pages)

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

Part B and C - Essay (03 pages)

- *Select minimum of **two** questions from each of the parts **B** and **C** and answer **four** questions only. Use the papers supplied for this purpose. At the end of the time allotted for this paper, tie the **three parts** together so that **Part A** is on the top of **Part B and C** before handing over to the supervisor.*
- *You are permitted to remove only **Parts B and C** of the question paper from the Examination Hall.*

For Examiner's Use Only

Part	Q. No.	Marks
A	1	
	2	
	3	
	4	
B	1	
	2	
	3	
C	4	
	5	
	6	
Total		
Percentage		

Final Marks

In Numbers	
In Words	

Code Numbers

Marking Examiner 1	
Marking Examiner 2	
Checked by	
Supervised by	

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PART A – Structured Essay

*Answer **all four** questions on this **paper itself**.*

(*Each question carries* **10** *marks*)

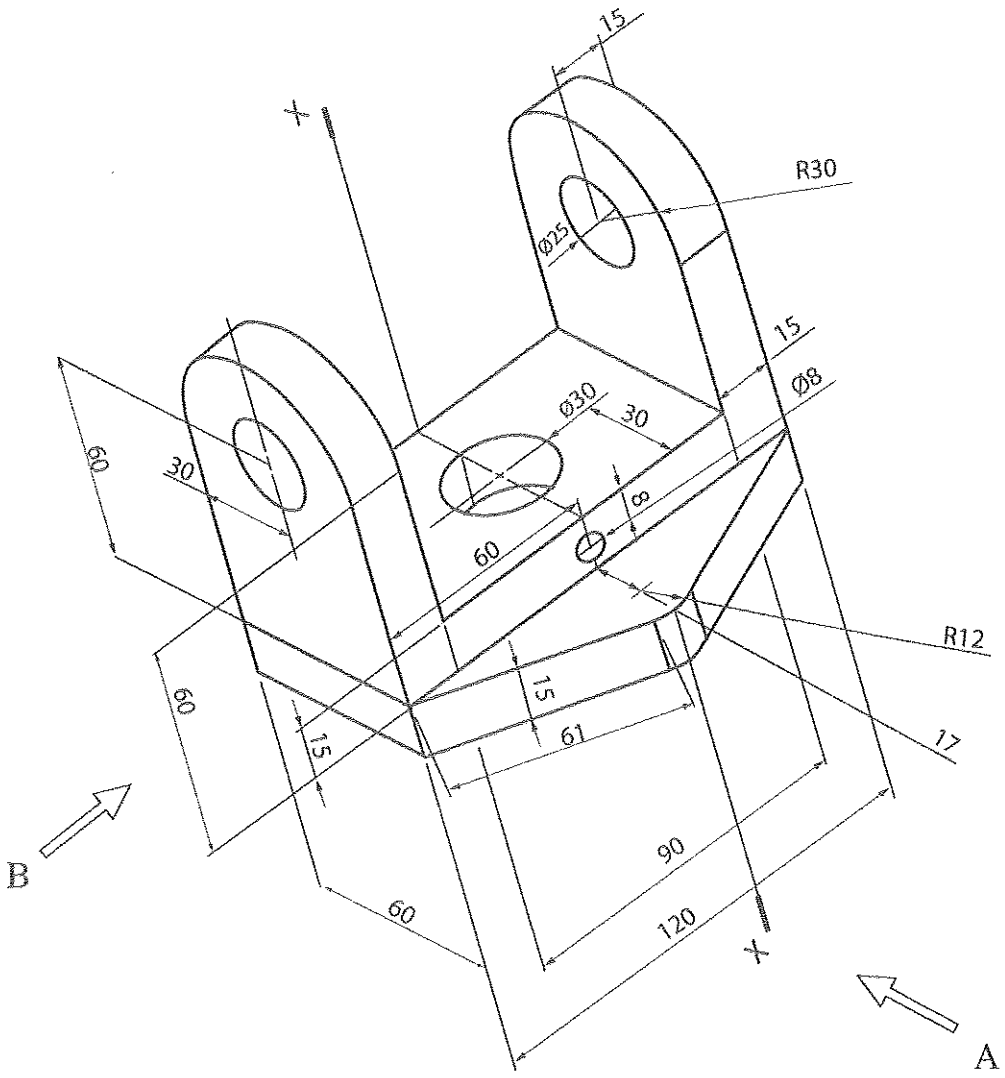
1. An isometric view of a machine component is shown in the figure. The centre hole (ϕ30) passes completely through the component. Machine component is symmetric along the vertical plane passing through **X–X**. Assuming any missing dimensions, draw the following to a suitable scale using first angle projection principle.

   (a) Front elevation seen through direction **A**

   (b) End elevation seen through direction **B**

   (c) Plan

   Show dimensions in the sketches. Use the graph papers given on page 3 and 4 to answer the question. (All dimensions are in mm.)



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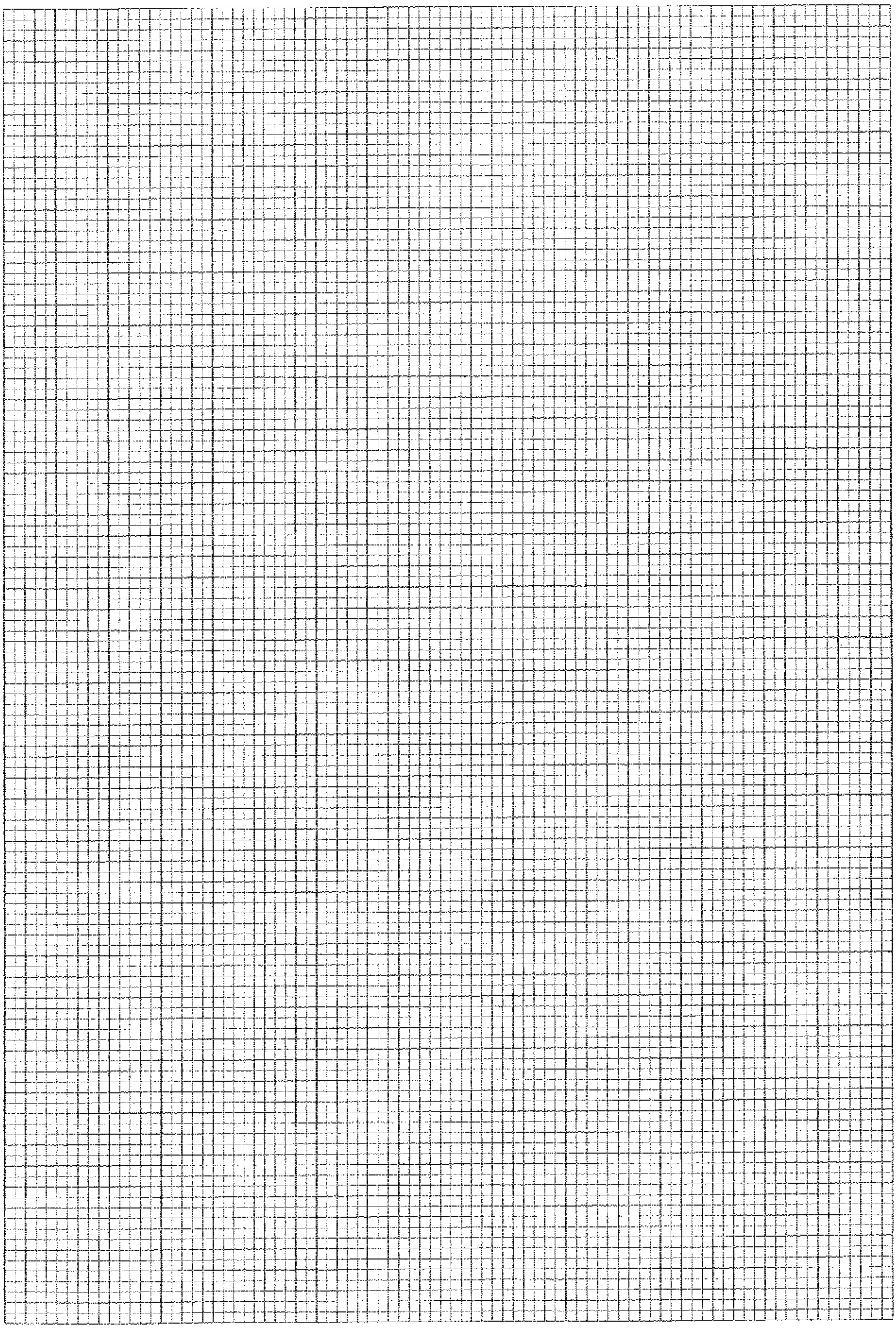

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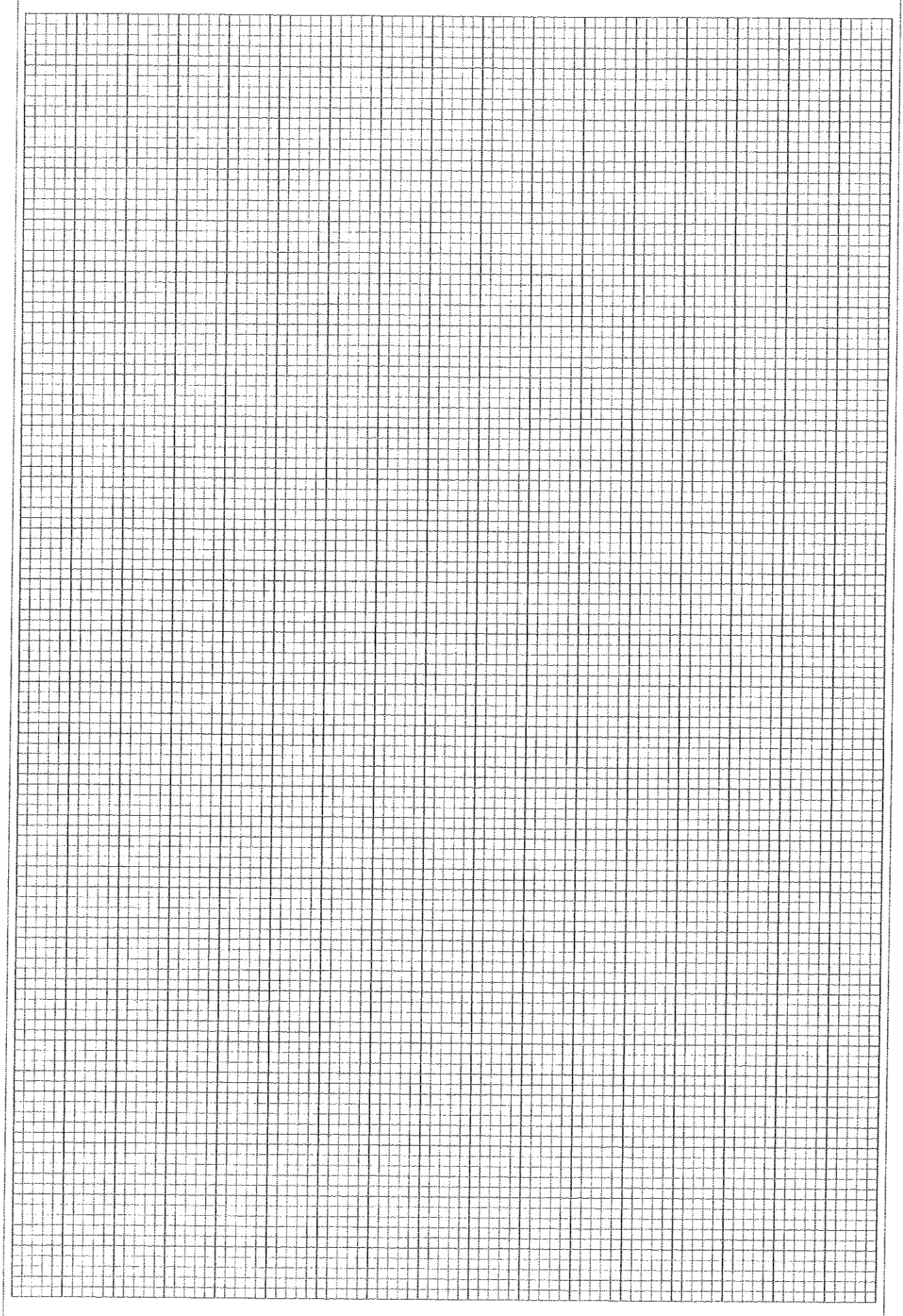

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2. Assume that you are appointed as an IT trainee manager of a hotel. Previously the hotel management has planned to establish a conference room, computer centre and wireless internet facilities in hotel premises. Assume that the previous project proposal is not available now. However, following list of items have already been purchased.

- System units
- Mouse
- Keyboards
- Monitors
- Printers
- Multimedia projector
- Network switches and cables
- Windows operating system
- Microsoft office package

(a) From the purchased items, list hardware and software items seperately.

Hardware : .....

.....

.....

.....

Software : .....

.....

.....

.....

(b) Proposed computer centre will be used for various customer needs, such as preparing documents, presentations, accessing internet and processing photos.

(i) List **three** essential items required to prepare a fully functional computer from available hardware.

1. .....
2. .....
3. .....

(ii) State, from available hardware, a hardware required to create a computer network for the computer centre.

.....

.....

.....

.....

(iii) Identify **two** software requirements for the computer centre in addition to the available ones.

1. .....
2. .....

(c) Proposed conference room will be used for special events, meetings and presentations.

(i) Identify a hardware required for the conference room from the available list.

.....

.....

(ii) Assume that the hotel management decided to have facilities for video conferencing in the conference room. Identify **two** hardware units and a software required for this purpose.

Hardware units

1. .....
2. .....

Software

1. .....

(d) List a hardware item required to purchase to provide the wireless internet facilities.

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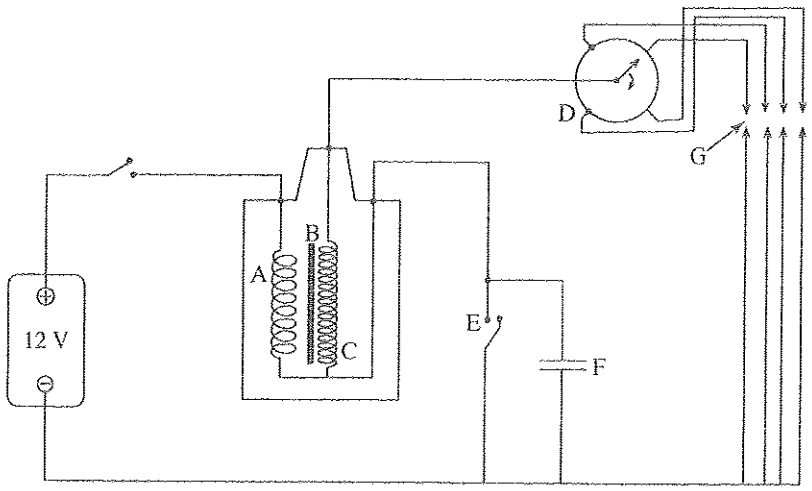
3. Figure shows an electrical circuit of a Spark Ignition system of a motor vehicle. In the figure G represents the spark plugs.



(a) Name A, B, C, D, E and F.

A - ..... B - .....

C - ..... D - .....

E - ..... F - .....

(b) State the function of the ignition coil.

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.....

(c) What is the function of component D in the circuit?

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(d) Which component has the highest possibility to burn easily with the time?

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.....

4. Figure 4 (a) shows how a clutch is used to transmit power from engine to the load.

Clutch

Figure 4 (a)

(a) State the main purpose of a clutch.

.....

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(b) List **two** types of clutches that can be used for the above power transmission.

1. .....

.....

2. .....

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(c) Give **two** disadvantages of use of a clutch for the power transmission.

1. .....

.....

.....

2. .....

.....

.....

(d) Propose a suitable method to transmit torque produced by the engine to the load when two shafts are **not** in the same axis as shown in Figure 4 (b).

Figure 4 (b)

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(e) State **two** reasons for the proposed method in (d).

1. .....

.....

2. .....

.....

* *

[see page eight

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

යාන්ත්‍රික තාක්ෂණවේදය	II
பொறிமுறைத் தொழினுட்பவியல்	II
Mechanical Technology	**II**

15 E II

Essay

* *Select* ***two*** *questions from each of the* ***Parts B*** *and* ***C*** *and answer* ***four*** *questions only.*
(Give concise answers. Sketch clear figures and label them where necessary.
(Each question carries ***15*** *marks.)*

Part B

1. The famous quote about energy is "Energy cannot be created or destroyed". However, energy can be transformed from one form to another. Different types of machines are used to transform energy into useful forms.
   (a) List **five** natural energy sources and state the basic form of energy stored in each source.
   (b) During energy transformation process, losses are inevitable. Briefly describe **three** reasons for energy losses during transformation process.
   (c) Efficiency of the energy transformation process depends on amount of losses in the process. High efficiencies can be guaranteed by reducing the amount of losses. State, how you minimize the energy losses in following processes.
      (i) Power generation at hydro-power plant
      (ii) Use of refrigerator at home
      (iii) Use of electric iron at home
   (d) Demand for energy is continuously increasing in the present society. However, some energy sources are scarce. Therefore, in the present context, different techniques have been implemented to popularize efficient use of energy. The energy club at your school has planned to organise a programme to make the community aware about the efficient use of energy.
      (i) Briefly explain **two** techniques that can be implemented to popularize efficient use of energy.
      (ii) Explain **two** facts you will discuss in the programme about the efficient use of energy in the following areas.
         1. Transportation
         2. Infrastructure development in public areas

2. Technology is very important in the present context in order to improve the quality of human life. Therefore, the influence of technology developments are widespread across the country. Three important areas; civil technology, mechanical technology and electrical, electronics and information technology are identified as some of the key technological areas for today's need. As a student who is following technology stream in advanced level, you have a social responsibility of making the community aware about the technological development in above areas.
   (a) State **three** benefits of making the community aware about the technology developments in above three areas.
   (b) Give **two** types of resources which can be used to make your community aware of the benefits of utilizing technology. Briefly explain how the mentioned resources are utilized for the purpose.
   (c) How do you overcome the resistance of community for the use of technology in identified areas?
   (d) Briefly explain **two** methods to get the attention of authorities (government/non-government) in order to popularize the use of technology in your community.

[see page nine

3. In a road development project of a city, it is expected to redesign the existing road and pavement system to smoothen the current traffic flow and to ensure the safety of pedestrians.

   (a) It is reported that many accidents happen due to cyclists in this city. Explain **one** suggestion to solve this issue in the road development project.

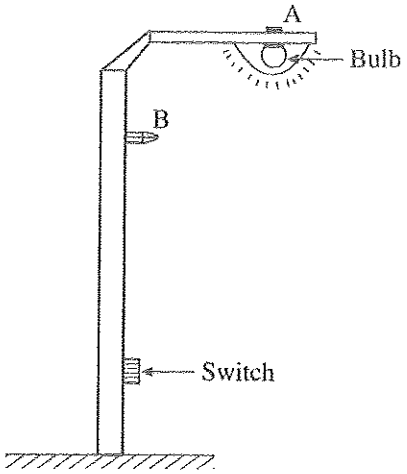
   (b) Propose **two** methods that can be adopted at junctions in order to ensure the safety of blind people.

   (c) Describe **two** methods to reduce the traffic congestion at the junction in the redesign process.

   (d) It has been found that use of personal vehicles is a major factor contributing to traffic congestion in the city. Propose **three** methods to discourage the use of personal vehicles.

Part C

4. In a road development project, it has been decided to install a street light system for the road. Figure shows a street light pole of such a system. A street light pole consists of a bulb, a switch and a control system. In order to turn on the bulb, pedestrians need to on the switch.



   (a) Giving reasons, state the type of control system in street light system.

   (b) You have been asked to modify the above control system so that the bulb should be turned on automatically in the evening/night and turned it off in the morning/day time.

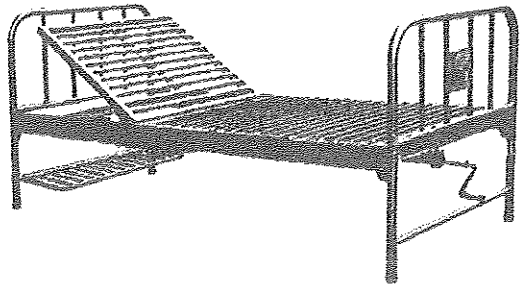
      (i) Give **two** sensors that can be used to distinguish between day and night light conditions.

      (ii) What is the measurement of each sensor?

      (iii) Illustrate the modified control system in a block diagram identifying physical input, output, controller and feedback.

   (c) From position A and B, which position do you select to mount the sensor that you have mentioned in (b) (i)? Justify your answer.

5. Figure shows a hospital bed fabricated using metals.



   (a) Name **one** material each that can be used to fabricate frame and legs. List **two** mechanical properties of each material.

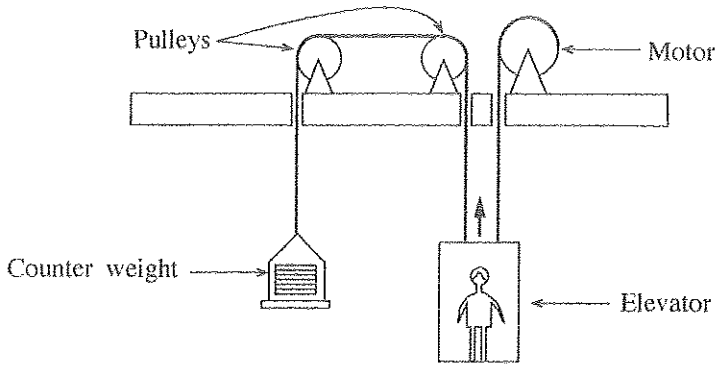
   (b) You are asked to fabricate the above bed. Describe each step of the bed manufacturing process. Use sketches to illustrate your answer.

[see page ten

(c) If you need to move the bed easily from one place to another, what modification can you apply?

(d) A mechanism is to be designed to adjust the height of this bed. Propose a suitable mechanism for this purpose.

6. A diagram of a passenger elevator system is given below. It consists of a motor, a counter weight, pulleys, an elevator cage and a rope.



(a) What are the forces acting on the elevator cage shown in the figure when it is at rest. Indicate the forces in a diagram.

(b) The elevator is moving from floor 1 to 3 as follows. It begins to accelerate upward from rest at 2 m/s^2 and accelerates for 1s. Then moves with constant upward velocity for 3s and begins to decelerates 2s until it approaches its destination.

(i) Calculate all the relevant velocities and accelerations in each step of the trip.

(ii) Draw the velocity-time and acceleration-time graphs for this trip.

(c) The elevator is to be used by a disabled person. Briefly describe **three** features that should be included in the elevator.

(d) State a reason for including counter weight for the elevator system.

* * *