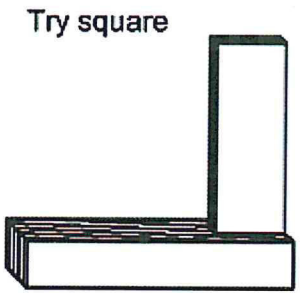
4.20 ELECTRICITY (448)

4.20.1 Electricity Paper 1 (448/1)

1. (a)	Four types of conducting materials. - Copper - Aluminum - Zinc - Silver - Iron **Any 4 x ½ = 2**	**(2 marks)**
(b)	**Advantages of circuit breakers.** - The overload tripping characteristics are set by the manufacturer and cannot be altered. - Faulty circuits can be easily identified. - Supply can be quickly and easily restored when fault has been cleared. **Any 3 x 1 = 3**	**(3 marks)**
2. (a)	**Reasons that may cause a business or entrepreneur to fail.** - Selection of business (poor). - Poor marketing. - Initial starting capital low. - Poor location of business. **Any 2 x 1 = 2**	**(2 marks)**
(b)	**Causes of accidents in a workshop.** - Carelessness - Ignorance - Improper dressing **Any 2 x 1 = 2**	**(2 marks)**
3. (a)	**Parts of a d.c machine** **(i) Commutator** - It is made of copper bars insulated from each other by Mica. The armature coils are connected to the commuter bars and so make contact with brushes.	**(2 marks)**

	(ii) Armature - It's the rotating part of the machine and usually consists of laminated iron cylinder with slots equally spaced around its circumference. Coils are usually fitted into the slots to form the armature winding.	**(2 marks)**
(b)	Iron losses - Hysteresis loss is the heating of the core as a result of internal molecular structure reversals which occurs as the magnetic flux alternates. - Eddy current loss is the heating of the core due to emf's being induced not only in the transformer windings but also in the core.	**(1 mark)** **(1 mark)**
4. (a)	(i) **Try square**  Correct sketch=1 (ii) This is used for setting lines at right angles to a face or edge and for testing surfaces at 90° to each other. (1 mark)	**(2 marks)**

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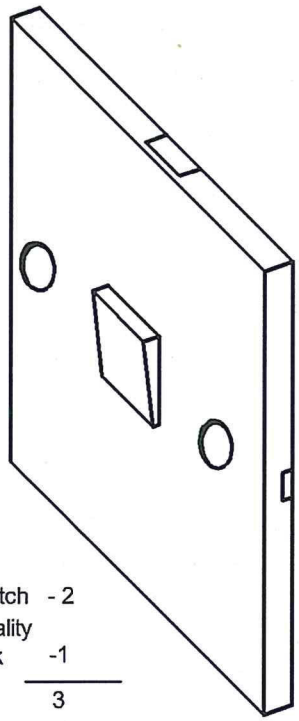
(b)	**Switch**  correct sketch - 2 Proportionality of line work -1 3	**(3 marks)**
5. (a)	**Functions of a controlling torque** - It increases with the deflection of the moving system so that the final position of the pointer will be according to the magnitude of electrical quantity to be measured. - It brings the pointer back to zero position. **(2 x 1 = 2 marks)**	**(2 marks)**
(b)	**Types of moving coil instruments** - Permanent magnet moving type. - Dynamo type of meter. **2 x ½ = 1**	(1 mark)

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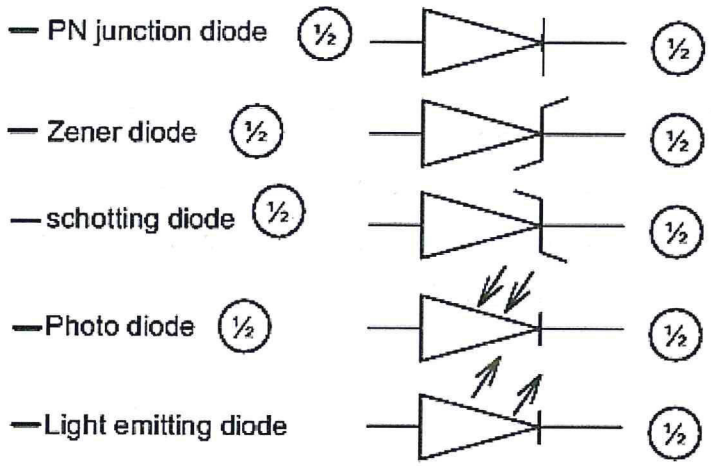
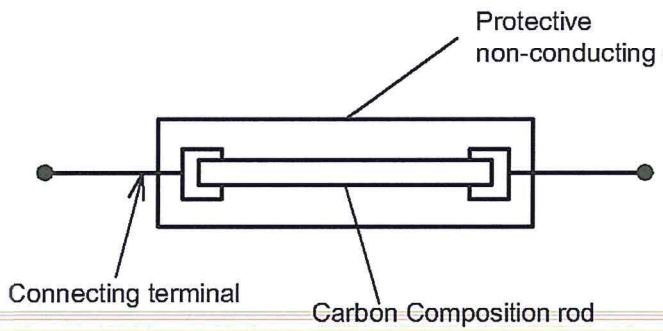
6. (a)	**Methods of demagnetization** - Heated to bright red hot then cooled away from a magnetic field. - Subjected to mechanical shocks such as jarring, vibrations or hammering. - Inserted in an alternating current coil and then slowly withdrawing from the coil.	**(3 marks)**
(b)	Non-magnetic materials - Copper - Aluminum - Silver - Paper **Any 2 x ½ = 1**	**(1 mark)**
7.	 (Any 3× 1 = 3 marks) **Any 3 x 1 = 3 marks)**	**(3 marks)**
(b)	**Difference between a switch and a diode.** The switch being mechanical is capable of conducting current in either direction while the diode only allows current to flow through it in one direction.	**(2 marks)**

(c)	Disposal of electrical waste - Burying deep in the ground. - Recycling, removing useful components. **(Any 2 x ½ = 1)**		**(1 mark)**
8.	(i)	P.d. across R_1 is the same as the supply voltage v. Hence supply voltage V = 4 x 5 = 20V.	**(1 mark)** **(1 mark)**
	(ii)	Reading on ammeter $I_2 = \frac{V}{R_2} = \frac{20}{10} = 2A$	**(2 marks)**
	(iii)	Current flowing through R_3 11 - 4 - 2 = 5A Hence $R_3 = \frac{V}{I_3} = \frac{20}{5} = 4\Omega$	**(1 mark)** **(1 mark)**
9. (a)	**Carbon resistor** Carbon Resistor  Correct drawing -½×3 =1½ Correct labelling -½×3 =1½ 3 marks		**(3 marks)**

(b)	**Inductance** It's the property of a circuit whereby there is E.M.F. induced into the circuit by the change of flux linkages produced by a current change.	**(2 marks)**
10.	**(a) Tests carried out on an electrical installation** - Polarity test ; ohmmeter - Continuity test; ohmmeter - Insulation test; megger - Earth test; Earth loop tester. **Any 3 x 1 = 3** **(b) Electrical Engineering** - Power option - Telecommunication option - Instrumentation option - Electronics **Any 2 x ½ = 1**	**(3 marks)** **(1 mark)**

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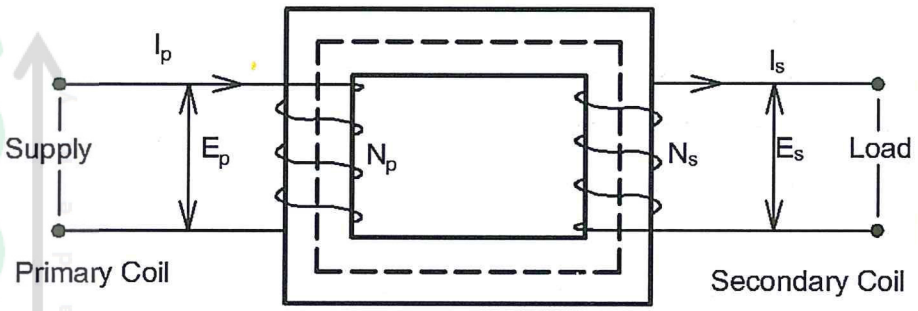
SECTION B

11. (a)



Correct drawing -½×3 =1½

Correct labelling -½×7 =3½

5 marks

(5 marks)

(b) (i) $V_1 = 240V, V_2 = 12V$

½ ½

$$I_2 = \frac{P}{V_2} = \frac{120}{12} = 10A$$

(1 mark)

1 1

$$\frac{V_1}{V_2} = \frac{I_2}{I_1} \text{ from which } I_1 = I_2\left(\frac{V_2}{V_1}\right)$$

(2 marks)

Hence current taken from the supply I^1

$$\Rightarrow I_1 = \frac{10\times12}{240} = 0.5A$$

(1 mark)

(ii) Turns ratio

½ ½

$$\frac{N_1}{N_2} = \frac{V_1}{V_2} = \frac{240}{12} = 20$$

(1 mark)

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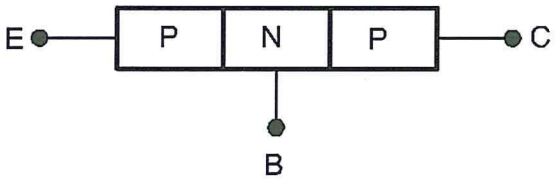
(c)	**Centrifugal switch** - It is normally attached to the rotating part of the motor and is normally closed. - As the motor starts rotating and approaches the synchronous speed the switch opens thereby removing the starting winding from the supply and the motor runs with only one winding. - The centrifugal switch is used to isolate the starting winding when the motor starts so that the winding does not burn since it is rated to run continuously.	**(1 mark)** **(1 mark)** **(1 mark)**
12. (a)	 Correct drawing -½×3 =1½ Correct labelling -½×3 =1½ 3 marks Emitter –it forms the left hand section or region as shown. It is more heavily doped than any other regions because its function is to supply majority carriers. Base – it forms the middle section. It is very thin as compared to other regions and lightly doped. Collector – it forms the right hand side section or region of the transistor. It's function is to collect majority charge carriers coming from the emitter.	**(3 marks)** **(2 marks)** **(2 marks)** **(2 marks)**

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(b) **Truth table OR gate**

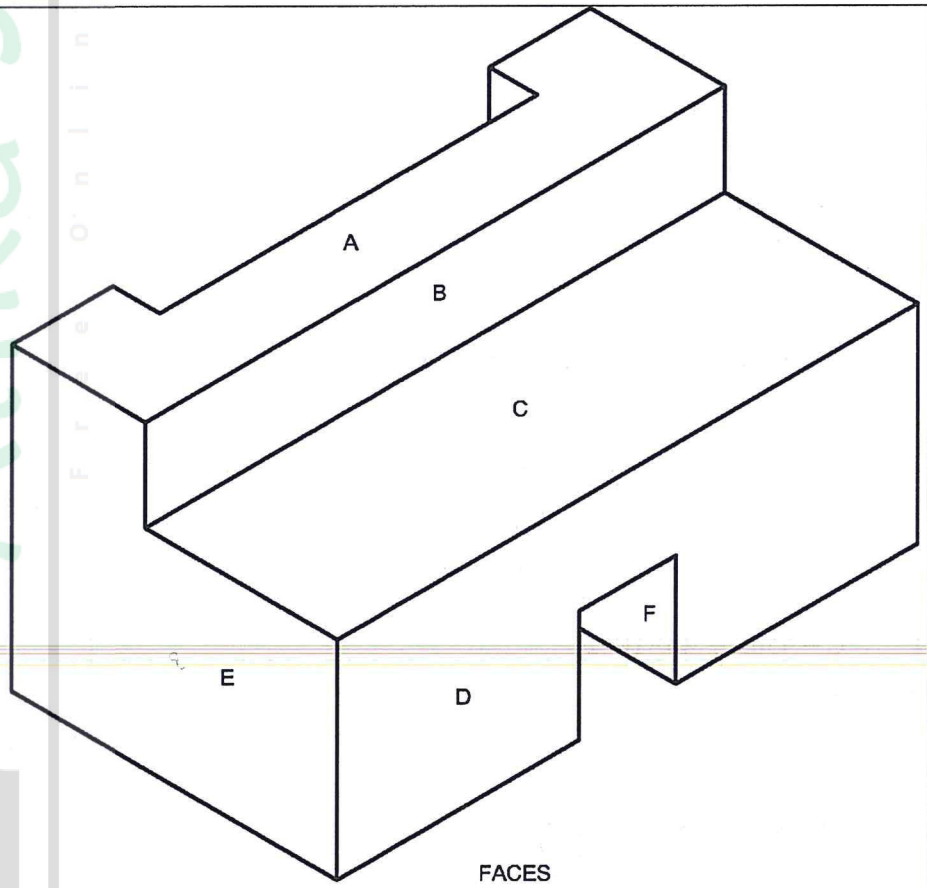
A	B	C
0	0	0
0	1	1
1	0	1
1	1	1

Inputs 4 x ½ = 2

Output 4 x ½ = 2

4 marks **(4 marks)**

13. (a)



FACES
A–2
B–1
C–1
D–3
E–3
F–1
Corner P –1
Line work/ Neatness– 1

13 marks

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14. (a)	(i)	A – Voltage B – Cycle C – Instantaneous value D – Peak value E – Time F – Peak to peak value 6 x @ ½ = 3	**(3 marks)**
	(ii)	For a sine wave	
		I) Mean value = 0.637 x maximum value (½)	**(1 mark)**
		Hence maximum value = $\frac{\text{mean value}}{0.637}$ (½)	
		$= \frac{120}{0.637} = 188.38\text{V}$ (½ ½)	**(1 mark)**
		II) R.M.S. value = 0.707 x Max value (½)	
		= 0.707 x 188.38 = 133.187V	**(1 mark)**
	(b)	R = 20Ω C = 45μF = 45×10^{-6}F V = 240V F = 50Hz	**(1 mark)**
		(i) Capacitive reactance $Xc = \frac{1}{2\pi fc}$	
		$\Rightarrow X_c = \frac{1}{2\pi(50)45\times10^{-6}} = 70.74\pi$	**(1 mark)**

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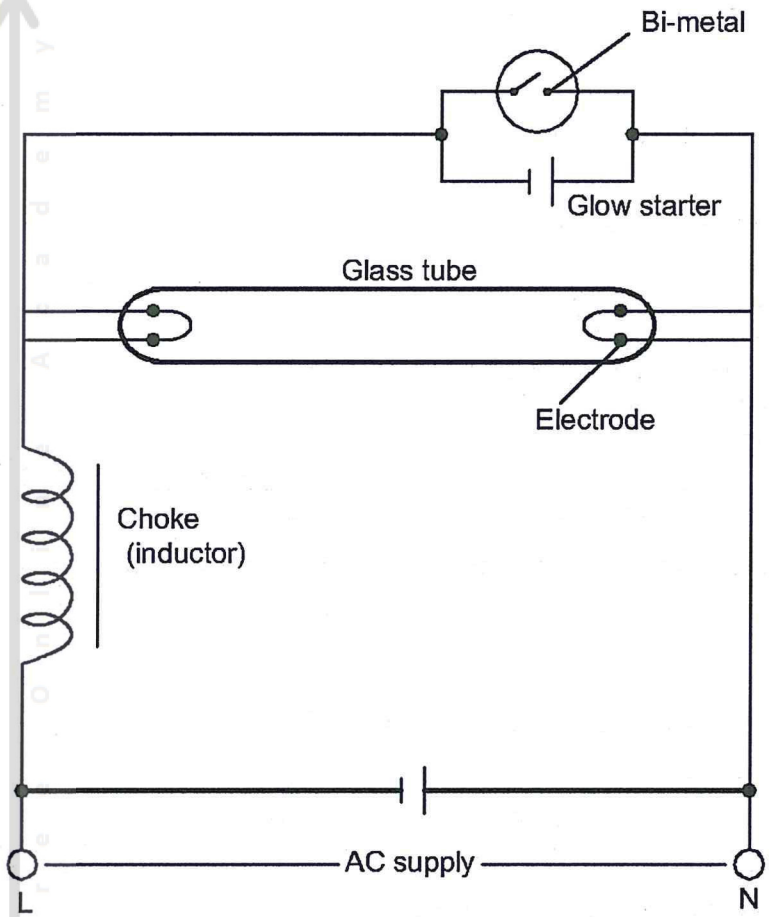
	(ii) Impedance $Z = \sqrt{R^2 + X_c^2}$	(1 mark)
	$= \sqrt{(20)^2 + (70.74)^2} = 73.51\pi$	(1 mark)
	(iii) Current $I = \frac{V}{Z} = \frac{240}{73.51} = 3.26A$	(1 mark)
	(c) Applications of electromagnets - Loudspeakers - Measuring instruments - Motors, generators - Door bells, buzzers, chimes - Circuit breakers - Relays **Any 4 x ½ = 2**	(2 marks)
15. (a)	Action to be taken on a victim in contact with live conductors: - Find the isolator for that circuit quickly and turn off the supply OR	(1 mark)
	- Break the person's contact with the supply by use of some insulating material such as a coat or broom handle (so as to avoid shock yourself).	(1 mark)
	- Lower the victim to the floor carefully and make him comfortable.	(1 mark)
	- If the victim is unconscious, and not breathing, begin emergency resuscitation.	(1 mark)
	- Get in touch with the doctor and report to appropriate personnel.	(1 mark)
(b)	**IEE regulations regarding 13A sockets.** - Each socket outlet of a twin or multiple socket is regarded as one socket outlet. - The number of spurs should not exceed the number of socket outlets in the circuit. - No standard socket outlet should not be connected in a room containing a bath. - Adjacent socket outlets should be in the same phase of supply.	(2 marks)
	Any 2 x 1 = 2	

(c) (i) **Fluorescent circuit;**

Fluorescent Circuit



Correct drawing 2 marks

Correct labelling Any 4 × ½ = 2 marks

4 marks **(4 marks)**

(ii) Lamp fails to start and there is no end glow.

- No supply or fuse is broken.
- Tube life span expired.
- Burnt starter.
- Burnt choke.
- Broken electrode terminals.

Any 2 x 1 = 2 **(2 marks)**

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