CONTENT AREAS AND TEST SPECIFICATION TABLE FOR APPLIED ELECTRICITY

	Content Areas	Competencies	Descriptive statement	Course Objectives/Outcomes (DOK)				Total
				Level 1 (Recall)	Level 2 (Skills)	Level 3 (Strategic Thinking)	Level 4 (Extended Thinking)	
1	Health, Safety and Protection.	• Recognize potential health and safety hazards in handling materials and equipment in the workshop. • Demonstrate knowledge of safety in the use of tools and materials in the workshop.	• Identify various types of electrical protective devices. • Outline safe working procedures and safety regulations • Explain appropriate uses of fire extinguishers. • Describe safety procedures • Describe precautions to be observed when working with electricity • Apply safety principles when working with electricity.	2	1	1	1	5
2	Direct Current Circuit Theory	• Demonstrate knowledge in the application of Ohm's law • Demonstrate understanding of the application of Kirchhoff's laws • Be aware of the types of resistors used in circuits.	• Describe types of resistors and their properties • Select any nominal value of resistor using colour codes. • Connect resistors in series and parallel. • Determine the power rating of a resistor. • Explain Ohm's law • Apply Ohm's law in a simple circuit • prove Ohm's law • Explain Kirchhoff's laws • Apply Kirchhoff's laws in simple circuits. • Analyse circuits with two loops using Kirchhoff's laws • Prove KCL and KVL • Identify various conductors and insulators, describe their properties and uses • Describe the nature of resistivity of a conductor. • Solve problems involving resistivity. • Examine the temperature coefficient of resistance and show its applications • Distinguish between power and energy in D.C. circuits. • Solve problems involving power and energy.	2	2	4	4	12

3	Magnetic Field and Circuits	• Demonstrate knowledge in the application of magnetisation and demagnetization. • Demonstrate understanding of the concept of electromagnetism.	• Identify types of magnets and describe their applications. • Identify materials that have magnetic properties and explain their usage in applied electricity. • Solve problems involving simple magnetic circuits. • Describe the magnetization and demagnetization of a magnetic material • Analyse the B/H curve and the hysteresis loop. • Assess the magnetic field around a current-carrying conductor and a solenoid when the direction of current is known • Determine a force on a current-carrying conductor in a magnetic field. • Explain Lenz's law and Fleming's Right-Hand Rule and their applications in applied electricity. • Determine the induced electromagnetic force (E.M.F). in a conductor cutting a magnetic field • Distinguish between self and mutual induction and solve problems involving self and mutual induction. • describe the applications of electromagnetism. • calculate the energy stored in a coil.	1	2	3	1	7
4	Electric Field and Circuits	• Demonstrate understanding of the concepts of electric field and magnetic field and their relationship • Demonstrate understanding of applications and calculations on capacitors	• state the importance of the electric field • explain the electric field and its properties. • explain types of capacitors. • explain the capacitance of a capacitor • state the relationship between charged and applied voltage of a capacitor. • relate the voltage rating of a capacitor to its application • solve problems involving capacitors in series and in parallel. • develop relations for series and parallel connection of capacitors • calculate the energy stored in capacitors. • compare total capacitance in series and parallel circuits	1	2	3	1	7

5	Measurement and Instruments	• Demonstrate knowledge of the principle of operation of measuring instruments. • Demonstrate skills in the use of measuring instruments. • Demonstrate skills in the use and care of the digital multi-meter for the measurement of quantities. • Demonstrate knowledge and skills in using the CRO for measuring waveform and voltage.	• explain the operation of the moving coil instrument. • describe the construction of a moving coil instrument. • describe the use of a galvanometer to measure resistance. • outline the advantages and disadvantages of moving coil instruments • convert a moving coil galvanometer to an ammeter or voltmeter. • compare MI to MC instruments • solve problems involving shunts and multipliers. • explain the operations of moving iron instruments. • state the advantages and disadvantages of moving iron instruments. • describe the construction of a moving iron instrument. • explain the function of the controls on CRO. • describe the application of CRO • draw a block diagram of CRO and explain the function of the blocks. • deduce voltage from waveforms measured by CRO	4	4	2	1	11
6	Alternating Current Circuit Theory	• Demonstrate knowledge and skills for solving problems connected with the alternating current generation. • Demonstrate knowledge and skills for solving problems connected with single-phase and 3-phase circuits • Demonstrate awareness of the effect of frequency on components in a circuit.	• identify and explain the various A.C. quantities. • solve problems involving RL and RC series circuits. • explain the conditions at which resonance occurs. • draw phasor diagram for RL and RC series circuit. • explain the characteristics of the RLC circuit and solve problems involving the RLC series circuit. • draw a phasor diagram for the RLC circuit. • explain the power factor and the effect of a low power factor. • determine power in a single-phase and 3-phase circuit. • solve problems involving active, apparent and reactive power. • analyse the relationship between star delta connections. • connect star and delta system of 3-phase and measure line and phase voltages and currents • solve problems involving line voltage and phase voltage, line current and phase current.	2	2	4	4	12

7	Transformers	• Be aware of the principles of operation of a transformer. • Be aware of the effects of losses in a transformer. • Recognize the importance of cooling a transformer. • Demonstrate knowledge and skills for solving problems connected with voltage regulation	• identify types of transformers and describe their construction • explain the principles of operation of a transformer. • solve problems involving the transformation ratio • identify the losses in a transformer. • describe the effects of losses in a transformer • determine losses in a transformer and explain its effect on efficiency. • identify and demonstrate various methods of cooling power transformers. • explain the importance of cooling a transformer. • explain voltage regulation. • explain the effects of load on the voltage regulation of a transformer • calculate the voltage regulation of a transformer.	2	3	3	-	8
8	Semi-Conductor Devices	• Demonstrate an understanding of the principles of semiconductor devices. • Recognize the difference between n-type and p-type materials.	• list the electrical properties of semiconductor materials in terms of the Periodic Table • differentiate between n-type and p-type semiconductor materials and their formation • explain the difference between forward and reverse biasing with reference to the P.N. diode. • draw a symbol of a P.N junction diode and explain the formation of the p-n junction diode • applications of P.N. diode	1	1	2	-	4
9	Electrical Energy Supply	• Demonstrate knowledge of the concept of power generation. • Develop an awareness of the layout of substations and items installed in substations.	• explain the various methods of generating electrical power. • explain the different classification of energy • renewable energy systems	1	2	2	-	5
10	Direct Current Machines	• Demonstrate knowledge of D.C. generators and motors. • be aware of the relationship between D.C. generators and motors.	• identify and list the parts of D.C. generators. • explain the principle of operation of D.C. generators and methods of connecting field windings. • identify the type of D.C. motors. • explain the principles of operation of D.C. motor and state methods of starting. • explain the applications for D.C. motors. • dismantle and describe the construction of motors • analyse various methods of speed control of D.C motors is varied.	2	2	4	3	11

11	Alternating Current Machines	• Demonstrate understanding of A.C. generators • Demonstrate understanding of A.C. motors	• identify the parts of an alternator. • identify types of Alternators. • explain the principles of operation of an alternator • explain the relationship between speed, the number of poles and frequency • identify types of three-phase and single-phase motors. • explain the principles of operation of an A.C. motor. • describe the application of AC. motors. • describe methods of starting 3- phase motors. • select and connect appropriate starters for different types of AC machines	1	2	4	3	10
12	Digital Electronic	• Demonstrate understanding of binary numbers and their various conversions with other number systems. • Demonstrate knowledge of the functions of the logic	• convert decimal numbers to binary numbers and vice versa. • explain each function and draw the truth table for each Boolean expression from a truth table and implement. • state the functions of the logic gates.	1	1	-	-	2
13	Communication	• Demonstrate knowledge of the concept of communication. • Demonstrate knowledge of the principle of modulation and waveforms.	• state the relationship between velocity, frequency and wavelength. • sketch the waveforms and explain amplitude modulation. • sketch waveforms and explain frequency modulation.	1	1	-	-	2
14	Electrical Wiring	• Demonstrate skills in electrical wiring. • Appreciate the importance of IEE/Ghana Code Wiring regulations.	• identify types of cables and accessories. • identify the size of cables and their current ratings • connect wire lighting circuit and socket outlets (ring and radial circuits) and connect plugs. • analyse conduit, surface and trucking installations. • explain the function of protective devices • select suitable sizes of protective devices for installation. • explain the earth loop impedance of an installation • explain the reason for earthing. • demonstrate the method of earthing.	1	1	1	1	4
			Total	**20%**	**25%**	**35%**	**20%**	**100%**

TABLE OF SPECIFICATION FOR APPLIED ELECTRICITY

	CONTENT AREAS	Course Objectives/Outcomes (DOK)				Total
		Level 1 (Recall)	Level 2 (Skills/Concepts)	Level 3 (Strategic Thinking)	Level 4 (Extended Thinking)	
1	Health, Safety and Protection.	1	1	1	2	**5**
2	Direct Current Circuit Theory	2	2	3	5	**12**
3	Magnetic Field and Circuits	1	2	3	1	**7**
4	Electric Field and Circuits	1	2	3	1	**7**
5	Measurement and Instruments	1	3	3	4	**11**
6	Alternating Current Circuit Theory	1	2	4	5	**12**
7	Transformers	1	3	3	1	**8**
8	Semi-conductor Devices	1	1	2	-	**4**
9	Electrical Energy Supply	1	2	1	1	**5**
10	Direct Current Machines	1	2	3	5	**11**
11	Alternating Current Machines	1	2	3	4	**10**
12	Digital Electronic	1	1	-	-	**2**
13	Communication	1	1	-	-	**2**
14	Electrical Wiring	1	1	1	1	**4**
Total		**15%**	**25%**	**30%**	**30%**	**100%**