BASIC ELECTRONICS/ ELECTRONICS

PREAMBLE

The syllabus is intended to equip candidates with broad understanding of the technology of manufacturing, maintenance and repair of domestic and industrial equipment. It will also offer candidates sufficient knowledge and skills to form valuable foundation for electronic-related vocation or pursue further educational qualifications.

Candidates will be expected to cover all the topics.

OBJECTIVES

The objective of the syllabus is to test candidates'

(1) knowledge and understanding of the basic concepts and principles of electronics;

(2) ability to use simple electronic devices to build and test simple electronic systems;

(3) problem-solving skills through the use of the design process;

(4) preparedness for further work in electronics;

(5) knowledge in entrepreneurial skills and work ethics.

SCHEME OF EXAMINATION

There will be three papers, Papers 1, 2 and 3, all of which must be taken. Papers 1 and 2 shall be composite paper to be taken at one sitting.

PAPER 1: will consist of fifty multiple-choice objective questions all of which are to be answered in 1 hour for 50 marks.

PAPER 2: will consist of seven short-structured questions. Candidates will be required to answer any five in 1 hour for 50 marks.

PAPER 3: will be a practical paper of two experiments both of which are to be carried out by candidates in 3 hours for 100 marks.

Alternative to Practical Test

Alternatively, in the event that materials for the actual practical test cannot be acquired, the Council may consider testing theoretically, candidates' level of

acquisition of the practical skills prescribed in the syllabus. For this alternative test, there will be two compulsory questions to be answered within 2 hours for 100 marks.

DETAILED SYLLABUS

CONTENTS	NOTES
1. ELECTRON EMISSION	
Types of electron emission	Qualitative treatment should include :
Application of electron emission	Thermionic emission; photoemission; secondary emission and field emission. Relate it to diode, triode, tetrode, pentode, and cathode ray tube.
2. MEASURING INSTRUMENTS	Qualitative treatment only which should include:
Concepts of measuring instrument	Classification – analogue and digital
Principles of operation and protection of measuring instruments	Types and uses of multimeter, voltmeter, ammeter, ohmmeter, oscilloscope etc.
3. SEMICONDUCTOR	Qualitative treatment only.
Concepts of semiconductor	
Semiconductor materials (silicon, germanium etc.)	

Doping Formation of p-type and n-type semiconductors.	Treatment should include operational principles of diodes
SEMICONDUCTOR DIODES Concept of diodes	Type of diodes Diode ratings – voltage, current and power Application of diodes
Biasing of diodes	Construction of a simple circuit using a P-N junction diode Practical demonstration of I-V characteristics of P-N junction diode in the forward and reverse bias modes.
TRANSISTORS Concepts of transistor	Meaning of transistor, biasing of transistor, Uses and advantages. BJT characteristics Advantages of transistor over valves Advantages of MOSFET over BJT
	Formation, function and principles of Operation. Transistor as a switch, inverter, an amplifier Verification of BJT characteristics. Input, output and transfer characteristics

	Transfer configuration Qualitative treatment only – formation, functions and principles of operation Advantages over discrete components
OTHER SEMICONDUCTOR DEVICES Thermistor, diac, triac and thyristor, etc	Circuit symbols Principles of operation Applications.
INTEGRATED CIRCUITS	Application of integrated circuits Explanation of RAM, ROM and EPROM
4. CIRCUIT ANALYSIS	
ELECTRIC CURRENT Structure of atom Conductors and insulators Direct and alternating current Sources of direct current Sources of alternating current	Qualitative treatment only Uses of conductors and insulators Differences between direct and alternating current

RELATIONSHIP BETWEEN VOLTAGE, CURRENT AND RESISTANCE Current, voltage and resistance. Ohm's law Simple calculation of current, voltage and resistance. **ELECTRIC POWER** Concept of electric power Relationship between power, current and voltage. Other formulae for finding electrical power Calculation of electric power in a given circuit **CIRCUIT COMPONENTS** Types of resistors, capacitors and inductors Symbols, signs and unit of measurement Colour coding and rating of resistors and capacitors **ELECTRIC CIRCUIT**	Construction of simple circuit to demonstrate Ohm's law Qualitative and quantitative treatments Practical determination of the value of a fixed colour code resistor Carry out practical wiring of different circuit arrangement

Electric circuit Circuit boards Circuit arrangement: series, parallel, series-parallel Calculation on circuit arrangement **ALTERNATING CURRENT CIRCUITS** R-L-C circuits Generator principles **POWER IN A.C. CIRCUITS**	Qualitative and quantitative treatments should include - Concepts of capacitive reactance, inductive reactance and impedance - RL and RC circuits - Calculations of capacitive reactance (X_C) and inductive reactance (X_L) - Resonance frequency Principles of operation of an a.c. generator Qualitative and quantitative treatments of - Power and power triangle - Power factor and its correction - Advantages and disadvantages of power factor correction - Calculation of power factor - Q-factor and bandwidth Biasing methods. Treatment of the transistor as single stage. Common-emitter amplifier. Frequency response of an amplifier Advantages and disadvantages of negative feedback

5. AMPLIFIERS	
	Classification: Class A, Class B, Class AB,
VOLTAGE AMPLIFIERS	Class C, application, power gain, methods of
	biasing and efficiency.
	Classification of power gain.
	Qualitative treatment including matched and complementary pairs.
	Properties of an ideal operational amplifier
	Inverting and non-inverting operational amplifiers(op-amps)
	Types of operational amplifiers
POWER AMPLIFIERS	Applications of op-amps
	Simple calculations involving inverting, non-inverting, summing amplifiers and voltage follower
	Dry cells, solar cells, cadium cells, accumulators
PUSH-PULL AMPLIFIERS	Batteries: Rechargeable and non-rechargeable
	Qualitative treatment should include:

OPERATIONAL AMPLIFIERS	- Rectification, regulation - Types of voltage regulator e.g. diac, triac, thyristor, series voltage regulator, transistorized electronic voltage regulator Functions of each block
6. POWER SUPPLY **D.C. POWER SUPPLY UNIT** **RECTIFICATION**	Difference between positive feedback(oscillator) and negative feedback (amplifier) Principles of an oscillator Types of oscillators: Hartley, Colpitts, phase shift, tuned (load and crystal) oscillators Advantages of negative feedback Calculations involving negative feedbacks Block diagram of an oscillator Application of oscillator
7. OSCILLATORS, MULTIVIBRATORS	Types of multivibrators (monostable, bistable and astable) Different number system e.g. binary, octal and hexadecimal

AND DIGITAL BASICS **OSCILLATORS** **MULTIVIBRATORS** **(Non-sinusoidal)** Principles of operation and applications **DIGITAL BASICS** Number system	Simple calculation in binary number Conversion from one base to another and vice-versa Addition and subtraction of binary numbers Qualitative treatments of AND, OR, NOT, NOR and NAND Logic gates using switching arrangements, truth table and Boolean expression Relationship between velocity frequency and wave length Meaning of radio communication Modulation and demodulation Advantages of F.M. over A.M. Phase modulation (mention only) Types of radio receivers Advantages of superheterodyne over direct input receiver Use faulty radio and detect and repair fault Project work on construction and designing of a simple radio receiver Block diagrams of A.M. and F.M. transmitters Block diagrams of A.M. and F.M.

Logic gates(Combinational)	superheterodyne radio receivers Block diagrams of mono and colour T.V.chrome receivers Functions of each block and direction of signal flow Qualitative treatment of T.V. standard (NTSC,PAL,SECAM,BIG)
8. COMMUNICATION SYSTEMS, TRANSDUCERS AND SENSORS	Fibre optics, microwave, satellite, cellular phone, digital communication network, etc.
Electromagnetic waves. characteristics of radio waves Principles of radio waves	Meaning of transducers and sensors Principles of operation Types and uses to include: Acoustic, dynamic electrostatic, electromagnetic, capacitive, pressure sensor, photoelectric, proximity sensor etc. Thermistor as a temperature sensing device
Stages of radio receiver Fault detection in radio receiver	Qualitative treatments only Types of acoustic transducers e.g. loudspeaker, microphone, earphone Principles of operation and function Application of acoustic transducers
Transmitters and receivers	Qualitative treatment only - Types of control circuits(open and close loop) - Principle of operation of open loop and close loop

	Qualitative treatment only - Meaning - Principle of operation, types, uses and application e.g. in car, doors, booths etc.
Methods of Communication	Trace magnetic lines of force current-carrying conductor Lenz's and Faraday's laws.
Transducers and Sensors	Definitions only Calculations involving energy stored in a coil Applications of electromagnetism Electric bell, solenoid, loudspeaker, buzzer, moving-coil instrument, moving-iron instrument, earphone and microphone
Acoustic transducer	

9. CONTROL SYSTEM **SERVO MECHANISM** **10. MAGNETIC AND ELECTRIC FIELDS, ELECTROMAGNETIC INDUCTION/TRANSFORMERS** Electromagnetic field Electromagnetic induction Self and mutual induction	
