**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**

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| **CONTENTS** | **NOTES** |
| 1. **ELECTRON EMISSION**

 Types of electron emission  Application of electron emission1. **MEASURING INSTRUMENTS**

Concepts of measuring instrumentPrinciples of operation and protection of measuring instruments1. **SEMICONDUCTOR**

Concepts of semiconductorSemiconductor materials (silicon, germanium etc.)DopingFormation of p-type and n-type semiconductors.**SEMICONDUCTOR DIODES** Concept of diodes  Biasing of diodes **TRANSISTORS**Concepts of transistor **OTHER SEMICONDUCTOR** **DEVICES**  Thermistor, diac, triac and thyristor, etc **INTEGRATED CIRCUITS** 1. **CIRCUIT ANALYSIS**

**ELECTRIC CURRENT**Structure of atom Conductors and insulatorsDirect and alternating currentSources of direct currentSources of alternating current**RELATIONSHIP BETWEEN VOLTAGE, CURRENT AND RESISTANCE**Current, voltage and resistance.Ohm’s lawSimple calculation of current, voltage and resistance.**ELECTRIC POWER**Concept of electric power Relationship between power, current and voltage.Other formulae for finding electrical powerCalculation of electric power in a given circuit**CIRCUIT COMPONENTS**Types of resistors, capacitors and inductorsSymbols, signs and unit of measurementColour coding and rating of resistors and capacitors**ELECTRIC CIRCUIT**Electric circuitCircuit boardsCircuit arrangement: series, parallel, series-parallelCalculation on circuit arrangement **ALTERNATING CURRENT           CIRCUITS**R-L-C circuits  Generator principles**POWER IN A.C. CIRCUITS**1. **AMPLIFIERS**

**VOLTAGE AMPLIFIERS****POWER AMPLIFIERS****PUSH-PULL AMPLIFIERS****OPERATIONAL AMPLIFIERS**1. **POWER SUPPLY**

**D.C. POWER SUPPLY UNIT****RECTIFICATION**1. **OSCILLATORS, MULTIVIBRATORS AND DIGITAL BASICS**

**OSCILLATORS****MULTIVIBRATORS****(Non-sinusoidal)**Principles of operation and applications**DIGITAL BASICS**Number systemLogic gates(Combinational)1. **COMMUNICATION SYSTEMS, TRANSDUCERS AND SENSORS**

Electromagnetic waves. characteristics of radio waves Principles of radio waves Stages of radio receiverFault detection in radio receiver Transmitters and receiversMethods of CommunicationTransducers and SensorsAcoustic transducer1. **CONTROL SYSTEM**

**SERVO MECHANISM**1. **MAGNETIC AND ELECTRIC FIELDS, ELECTROMAGNETIC INDUCTION/TRANSFORMERS**

Electromagnetic fieldElectromagnetic inductionSelf and mutual induction | Qualitative treatment should include : Thermionic emission; photoemission; secondary emission and field emission.Relate it to diode, triode, tetrode, pentode, and cathode ray tube.Qualitative treatment only which should include:Classification – analogue and digitalTypes and uses of multimeter, voltmeter, ammeter, ohmmeter, oscilloscope etc.Qualitative treatment only.Treatment should include operational principles of diodes Type of diodesDiode ratings – voltage, current and powerApplication of diodes Construction of a simple circuit using a P-N junction diodePractical demonstration of I-V characteristics of P-N junction diode in the forward and reverse bias modes.Meaning of transistor, biasing of transistor, Uses and advantages. BJT characteristicsAdvantages of transistor over valvesAdvantages of MOSFET over BJTFormation, function and principles of Operation.Transistor as a switch, inverter, an amplifierVerification of BJT characteristics.Input, output and transfer characteristicsTransfer configurationQualitative treatment only – formation, functions and principles of operation Advantages over discrete componentsCircuit symbolsPrinciples of operationApplications.Application of integrated circuitsExplanation of RAM, ROM and EPROMQualitative treatment onlyUses of conductors and insulatorsDifferences between direct and alternating currentConstruction of simple circuit to demonstrate Ohm’s lawQualitative and quantitative treatmentsPractical determination of the value of a fixed colour code resistorCarry out practical wiring of different circuit arrangementQualitative and quantitative treatments should include * Concepts of capacitive reactance,

inductive reactance and impedance* RL and RC circuits
* Calculations of capacitive reactance (XC) and inductive reactance (XL)
* Resonance frequency

Principles of operation of an a.c. generatorQualitative 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 amplifierAdvantages and disadvantages of negative feedbackClassification: Class A, Class B, Class AB, 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 amplifierInverting and non-inverting operational amplifiers(op-amps)Types of operational amplifiersApplications of op-ampsSimple calculations involving inverting, non-inverting, summing amplifiers and voltage followerDry cells, solar cells, cadium cells, accumulatorsBatteries: Rechargeable and non-rechargeableQualitative treatment should include:* Rectification, regulation
* Types of voltage regulator e.g. diac, triac, thyristor, series voltage regulator, transistorized electronic voltage regulator

Functions of each block Difference between positive feedback(oscillator) and negative feedback (amplifier)Principles of an oscillatorTypes of oscillators: Hartley, Colpitts, phase shift, tuned (load and crystal) oscillatorsAdvantages of negative feedbackCalculations involving negative feedbacksBlock diagram of an oscillator Application of oscillatorTypes of multivibrators(monostable, bistable and astable)Different number system e.g. binary, octal and hexadecimalSimple calculation in binary numberConversion from one base to another and vice-versaAddition and subtraction of binary numbersQualitative treatments of AND, OR, NOT, NOR and NANDLogic gates using switching arrangements, truth table and Boolean expressionRelationship between velocity frequency and wave lengthMeaning of radio communicationModulation and demodulation Advantages of F.M. over A.M.Phase modulation (mention only)Types of radio receiversAdvantages of superheterodyne over direct input receiverUse faulty radio and detect and repair faultProject work on construction and designing of a simple radio receiverBlock diagrams of A.M. and F.M. transmittersBlock diagrams of A.M. and F.M. superheterodyne radio receiversBlock diagrams of mono and colour T.V.chrome receiversFunctions of each block and direction of signal flowQualitative treatment of T.V. standard (NTSC,PAL,SECAM,BIG)Fibre optics, microwave, satellite, cellular phone, digital communication network, etc.Meaning of transducers and sensorsPrinciples of operationTypes and uses to include: Acoustic, dynamic electrostatic, electromagnetic, capacitive, pressure sensor, photoelectric, proximity sensor etc.Thermistor as a temperature sensing deviceQualitative treatments onlyTypes of acoustic transducers e.g. loudspeaker, microphone, earphonePrinciples of operation and functionApplication of acoustic transducersQualitative 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.

Trace magnetic lines of force current-carrying conductorLenz’s and Faraday’s laws.Definitions onlyCalculations involving energy stored in a coilApplications of electromagnetismElectric bell, solenoid, loudspeaker, buzzer, moving-coil instrument, moving-iron instrument, earphone and microphone |