## Module 4 – Electronic Fundamentals

### 4.1 Semiconductors

#### 4.1.1 Diodes

(a) Diode symbols;  
Diode characteristics and properties;  
Diodes in series and parallel;  
Main characteristics and use of silicon controlled rectifiers (thyristors), light emitting diode, photo conductive diode, varistor, rectifier diodes;  
Functional testing of diodes.

(b) Materials, electron configuration, electrical properties;  
P and N type materials: effects of impurities on conduction, majority and minority characters;  
PN junction in a semiconductor, development of a potential across a PN junction in unbiased, forward biased and reverse biased conditions;  
Diode parameters: peak inverse voltage, maximum forward current, temperature, frequency, leakage current, power dissipation;  
Operation and function of diodes in the following circuits: clippers, clampers, full and half wave rectifiers, bridge rectifiers, voltage doublers and triplers;  
Detailed operation and characteristics of the following devices: silicon controlled rectifier (thyristor), light emitting diode, Schottky diode, photo conductive diode, varactor diode, varistor, rectifier diodes, Zener diode.

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### 4.1.2 Transistors

(a) Transistor symbols;  
Component description and orientation;  
Transistor characteristics and properties.

(b) Construction and operation of PNP and NPN transistors;  
Base, collector and emitter configurations;  
Testing of transistors;  
Basic appreciation of other transistor types and their uses;  
Application of transistors: classes of amplifier (A, B, C);  
Simple circuits including: bias, decoupling, feedback and stabilisation;  
Multistage circuit principles: cascades, push-pull, oscillators, multivibrators, flip-flop circuits.

### 4.1.3 Integrated Circuits

(a) Description and operation of logic circuits and linear circuits/operational amplifiers;  
Introduction to operation and function of an operational amplifier used as: integrator, differentiator, voltage follower, comparator;  
Operation and amplifier stages connecting methods: resistive capacitive, inductive (transformer), inductive resistive (IR), direct;  
Advantages and disadvantages of positive and negative feedback.

### 4.2 Printed Circuit Boards

Description and use of printed circuit boards.

### 4.3 Servomechanisms

(a) Understanding of the following terms: Open and closed loop systems, feedback, follow up, analogue transducers  
Principles of operation and use of the following synchro system components/features: resolvers, differential, control and torque, trans-formers, inductance and capacitance transmitters;

(b) Understanding of the following terms: Open and closed loop, follow up, servomechanism, analogue, transducer, null, damping, feedback, deadband;  
Construction operation and use of the following synchro system components: resolvers, differential, control and torque, E and I trans-formers, inductance transmitters, capacitance transmitters, synchronous transmitters;  
Servomechanism defects, reversal of synchro leads, hunting.