

# SENIOR SCHOOL CURRICULUM

## 2017-18

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### ELECTRONICS TECHNOLOGY

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#### Course Objectives

After successfully completing the two year of senior secondary vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Electronics so that he/she is properly equipped to take up gainful employment in this Vocation.

Thus he should have acquired

#### A. Understanding of

- (a) The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Mathematics) so that he/she is able to understand the different vocational subjects.
- (b) The basic concepts in engineering drawing.
- (c) The concepts, principles of working of basic electronic devices and circuits.
- (d) The knowledge of testing procedure of components and circuits by making use of different test instruments.
- (e) The procedure of making P.C.B.
- (f) The concepts and principles used in Radio/Audio/Video Systems and Communication devices and its maintenance.

#### B. Adequate Professional Skills and Competencies in

- (a) Testing different electronic components.
- (b) Testing the performance of electronic circuits.
- (c) Locating the fault at component level and at the stage level.

#### C. A Healthy and Professional Attitude so that He/She has

- (a) An analytical approach while working on a job.
- (b) An open mind while locating/rectifying faults.
- (c) Respect for working with his/her own hands.
- (d) Respect for honesty, punctuality and truthfulness.

**CLASS–XI**  
**ELECTIVE**  
**BASIC ELECTRONICS (789)**  
**THEORY**

*Time: 2.5 Hours*

*Marks: 50*

#### 1. Overview of Atom, Sub-Atomic Particles and CRO

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- Brief History of Electronics.
  - Atom and its elements, Bohr Atomic model, Atomic energy level.
  - Electron, Force, Field intensity, Potential, Energy, current, current density, Ionization potential.
  - Electric field, Magnetic field, Motion of charged particles in electric and magnetic field.
  - Overview of CRO, Electronic and Magnetic deflection in CRO, Applications.
- 2. Voltage and Current** **10**
- Resistance, Ohm's law, V-I Characteristics, Resistors, Capacitors, Inductors.
  - Voltage and Current sources, Symbols and Graphical representation, Conversion of current and voltage sources.
  - Overview of AC, DC, Cells and Batteries, Energy and Power.
- 3. Basics of Semiconductor** **15**
- Semiconductor materials, Energy band structure of Insulators, Metals and Semiconductors, Energy gap, Field and Photo-electric emission.
  - Intrinsic & Extrinsic semiconductor, N-type and P-type semiconductor, Drift current, Diffusion current and Total current, Mobility of charges, Effects of temperature on Conductivity of semiconductor.
  - PN junction diode, depletion layer, potential barrier, Forward & Reverse bias, V-I Characteristic, Effects of temperature, Resistance levels, Breakdown in Junction diode, Zener diode, Photo diode, LED, Types and applications of diode.
  - Diode as a rectifier, Half wave and full wave rectification, Voltage multipliers, Zener diode Regulator.
  - \*Special information – (Introduction to Filters, Clippers, Clampers).
- 4. Bipolar Junction Transistor** **10**
- Construction and operation of NPN and PNP transistors, Biasing of BJT.
  - CB, CE and CC configuration, Characteristics and transistor parameters for CB, CE, CC configuration.
  - Introduction to FET, JFET, MOSFET, CMOS and VMOS, Characteristics of various transistors, Comparison of various transistors.
- 5. Transistor Amplifier and Applications** **10**
- Introduction, Single and Multi stage amplifiers, General amplifier characteristics, Feedbacks in amplifier.
  - Introduction to Oscillators, Multi-Vibrators and Signal generator.
  - \*Special information - (Introduction to Thyristors, PNPN diode, SCR, LASCR, DIAC, TRIAC).

## **PRACTICAL**

*Time: 2.5 Hours*

*Marks: 50*

1. Study of current and voltage measurement using Ammeter and Voltmeter.
2. Study of current and voltage measurement using Galvanometer.

3. Study of current, voltage and resistance measurement using of Multi-meter
4. Study of Power and Energy measurement using Wattmeter and Energy meter.
5. Study of working principle of Signal Generator and measurement of amplitude, time period and frequency of signal using Oscilloscope.
6. Study of V-I Characteristic of Diode.
7. Study of V-I Characteristic of Zener Diode. And use of Zener Diode as voltage regulator.
8. Study of Half wave rectifier with and without filter circuit.
9. Study of Full wave rectifier with and without filter circuit.
10. Study CE configuration for NPN and PNP transistors and measurement of voltage and current gain.
11. Study CB configuration for NPN and PNP transistors and measurement of voltage and current gain.
12. Study CC configuration for NPN and PNP transistors and measurement of voltage and current gain.
13. Study of working of single layer PCB manufacturing
14. Study of working of double layer PCB manufacturing.
15. Design of 7 segment display using LED and bread board.

### **PRACTICAL GUIDELINES**

<b>Parameters</b>	<b>Marks</b>
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
<b>Total</b>	<b>50</b>

## **CLASS–XI ELECTIVE DIGITAL ELECTRONICS (790) THEORY**

*Time: 2.5 Hours*

*Marks: 50*

### **1. Number Systems and Boolean Algebra**

- Basics of Analog and Digital.
- Number systems: Binary, Octal and Hexadecimal, Fixed point, floating point 1's complement, 2's complement, conversions and arithmetic operations, BCD, Gray code, ASCII codes.
- Boolean algebra, De-morgan's law, Truth tables.

### **2. Logical Circuits**

- Logic gates: Negative logic and positive logic, AND, OR, NOT, NOR, NAND, XOR, XNOR.
- Combinational Circuits:

- (i) Arithmetic Circuits: Half adders, Full adders , Subtractors,
- (ii) Data Processing Circuits: Encoders, Decoders, Multiplexers, De-Multiplexers, Code converters, Comparators.

### **3. Latches and Flip-Flops**

**12**

- Concept of Latches, Types of Latches, SR latch.
- SR Flip Flop, JK Flip Flop, D Flip flop , T Flip Flop, Flip Flop as basic memory.
- Introduction to counters, Types of counters Asynchronous and Synchronous.
- Introduction to shift registers, types of shift registers, Universal shift registers.
- \*Special Information – (Right shift, Left shift, Bi directional).

### **4. Introduction to Display Devices**

**8**

- LED, LCD, 7 segment display, Common anode and Common cathode display.

### **5. Integrated Circuits and Memories**

**8**

- Introduction to IC's, Importance and applications, Linear and Digital IC's.
- Introduction to SSI, MSI, LSI and VLSI (Terminology & Definitions).
- Memory Organisation and Operations, Classification and Characteristics of memories, RAM, ROM.
- Block diagram of basic microprocessor system and microcontroller system, applications.

## **PRACTICAL**

***Time: 2.5 Hours***

***Marks: 50***

1. Verification of truth tables for AND, OR, NOT and NAND logic gates.
2. Verification of truth tables for NOR, XOR and XNOR logic gates.
3. Construction and verification of operations of half adder and full adder circuits using basic gates.
4. Construction and verification of operations of half adder and full adder circuits using XOR gates.
5. Construction and verification of operations of full adder and full adder circuits using NAND gates.
6. Construction and verification of operations of half & full Subtractor circuit using basic gates.
7. Construction and verification of operations of half & full Subtractor circuit using XOR gates.
8. Construction and verification of operations of half & full Subtractor circuit using NAND gates.
9. Study and verification of truth tables for 3 line to 8 line decoder.
10. Study and verification of truth tables for 8 line to 3 line and 10 line to 4 line encoder.
11. Study and verification of truth tables for 4:1 MUX using gates
12. Study and verification of truth tables for 1:4 DEMUX using gates.
13. Study and verification of truth tables for 8:1 MUX using IC 74151.
14. Study and verification of truth tables for 1:8 DEMUX using IC 74138.
15. To study and verify the truth table of excess-3 to BCD code converter.

16. To study and verify the truth table of binary to gray code converter.
17. Construction and verification of truth tables for S-R, D and J-K flip flops.
18. Study working of various display devices. (LED, Common anode, Common cathode 7 segment display)
19. Study and verification of truth table for universal shift register.
20. Study the operation of a synchronous counter.

## **PRACTICAL GUIDELINES**

<b>Parameters</b>	<b>Marks</b>
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
<b>Total</b>	<b>50</b>

### **CLASS–XI** **GENERAL FOUNDATION COURSE (501)** **(Common for Engineering & Technology Based Courses)**

(Refer to page 7)

### **CLASS–XII** **ELECTIVE** **OPERATION AND MAINTENANCE OF COMMUNICATION DEVICES** **(789)** **THEORY**

*Time: 2.5 Hours*

*Marks: 50*

#### **1. Introduction to Communication System**

- Information signals, Elements of communication system, Transmitters and Receivers, Bandwidth of signals, Propagation of electromagnetic waves in the atmosphere, Sky and space wave propagation.
- Noise, Classification of noise, Source and description of noise.
- Fundamentals of Analog and Digital communication, Digital data transmission.
- Need of modulation, Modulation/ Demodulation of Amplitude-modulated wave, Phase-modulated and Frequency modulated wave, Pulse modulation.
- Introduction to Wireless communication, Basics of mobile communications, A simple reference model, Mobile and Wireless devices.
- Frequencies for Radio Transmission, Regulations act.

- Basics of cellular system, Elements of cellular radio systems, Performance criteria.
- 2. Satellite Communications** **5**
- Introduction and brief history of satellite communication, Overview of Satellite system.
  - Satellite frequency bands, Introduction to Telemetry, Tracking and Command, Satellite mobile communication, Introduction to C/N ratio and S/N ratio, Introduction to VSAT technology.
  - \*Special Information - (Introduction to Radio propagation and Antenna).
- 3. Mobile Technology** **10**
- History of Mobile technology, Generation of mobile phones.
  - Basics of TDMA, FDMA, CDMA and GSM, Mobile Services.
  - (\* Special Information - GSM and CDMA Architecture).
  - Overview of Mobile phone components, Bluetooth, Infrared, GPRS, Wi-Fi, SIM, IMEI.
  - (\* Special Information - DECT, UMTS, IMT-2000).
  - Base and Master system
- 4. Mobile Hardware and Software** **10**
- Introduction to Mobile hardware and their faults, Basic circuit board configuration, Identification and Working of different BGA IC's, Working on SMD and PCB's.
  - Introduction to software and their faults, Formatting of virus affected mobiles, Removing software problems by codes, Unlocking of mobile phones using codes and software, Unlocking codes for GSM & CDMA.
- 5. Support Program** **10**
- How to open and manage your own mobile repair shop.
  - How to successfully work as a technician.
  - Where to procure tools, spare parts and accessories.
  - How to deal with customers and distributors.
  - Technical support guidance.

## **PRACTICAL**

*Time: 2.5 Hours*

*Marks: 50*

1. Assembling & disassembling of different types of mobile phones.
2. Use of various tools & instruments used in mobile phone repairing.
3. Study of basic parts of mobile phones (mic, speaker, vibrator, LCD, antenna, etc) And Testing of various parts with multi-meter.
4. Recognize different IC's and study their working.
5. Soldering and De-soldering of different BGA IC's using soldering iron.
6. Practice of changing Driver IC Jumper.
7. Practice of changing Display in mobiles.

8. Practice of changing various jacks in mobile phones.
9. Practice of changing Bluetooth module.
10. Cool testing and hot testing of mobile phones for fault finding.
11. GSM
12. CDMA

## **PRACTICAL GUIDELINES**

<b>Parameters</b>	<b>Marks</b>
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
<b>Total</b>	<b>50</b>

## **CLASS–XII ELECTIVE TROUBLE SHOOTING & MAINTENANCE OF ELECTRONIC EQUIPMENTS (790)**

### **THEORY**

*Time: 2.5 Hours*

*Marks: 50*

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|-----------|---|-----------|
| <b>1.</b> | <b>Basic Occupational Safety and Precautions</b>  | <b>15</b> |
| <b>2.</b> | <b>Microphones and Loudspeakers</b>   | <b>5</b>  |
|           | <ul style="list-style-type: none"> <li>• Construction, working principle and frequency response of Carbon Microphone, Variable Reactance Microphone, Capacitance Microphone, Piezo-Electric Microphone, Moving Coil Microphone.</li> <li>• Frequency ranges of musical instruments, Intensity and Dynamic Range, Constructions and working principles of Moving Coil Loudspeaker, Impedance and Power Level of loudspeaker, Frequency characteristics of Practical Loudspeakers: Woofer, Tweeter, Squawker, and Loudspeaker Enclosure.</li> </ul> |           |
| <b>3.</b> | <b>Recorders</b>  | <b>10</b> |
|           | <ul style="list-style-type: none"> <li>• Analog and digital sound recording, Disk recording and reproduction, working principle with block diagram of disk recording and reproduction.</li> <li>• Principle of magnetic recording and playback, Requirement of bias, Working principle with block diagram of a tape recorder system.</li> <li>• Principle of optical recording, CD/ DVD manufacturing and recording, CD/ DVD player system, Advantages/ Disadvantages.</li> <li>• Steps for Fault finding &amp; Analysis.</li> </ul>              |           |
| <b>4.</b> | <b>TV System</b>  |           |

- Working principle with block diagram of TV transmitter and receiver, Brief description with circuit diagram: TV Tuner, Video IF stage, Sound stage, Picture tube & its associated circuit, Synchronizing circuits, Horizontal & vertical deflection circuits, Remote control of a TV receiver, Idea of bandwidth, blanking and synchronization pulses, modulation scheme, monochrome system, extension of colour transmission.
- Channel and cable type TV system, Head end processor, Trunk & cable distribution system with block diagram, Scrambling.
- Introduction to LCD and LED TV systems, Introduction to high definition systems.
- Steps for Fault finding & Analysis.

## 5. Modern Appliances

10

- Working principle and block diagram of following:  
Microwave oven, Telephone, Fax machine, Printers, Scanners.
- Steps for Fault finding & Analysis.

## PRACTICAL

*Time: 2.5 Hours*

*Marks: 50*

1. Assembly study and fault finding of an audio amplifier.
2. Assembly, study and fault finding of a graphic equaliser.
3. Study working, assembly & fault finding of Colour TV.
4. Study working, assembly & fault finding of LCD TV.
5. To trace the fault in the following panel controls and correct them:
  - Volume control.
  - Brightness control.
  - Contrast control.
  - Vertical hold control.
6. To trace the following stages of T.V. set:
  - Tuner.
  - MF stage.
  - Video detector.
  - Video amplifier.
  - Sound I.T.
  - Sound output stage.
  - Syne separator.
  - Vertical oscillator.
  - Horizontal oscillator.
  - Line Driver Stage.



- Line output transformer.
  - Power supply.
7. To find fault for the following defects:
    - No picture no sound.
    - Sound present, picture missing.
    - Picture rolls vertically.
    - Picture tears (Horizontal oscillator).
    - Faults in tuner/IF/power supply.
  8. Study working, assembly & fault finding of tape recorder system.
  9. Study working, assembly & fault finding of CD/DVD player system.
  10. Study working, assembly & fault finding of Printer.
  11. Study working, assembly & fault finding of Scanner.
  12. Study working, assembly & fault finding of Microwave oven.
  13. Study working, assembly & fault finding of Telephone.
  14. Study working, assembly & fault finding of Fax Machine.
  15. Study working, assembly & fault finding of UPS system.
  16. Study working, assembly & fault finding of DTH kit.

## **PRACTICAL GUIDELINES**

<b>Parameters</b>	<b>Marks</b>
Project / Practical Activities.	10
Viva Based on Project.	10
Practical File / Report or Portfolio.	10
Demonstration of skill Competency in Lab Activities.	20
<b>Total</b>	<b>50</b>

## **CLASS–XII**

### **GENERAL FOUNDATION COURSE (501)**

**(Common for Engineering & Technology Based Courses)**

(Refer to page 13)

## **GUIDELINES FOR EXAMINERS**

1. Examiner should check up at least one result of the examinee.
2. As far as possible each examinee should be given separate experiment.
3. Main emphasis should be given on the evaluation of work done, professional competency, workmanship and finish etc.

4. The object of Viva-voce should be to ascertain the depth of knowledge and understanding of the student. Questions asked should pertain to experiment performed by the student as well as other experiments.
5. Each student may be allotted two experiments from the list and he/she may perform any one out of the two.

### **GENERAL INSTRUCTIONS TO THE STUDENTS/CANDIDATES**

**Note:** Before starting the practical, student should submit the connection diagram along with the list of equipment to the examiner.

1. Each student should check up the material/tools and equipments as per the requirement of the examination.
2. Each student should make himself/herself clear in understanding the question paper fully before its commencement.
3. Any student who finds any problem in handling the machine/equipment should immediately contact his/her Invigilator/Examiner.
4. Each student must do all the required operations himself/herself without the help of other students.
5. Each student should bear in mind the time allotted to him/her so that he/she may finish his/her jobs within the stipulated time.

### **LIST OF EQUIPMENTS AND INSTRUMENTS**

<b>S. No.</b>	<b>Description of Item</b>
1.	Resistance - various values/sizes.
2.	Condensers - various values/sizes.
3.	Transformer such as Battery Eliminator mains and Battery charger.
4.	Side cutting insulated pliers – 15 cm.
5.	Long Nose insulated pliers 15 cm.
6.	Wire cutter, spring type.
7.	Screw driver set – 10 cm, 15 cm, 20 cm.
8.	Soldering Iron – 35 W/220 V, Solder Wire – 60, 40 and soldering Iron Stand.
9.	Tinned Copper Wire.
10.	VARIAC Single Phase.
11.	Wire Stripper.
12.	Steel Scale.
13.	Combination Pliers.
14.	Crimping Tools.
15.	Electronic Tool Kit.

S. No.	Description of Item
16.	Analog Oscilloscope: Oscilloscope 30 Mhz Dual Trace.
17.	Digital Multimeter 4 & ½ Digits.
18.	Function Generator 0.3 Mhz To 3 Mhz.
19.	DC regulated Power Supply (30 V/5A).
20.	Frequency Counter 0.1 Hz to 1 GHz.
21.	Universal IC Tester, Digital IC upto 40 pins.
22.	Three Terminal Voltage Regulator Trainer Board.
23.	Diode & Zener diode Characteristics Trainer Board.
24.	Rectifier and Filter Trainer Board.
25.	Transistors Characteristics Trainer Board (CE,CB,CC).
26.	TV pattern Generators.
27.	Telephone Trainer Kit.
28.	Mobile Communication Training System.
29.	Communication Simulation Software.
30.	Fax machine trainer.
31.	Mobile Phone Trainer.
32.	Single Phase Half Wave Control Rectifier Using SCR Board.
33.	UPS Trainer.
34.	Temperature Oven (0-200 °C).
35.	Different Microphones & Loudspeaker (for study of frequency response of microphone).
36.	Microwave Oven.
37.	Colored Television Demonstration kit.
38.	CD/DVD Player Trainer Kit.
39.	Stereo Cassette player demonstration cum trainer.
40.	Facsimile Machine.
41.	DTH System.
42.	8 bit digital multiplexer.
43.	1:8 line de-multiplexer.
44.	Multiplex two BCD numbers to seven segment display.
45.	3 bit asynchronous up-counter 3 bit synchronous down counter.
46.	Universal Shift Registers having SISO, SIPO, PIPO, PISO.

S. No.	Description of Item
47.	Encoder/decoder trainer.
48.	Digital IC Testers.
49.	Digital IC Power Supplies (+/- 5V/1A, +/-12V/1A/+15V, 1A).
50.	GSM trainer kit.
51.	CDMA trainer kit.
52.	Digital Trainer Kit with following on board facility: Breadboard, 16 Nos. of input toggle switches, Sixteen nos. of LED output provision, Fixed +5V@1A and variable $\pm 15V@500mA$ power supply, Pulser switch for clock input, Variable frequency clock signal (1Hz to1KHz), Digital voltmeter Seven segment display
53.	TTL IC 7400(NAND), 7402 (NOR), 7404(NOT), 7408(AND), 7432(OR), 7486(XOR) TTL IC 7446 (Common anode decoder driver), IC 7448 (Common cathode decoder driver), seven segment display (both common anode: MAN 3910 or equivalent and common cathode: MAN 3940 or equivalent).
54.	8085 microprocessor based microprocessor trainer kit.

