MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI - 51

<table>
<tr><td>1</td><td>Name of Course</td><td>Certificate Course in Operation of Instrument used in Hospital (301108)</td></tr>
<tr><td>2</td><td>Max. Nos. of Student</td><td>25 Students</td></tr>
<tr><td>3</td><td>Duration</td><td>6 Months</td></tr>
<tr><td>4</td><td>Type</td><td>Part Time</td></tr>
<tr><td>5</td><td>Nos. of Days / Week</td><td>6 Days</td></tr>
<tr><td>6</td><td>Nos. of Hours /Days</td><td>4 Hrs</td></tr>
<tr><td>7</td><td>Space Required</td><td>Theory Class Room – 200 sqft Practical – 200 sqft</td></tr>
<tr><td>8</td><td>Entry Qualification</td><td>S.S.C. appeared</td></tr>
<tr><td>9</td><td>Objective Of Syllabus/ introduction</td><td>1) Knowledge of soldering techniques, use of tools in assembly.
2) Knowledge of electronic competent used in various Instrument in hospital.
3) Ability to read schematic layouts wrings diagrams.
4) Awareness of Safety precautions.
5) Maintenance of various Instrument used in Hospital</td></tr>
<tr><td>10</td><td>Employment Opportunity</td><td>The trainee will either to be able to take up jobs with agencies which maintain and repair such equipments or with working experience will be in a position to start his own independent Business.</td></tr>
<tr><td>11</td><td>Teacher’s Qualification</td><td>Diploma in Medical Electronics..</td></tr>
<tr><td>12</td><td>Training System</td><td>Training System Per Week
<table>
<tr><th>Theory</th><th>Practical</th><th>Total</th></tr>
<tr><td>6 hrs</td><td>18hrs</td><td>24hrs</td></tr>
</table></td></tr>
<tr><td>13</td><td>Exam. System</td><td>
<table>
<tr><th>Sr. No.</th><th>Paper Code</th><th>Name of Subject</th><th>TH/PR</th><th>Hours</th><th>Max. Marks</th><th>Min. Marks</th></tr>
<tr><td>1</td><td>30110811</td><td>Basic Electronics & Assembly Technique</td><td>TH-I</td><td>3 Hrs</td><td>100</td><td>35</td></tr>
<tr><td>2</td><td>30110812</td><td>Operation of Instrument used in Hospital</td><td>TH-II</td><td>3 Hrs</td><td>100</td><td>35</td></tr>
<tr><td>3</td><td>30110821</td><td>Basic Electronics & Assembly Technique</td><td>PR-I</td><td>3 Hrs</td><td>100</td><td>50</td></tr>
<tr><td>4</td><td>30110822</td><td>Operation of Instrument used in Hospital</td><td>PR-II</td><td>3 Hrs</td><td>100</td><td>50</td></tr>
<tr><td></td><td></td><td>Total</td><td></td><td></td><td>400</td><td>170</td></tr>
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SYLLABUS

Theory – I
Basic Electronics & Assembly Technique

1. Introduction of training & institute, Familiarization with the institute, type of work & responsibility of trainees, syllabus, safety precautions, elementary first aid, and symbols related to the theory Han- Tools & equipments identification, Introduction to Tools & Soldering Techniques, SMT Technology, uses and maintenance
2. Introduction to electricity, batteries, voltage, current, resistance & power ohm's law. Alternating current A. C. induced voltage, current. Direct current simple lead cell, lead acid accumulator, battery charger, Battery is an electric.
3. RESISTORS: - Construction of carbon resistor wire wound resistors, wire wound resistors potentiometer, thermostat, series & parallel connection of resistors colour code of resistors, unit for resistance.
4. Capacitors :- what is capacity & capacitance parallel & series connection of capacitor in electric circuit unit of capacitor different, types of capacitor variable & fixed value trimmers, mica ceramic, paper polyester electrolytic etc value of capacitor
5. Inductor & transformer-coil concept, mutual induction series & parallel connection of inductors Types of coils, air core, Iron core, Powdered iron core etc. unit for inductance Transformers, turns ration types of transformer, step-up & step down transformer, power transformer etc.
6. Simple Meters: - Moving coil meter voltmeter, ammeter, ohm meter, multimeter (Moving coil and digital).
7. Semiconductor: - difference between semiconductor & conductor, Germanium & Silicon. Type semiconductor 'P' type & 'N' type semiconductor, P.N. junction diode, junction diode types of diodes, Zener diode, LED etc.
8. Transistor: - PNP and NPN transistor pin configuration, CB, CE, CC connection function of transistor Heat sink, use of heat sink. P C B (printed circuit Board).
9. Rectifiers, filters, Regulated power supply with Zener diode, transistors and regulator IC's 741, 7806, 7906, 7812, 7912, etc.
10. Op-Amp - Introduction, applications, construction, comparators.
11. Single phase and three phase system, Different types of inverter, UPS, Working principle, specifications, explanation with the help of block diagram, basic principle of working of power switches, testing methods, discussions of various faults, diagnosing methods, rectifying common faults.
12. Amplifier: - Range of audio amplifier frequency use of amplifier, types of amplifier transistor as an amplifier, coupling of amplifier pre-amplifier.
13. AF power amplifier: - Use of transformer matching, push-pull amp. Transformer less amplifier, differential amplifier, feedback circuit.
14. What is IC? Use of IC's in Home Theater, IC based AF power amplifiers with different no's IC's.
15. Transducer
    Microphones, Loudspeakers, Photocell, Laser diodes, Telephone.

Theory - II

Operation of Instrument used in Hospital

1. Safety and security, health hazards List out various instruments in clinical laboratory,
2. Bioelectric signals: origin – recording and monitoring display – patient monitoring – telemetry computer application – safety.
3. Measurement and analysis: electromagnetic - ultrasonic – nuclear magnetic resonance- laser Doppler – oxiometer – audiometer
4. Diagnostic equipment principles – electro cardiograph – phono cardiograph – electro myo graph –
    a. Electroencephalograph.
5. Therapeutic equipment principles cardiac pacemakers – Defibrillators,– dialysis – physiotherapy and electro therapy.
6. Modern imaging – X-ray machine- X-ray CT scanner – MRI – Ultrasonic thermography, Image reconstruction
7. Hot plate and magnetic stirrer -operating procedure, care important specification
8. Centrifuges - construction, working principle, use, care rpm calibration, timer calibration, thermometer calibration, preventive maintenance, selection of centrifuge, various types of centrifuges.
9. Hot air oven - use, operating procedure, construction procedure, use, care, important specification
10. Incubator- use, construction, care.
11. Temperature bath: - use, construction, care.
12. Body fluids- blood, urine, CSF & other body fluids
13. Colorimetry and photometry - define: - light wave, wavelength, unit of wavelength, monochromator, light source, curette, photo detector, colored solution
14. Colorimeter - use, construction, front panel controls, operating procedure, care, important specification
    Spectrophotometer - use, Construction, front panel controls, operating procedure, care, important specification
15. Flame photometer - use, construction, front panel controls operating procedure, care, important specification.
16. Gamma counter - use, construction, front panel controls, operating procedure, care, important specification
17. Use of pH strip Microscope with oil immersion - use, construction, operating procedure, care and maintenance, important specification
18. Glucometer - use, construction, accessories, front panel controls, operating procedure, care and maintenance, important specification
19. Semi auto analyzer - use, construction, accessories, front panel controls, operating procedure, care and maintenance, important specification

LABORATORY PRACTICAL
Practical –I
Basic Electronics & Assembly Technique

1. Introduction to work- shop & equipments care. Introduction to electricity supply system. Uses of Tools, measuring instruments soldering & disordering.
2. Identification of conductors, insulator voltage, current power. Test measure of A. C. Voltage current. Test of measure of D. C. Voltage and current.
3. To study differ. Types of resistors. Colour code reading valve of resistors calculation of series & parallel resistance testing of resistance by multimeter.
4. Checking of capacitor, testing by multimeter. Function and uses of capacitor.
5. Checking of coil by multimeter. Checking of differ. Type of transformer hot checking & cold checking To sturdy their uses.
6. Operation, Rules and use of multimeter, voltmeter, ammeter.
7. Testing of P N junction diode by multimeter Identify their poles (A & K.)
8. Transistor testing by multimeter Identification of lead, Build a CB, CC & CE circuits. Design the PCB.
9. Assembled various rectifier circuits with R.C. & L. C. filter CKT. Voltage doublers circuit.
10. Build Zener diode regulator circuit, Build transistor regulator circuits, Build a regulator circuit, and Build a regulator IC power supply
11. Find the total load and select a suitable UPS/Inverter (rating factor) Installation of UPS and Inverters Maintenance of battery.

LABORATORY PRACTICAL
Practical –II
Operation of Instrument used in Hospital

Practice procedures for safety and health hazards measures Identify and Operate centrifuges, incubator, colorimeter, spectrophotometer, flame photometer, gamma Counter, Microscope. Perform calibration on centrifuge Perform preventive maintenance on centrifuges, incubator, colorimeter, spectrophotometer, flame photometer, gamma Counter, Microscope.

1. Measurement of differential temperature -Thermometer,
2. Study and testing of ECG Equipment, (Signal analysis and vector cardio graph, abnormality)
3. Study and waveform analysis -Electronic Stethoscope,
4. Study (Arterial) Blood gas Analyzer (non -Invasive),
5. Study and testing of Endoscopes (non -Invasive),
6. Study and testing of Human Body Vibration Simulator,
7. Study and testing Pulse Oximeter (Under different BP conditions/exercise/ respiratory disorders / vaso / dilation /vaso constriction),
8. Study and testing ultra sonic images-Ultrasound – 4 MHz,
9. Study and testing X-Ray digitizer
10. Study and testing Insulin Pumps, Drug Delivery Testing System-PC Based.

List of Tools & Equipment :

Sr No	Description of Tools/ Equipments	No. Required
1.	Low Power Audio Amp.	2
2.	Low Voltage Power Supply	2
3.	Multimeter (low sensitivity)	28
4.	Multimeter (High sensitivity 20 KZ/V)	1
5.	Record player	1
6.	R.F. Signal Gen	1
7.	Oscilloscope	1
8.	Hot plate and magnetic stirrer	1 Each
9.	Centrifuge	1 Each
10.	Hot air oven	1 Each
11.	Incubator	1 Each
12.	Constant temperature bath	1 Each
13.	Colorimeter	1 Each
14.	Spectrophotometer	1 Each
15.	Flame photometer	1 Each
16.	Gamma counter	1 Each
17.	Microscope with oil immersion	1 Each
18.	Glucometer	1 Each
19.	Stopwatch	1 Each
20.	Semi-auto analyzer	1 Each
21.	Other Components. Accessories material as per laboratory equipment	
22.	Thermometer,	1 Each
23.	ECG Equipment	1 Each
24	Endoscopes	1 Each
25.	Human Body Vibration Simulator	1 Each
26	Pulse Oximeter	1 Each
27.	Ultra sonic images-Ultrasound – 4 MHz	1 Each
28	X -Ray digitizer	1 Each
29	Furniture	
30	11/2 X 4 Table	
31	Small Cupboard	
32	Stool	
33	White Board	
34	Desirable – for video cassette demonstration i. DVD Player ii. Colour TV.	

Reference Book

A)

i)	Practical Transistor Radio Servicing – by R.C Vijay
ii)	DVD Servicing – by R.C. Vijay
iii)	Basic Radio and Television – by S.R. Sharma
iv)	Electronic Technical Handbook – by Cafule A Grads Russi Terpoori
v)	Stereo Amplifier – by Nishinak Tata Mc
vi)	Principal Of Electronics -- By V. K. Mahata
vii)	Hand book biomedial instrumentation By R.S. Khandpur McGraw Hill
Vii)	Biomedical instrumentation and measurements By, Leslle Cromwell, Fred J. Weibell and Erich A. Prelffer
viii)	EEG Technology, By Cooper, Ossciton and Shaw

B) Video CD/DVD

1) Fundamental of Electricity I and II
2) Safety in Electrical
3) Multimeter
4) Know your oscilloscope
5) Waves
6) Transformer
7) Junction Diode
8) Semi Conductor I, II, III.
