ELECTIVE-1

IMAGING TECHNIQUES AND EQUIPMENTS

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The study of this subject will help the students to gain the knowledge of functions, working principles, construction, application & maintenance aspect of Bio-medical equipment based upon X-RAY & imaging techniques.

DETAILED CONTENTS

1. **X-RAY:** 30%

Origin & nature of x-ray. Units & properties of x-ray

X-ray circuit:

(a) Basic components
(b) Basic x-ray machine
(c) Modern x-ray tubes
(d) Types of anode & anode supply
(e) Filament supply
(f) Timing devices
(g) Interlock & safety devices
(h) Types of x-ray machines

IMAGE INTENSIFIER SYSTEMS

(a) X-ray image intensifier tube
(b) C.C.T.V/CCD Camera
(c) High voltage supply
(d) Optical coupling system
(e) Fluoroscopy

2. **ULTRASOUND INSTRUMENTATION** 20%

Basic principles of Ultrasonics. Doppler principle. Units of ultrasound machines and their operation. Foetal monitor. Pulse echo technique. Pulse echo- instruments & imaging system. Scanners- Echocardiography. Choencephalography, Computed Sonography- block diagram & advantages.

3. **COMPUTED TOMOGRAPHY** 20%

Principle of operation. Block diagram of C.T. Scanner. Units of C.T. scanner. Features of C.T. Scanners. Advantages of CT over conventional X-ray.

4. **MEDICAL RESONANCE IMAGING (MRI)** 10%

Principle of MRI.. Superconductivity & MRI. Block diagram of MRI. Advantages of MRI over C.T.

5. **DIGITAL SUBTRACTION ANGIOGRAPHY** 10%

Principle of operation. Components of digital radiography system. Block diagram & operation. Advantage of digital subtraction Angiogram over conventional Angiogram.

6.

6. **NUCLEAR MEDICINE INSTRUMENTS:** 10%

Types of Radio active particles. Radiation Detectors. Radio Isotopes scanners for medical application. Gamma camera- components & working principle. Advantage & disadvantage of Gamma scan.

PRACTICALS:

1. Operation and function of all controls of hospital based X-ray machine.
2. Identification of different block / sub systems circuits in X-ray machine.
3. Measurement of EHT in X-ray machine
4. X-Ray film processing (expose & developing of x-ray film through manual method & automatic digital film processor.)
5. Study of Ultra sound machine & transducer operation.
6. Identification of different unit of ultra sound machine
7. Study of operating consol & features of ultrasound machine.
8. Development of ultrasound investigation film.
9. Study of Fluoroscopy with the help digital Radiography System & trouble shooting.

BASIC MEDICAL ELECTRONICS

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4 - 3

RATIONALE

The knowledge of subject is required as the basic input for specialization in Bio- medical equipments & instruments. The students will be made aware of various types of basic tools & equipments such as Electrodes, Transducers, Wave form display Devices, Circulatory, Respiratory & therapeutic equipments.

DETAILED CONTENTS

1. **OVER VIEW OF MEDICAL ELECTRONIC EQUIPMENTS:** 10%
   Classification application and specification of Diagnostic, Therapeutic & Clinical laboratory equipments

2. **ELECTRODES :** 10%
   Elementary idea of cell structure, Bio electric signals. Bio- electrode. Electrode - Tissue interface. Contact impedance. Types of electrodes. Electrodes for ECG, EMG and EEG.

3. **TRANSDUCER:** 10%
   Typical signal from physiological parameter. Pressure transducer- types of pressure transducers. Flow Transducer, Temperature transducer, Thermocouples, Thermister. Pulse sensors, Respiration sensors.

4. **WAVE FORM DISPLAY DEVICES** 10%
   PMMC Instruments. Servo – Recorders & Recording Potentiometers. Dot matrix analog recorders. Oscilloscope - medical oscilloscope, Bed side monitor, multi beam oscilloscope, non fade oscilloscope, Modern oscilloscope designs

5. **CIRCULATORY SYSTEM & CARDIAC EQUIPMENTS :** 15%
   The heart. Electro conduction system of heart. ECG wave form. The standard lead system. ECG machine- block diagram, working principles. Defibrillator types, circuit & testing of defibrillator. Pace maker – operation & classification. Heart lung machine.

6. **RESPIRATORY SYSTEM & RELATED EQUIPMENTS:** 15%
   The human respiratory system. Internal & external respiration. Organs of respiratory system. Mechanics of breathing. Parameters of respiration & their measurements. Impedance Pneumograph. Spiro meters.

7. **THERAPEUTIC EQUIPMENTS:** 10%
   Intermittent Positive Pressure Breathing (IPPB) Respirator. Functional block diagram. Artificial Ventilators, Humidifiers & Nebulizers.

8. **NERVOUS SYSTEM & RELATEDE EQUIPMENTS:** 10%
   The Neuron Structure & Function of Central Nervous System. Cerebral Angiography. Electroencephalography . EEG electrode system. EEG amplitude & frequency bands. EEG system block diagram. Multi channel EEG recording system & typical external control system.

9. **MUSCULATORY SYSTEM & RELATED EQUIPMENTS:** 10%
Muscle action EMG Machine- -Different unit & working principle. Physiotherapy- short wave Diathermy Ultrasonic Diathermy. Micro wave Diathermy unit. Stimulators- types & Application.

PRACTICALS

1. Measurement of skin contact impedance & technique to reduce it.
2. Determine the contact impedance of following electrodes- ECG, EEG, EMG.
3. Study of ECG machine & taking ECG of subject & observing artifacts in ECG recording.
4. Measurement of heart rate/pulse rate, blood pressure monitoring , respiration monitoring through multi para monitor digital machine.
5. Direct blood pressure measurement (under normal & stimulated condition)
6. Study of different units of EEG machines & placement of EEG electrodes.
7. Taking EEG of a subject & observing artifacts in EEG recording.
8. Study of EMG machine- different control, units & placement of electrodes
9. Constructional study, use & trouble shooting of Defibrillator.
10. Constructional study, use & trouble shooting of artificial electronic/digital Ventilators.
11. Study of respiration parameters with the help of Spiro meters & troubleshooting.

MEDICAL ELECTRONICS –I

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4 - 3

RATIONALE

The student is made aware of this functions, Working Principles, Construction, merits & application of various Bio- medical equipments, such as laboratory Centrifuge, Incubators, Calorimeters, Flame photo meters, Chromatography m/c, PH meters, Microscopes, Operation Room Equipments.

DETAILED CONTENTS:

1. **LABORATORY CENTRIFUGE:** 10%
   Parts of centrifuge m/c, speed control in centrifuges, refrigerated centrifuges & trouble shooting of various parts of centrifuge m/c.

2. **INCUBATORS & OVENS:** 10%
   Types of incubators & ovens, Temperature control of incubator & ovens & trouble shooting of incubators & ovens.

3. **BASIC COMPONENTS OF CLINICAL LABORATORY INSTRUMENTS:**
   Electromagnetic spectrum, light sources, photo detectors. Monochromators, display system. 5%

4. **COLORIMETERS :**
   Basic parts of Colorimeters, Testing individual Colorimeter part, Calibration procedures. Auto Analyzer. 10%

5. **FLAME PHOTOMETER :** 10%
   Emission system, optical system, calibration of flame photometer. Spectrophotometer meter.

6. **PH METER** 10%
   Types of PH meters (analog & digital) typical pH circuits, Testing & calibration of PH meter. PH Electrodes.

7. **BLOOD CELL COUNTERS:** 5%
   Blood, components of blood, Basic block diagram, working principle and maintenance of Blood Cell Counters.

8. **ELECTROPHORESIS APPARATUS:** 10%
   Electrophoresis technique, Electrophoresis apparatus & high voltage regulated power supplies.

9. **ELECTRON MICROSCOPE:** 10%
   Over view of optical microscope, Block diagram of electron microscope. Working, principle & application in medical field.

10. **OPERATION ROOM EQUIPMENTS:** 10%

Electro surgery machine, Electro surgery circuits, testing & safety of electro surgery units. Sterilization & Anesthesia machines. Medical Deep Freezer –working, construction & troubleshooting.

11. CHROMATOGRAPHY: 10%

General principle, working & Construction of chromatography machines, Types of chromatography – Gas chromatography, Liquid chromatography & troubleshooting.

PRACTICALS

1. Operation & testing the parts of Centrifuge.
2. Operation and testing the parts of incubator.
3. Operation and testing the parts of Spectro photometer
4. Testing of a blood sample using colorimeter.
5. Measurement of simulated samples on flame photometer
6. Study of different control of auto analyzer.
7. Identification of different types of PH electrode & calibration of PH meter & its trouble shooting
8. Familiarization with different units of electron micro scope & its operation.
9. Study of different units of automatic Blood cell counter, its operation & trouble shooting
10. Study of different controls of computer controlled automatic chromatography machine & its troubleshooting
11. Constructional study & trouble shooting of deep freezer used in medical laboratory.
12. Working, Construction & study of different control of Anesthesia machine.

DIGITAL SYSTEM DESIGN

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1. Memories **(4 Hr)**

(i) Basic RAM cell, NXM bit RAM, Expansion of word length and capacity, static and dynamic RAM, basic idea of ROM, PROM, EPROM, EEPROM.

2. A/D and D/A Converters **(4 Hr)**

(i) General principles of A/D and D/A conversion and brief idea of their applications.

(ii) A/D Converter : Binary Ladder

(iii) D/A Converter : Simultaneous method, counter type and continuous counter, successive approximation types of ADCs, integrating type (single slope and dual slope)

3. Combinational Circuits **(8 Hr)**

(i) Boolean algebra and minimization techniques

(a) Review of logic variables, Boolean expression, and minimization of Boolean expression using K-map method (up to 5 variables) Tabular method of function minimization

(ii) Combinational circuit design

(b) Components of combinational circuits

(c) Design procedures and implementation using gates (SSI approach) e.g., half and, full adder, half and full sub tractors, multiplexer, de-multiplexer /decoder (MSI approach)ROM / PLA (LSI approach)

4. Sequential Circuits **(12 Hr)**

(i) Essential Components of a Sequential Circuit Synchronous and asynchronous sequential circuits Classification of sequential circuits (Mealy and Moore Machines)

(ii) Sequential Circuit Design Sequential logic circuit, review of RS,D,JK (including Master/slave JK) and T flip-flops. Their truth tables, characteristic tables, characteristic equation, exciation tables, conversion of one Flip Flop to another.

(iii) Design of clocked sequential circuits: Generation of primitive state table/diagram, minimization of states, state assignment, choice of memory element. Design of counters

4. Synchronization of asynchronous inputs spikes in output and their removal. Design approach to asynchronous circuits, definition of cycles, races and hazards. **(4 Hr)**

LIST OF PRACTICALS

1. Design and implement a code converter for Binary to Grey code conversion using decoder.
2. Design and implement full adder and full subtractor using multiplexer.
3. Program an EPROM using EPROM Programmer.
4. Using PROM / PLA design and implement a combinational circuit.
5. Design and implement a Modulo 5 synchronous counter using JK flip-flops.
6. From a given problem statement, design and test a typical sequential circuit.
7. Design a 4 bit sequence generator using JK Flip Flops.
8. To Construct & test 4/8 bit D/A converter using IC.
9. To Construct & test 4/8 bit A/D converter using IC.
10. Design a BCD adder and implement using combinational logic.
11. Design 4 bit up/down counter using T-Flip Flops.

Syllabus for Semester vth, Diploma (Electronic MEDICAL)

CRRIT Kanjhawala Delhi

Course Code :- EC 574 **Course:- T.S.M.E**

L: 4Hrs Per week **Total Marks: 150 marks**

Coures Outcome

1.To understand concepts of maintenance and its policy their various types and basic procedures of service and maintenance.

2.To understand the concepts of trouble shooting techniques

3. To understand the procedure for checking passive and active components .

4. To understand the trouble shooting procedures using digitals tools like logic clip, logic probe, logic pulser etc

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Unit:-1 Repair, Servicing and Maintenance Concepts

Introduction, Modern electronic equipment, Mean time between failures (MTBF), Mean time to repair (MTR), Maintenance policy, potential problems,preventive maintenance, corrective maintenance.

a) Study of basic procedure of service and maintenance

b) Circuit tracing techniques

c) Concepts of shielding, grounding and power supply considerations in instruments.

UNIT:-2 Fundamental Trouble Shooting Procedures

Fault location

Fault finding aids

- Service manuals

- Test and measuring instruments

- Special tools

Trouble Shooting Techniques

- Functional Areas Approach

- Split half method

- Divergent, convergent and feedback oath circuits analysis

- Measurement techniques

UNIT:-3 Passive components

Test procedures for checking passive components, resistors, capacitors, inductors, chokes and transformers.

UNIT:-4 Semiconductor Devices (From Testing procedure point of view)

Dicoes rectifier and zener diodes <W> transistors. Field effecr transistors JFET and FET Thyirstors. unijuction transistors, Photo cells, Transistor equivalents. Data Books on

transistors.

UNIT:-5 Trouble-shooting Digital Systems

Typical faults in digital circuits. Use of Logic clip, logic probe, logic pulser,IC tester.

UNIT:-6 Typical Examples of Trouble Shooting

Trouble shooting procedures for the following:

- Oscilloscope

- Power supplies

- Digital multimeters

- Signal generator

- PA system

- Tape reorder and

- Stereo amplifier

UNIT:-7 Log Book & History Sheet

Introduction, preparation and significance of log book and History sheet.

Text Books:

1. TSME books by R.S.Khandpur Published by S.K.Katariya

Syllabus for Semester vth , Diploma (Electronic) MEDICAL

CRRIT Kanjhawala Delhi

Course Code :- EC584
Designation :- Required
P:3Hrs Per week

Course:- T.S.M.E (Lab)
Total Marks: 100 marks

Course outcomes:

1. Student will be understood about various tools that are used to troubleshoot electronics devices and circuits.

2. Student will aware about assembly of components.

3. Student can understand about testing of equipments .

List of Practicals

1. Selection, demonstration and correct use of tools and accessories, tools pliers',wire cutter, wire stripper, tweezers, soldering iron, desoldering tools, neontester, screw driver. Accessories insulating tapes, solders, solder tips, flux, desoldering, wick , solder cleaning fluids , sleeves , tags , identifiers

2. Develop skill in assembly of components, wiring, soldering and deso1dering Methods

3. Selection and use of commonly used passive components and accessory

4. Testing of active and passive components.

5. Testing of 1inear integrated circuits

6. Use of .digital tools for troubleshooting digital components

7. Trouble, shooting at least two of the following equipments: Oscilloscope , Power supplies, electronic multimeter , signal generator, PAsystem, Tape recorder and Stereo amplifier

Reference Material :- Lab Manuals

Syllabus for Semester VIth, Diploma (Electronics) Medical

CRRIT Kanjhawala Delhi

Course code:EC585 **Course: Industrial training preparation & Report**

P: 1 hrs., Per Week **Total Marks: 150**

Course Outcomes

1. Student will be able to work in industrial atmosphere.
2. Student wil be able to work with live site.
3. Student will able to project themselves as representative.

Industrial training report presentation means for solving live problems faced electronics industries by applying the knowledge and skills obtained through the diploma course in electronics. The institute offering the course will identify live problems pertaining to Electronics industries. The activity of problem identification should begin well in advance (say in the beginning of fourth semester). Students should be allotted a problem of interest to him/her. The students will execute the work under the guidance of teachers. Each teacher would not have more than six students for guiding and supervise.

The students shall go for industrial training for a period of 4 to 6 weeks in the summer vacation after the examination of IV semester. The students will submit a comprehensive training report (in a presentable manner, preferably typed and bound) for evaluation by the teacher guide, an expert from the industry and an external examiner.

The industry for training should be related to Electronics, Microprocessor, Electronic Instruments and institution like Scientific Laboratories, Radio Station, VSNL, Radio & TV Transmitters, Telephone Exchange or any other electronics related field.