MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF ALLIED HEALTH CARE SCIENCES AND TECHNOLOGY

Suraram X Roads, Jeedimetla,
Hyderabad-500055
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Program

B.Sc. (Hons) Medical Equipment Technology

2026

MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF ALLIED HEALTH CARE SCIENCES AND TECHNOLOGY

B.SC. (HONS.) MEDICAL EQUIPMENT TECHNOLOGY

Vision

To become a center of excellence in Medical Equipment Technology education by producing skilled professionals capable of managing healthcare technologies and contributing to quality patient care, innovation, and healthcare advancement.

Mission

1. To provide strong foundations in biomedical sciences, medical equipment, and healthcare technologies.
2. To develop practical skills in operation, maintenance, safety, and management of medical equipment.
3. To promote ethical values, lifelong learning, and professional competency in healthcare environments.
4. To encourage research, innovation, and interdisciplinary collaboration in healthcare technology.

Program Educational Objectives (PEOs)

Graduates of B.Sc Medical Equipment Technology will:

1. Apply knowledge of medical equipment and healthcare technology in clinical environments.
2. Demonstrate competence in installation, maintenance, troubleshooting, and management of medical devices.
3. Exhibit professional ethics, communication skills, teamwork, and leadership abilities.
4. Adapt to emerging healthcare technologies through lifelong learning and professional development.
5. Contribute to improving patient care and healthcare systems through technology-based solutions.

Program Outcomes (POs)

At the end of the program, graduates will be able to:

1. Apply knowledge of biomedical sciences, engineering, and healthcare technology.
2. Identify and analyze technical problems related to medical equipment.
3. Operate, maintain, and troubleshoot medical devices safely and effectively.
4. Apply modern tools and techniques in healthcare technology management.
5. Understand healthcare regulations, quality standards, and patient safety practices.
6. Communicate effectively with healthcare professionals and patients.
7. Function effectively as individuals and as members of multidisciplinary teams.
8. Demonstrate professional ethics and social responsibility.
9. Engage in lifelong learning and continuous professional improvement.
10. Adapt to advances in medical equipment technologies and healthcare systems.

Program Specific Outcomes (PSOs)

After successful completion of the program, graduates will be able to:

1. Install, calibrate, test, and maintain various medical equipment used in healthcare settings.
2. Perform preventive maintenance and troubleshooting of diagnostic and therapeutic devices.
3. Apply principles of healthcare technology management and quality assurance.
4. Ensure safety standards and regulatory compliance in medical equipment usage.
5. Support healthcare delivery through efficient equipment management and clinical collaboration.

Course Outcomes (General Course-Level Outcomes)

Students completing individual courses in B.Sc Medical Equipment Technology will be able to:

1. Explain the principles and working mechanisms of medical equipment.

2. Demonstrate practical skills in handling and operating healthcare devices.
3. Apply theoretical concepts to solve equipment-related problems.
4. Analyze equipment performance and maintenance requirements.
5. Follow safety procedures, standards, and ethical practices in healthcare environments.
6. Communicate technical information effectively and work collaboratively in clinical settings.
7. Integrate knowledge and skills for healthcare technology applications.

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SCHOOL OF ALLIED HEALTH CARE SCIENCES AND TECHNOLOGY

B.SC. (HONS) MEDICAL EQUIPMENT TECHNOLOGY

COURSE STRUCTURE

I year I semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Human Anatomy - I	4	-	-	4	30	70	100
2		Human Physiology - I	4	-	-	4	30	70	100
3		Medical Bio-chemistry	4	-	-	4	30	70	100
4		Sociology	2	-	-	2	30	70	100
5		English and Communication Skills	2	-	-	2	30	70	100
6		Basics of Computers	1	-	2	2	30	70	100
7		Human Anatomy - I Practical	-	-	4	2	30	70	100
8		Human Physiology - I Practical	-	-	4	2	30	70	100
9		Professionalism and values	1	-	-	1	100	-	100
TOTAL			**18**	**-**	**10**	**23**	**340**		**-**

I year II semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Fundamentals of medical equipment	2	-		2	30	70	100
2		Biomedical instrumentations -1	3	-		3	30	70	100
3		Mechanics of medical devices	2	-		2	30	70	100
4		Medical device basics	2	-		2	30	70	100
5		Equipment Basics - Practical	-	-	2	1	30	70	100
6		Clinical postings	-	-	18	9	30	70	100
7		Health and well being	1	-	-	1	100	-	100
	TOTAL		**10**		**20**	**20**	**280**	**420**	**700**

II year III semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Medical Device Safety	3			3	30	70	100
2		Imaging Equipment	3			4	30	70	100
3		Biomedical Instrumentation – II	3			3	30	70	100
4		Healthcare Administration	3			3	30	70	100
5		Practical: Equipment Safety and Maintenance			4	2	30	70	100
6		Clinical Postings			14	7	30	70	100
7		Stress management	1			1	100		100
TOTAL			**13**		**18**	**22**	**280**	**420**	**700**

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II year IV semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Advanced Biomedical Equipment	4			4	70	30	100
2		Diagnostic Equipment	3			4	70	30	100
3		Calibration and Quality Control	3			3	70	30	100
4		Biomedical Sensors and Transducers	3			3	70	30	100
5		Practical – Diagnostic Equipment Maintenance			4	2	70	30	100
6		Clinical Postings			12	6	70	30	100
7		Environmental awareness	1				100		100
TOTAL			**14**		**16**	**22**	**520**	**180**	**700**

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III year V semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Telemedicine and Digital Healthcare Systems	2			2	70	30	100
2		Therapeutic Equipment	3			3	70	30	100
3		Operation and Maintenance of ICU Equipment	3			3	70	30	100
4		Equipment Troubleshooting	3			3	70	30	100
5		Medical Equipment Networking and Informatics	3			3	70	30	
6		Practical – ICU Equipment Management			4	2	70	30	100
7		Clinical Postings			10	5	100		100
8		Interpersonal communication	01			01	100		100
		TOTAL	**15**		**14**	**22**	**620**	**180**	**800**

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III year VI Semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Medical Equipment Planning, Installation and Testing	4			4	70	30	100
2		Public Health and Medical Equipment	3			3	70	30	100
3		Healthcare Technology Management and Quality Assurance	3			3	70	30	100
4		Medical Equipment Regulations and Safety Standards	3			3	70	30	100
5		Practical – Advanced Equipment Management			4	2	70	30	100
6		Clinical postings			12	6	70	30	100
7		Soft skill development	01			01	100		100
TOTAL			**14**		**16**	**22**	**520**	**180**	**700**

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IV year /VII semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	MARK		TOTAL MARKS
							INT	EXT	
1		Internship-I	0	0	40	20	30	70	100
2		Project-I	-	-	2	1	100	-	100
		TOTAL	**0**	**0**	**42**	**21**	**230**	**70**	**300**

IV year/VIII semester

S. NO	SUBJECT CODE	SUBJECT	L	T	P	C	MARKS		TOTAL MARKS
							INT	EXT	
1		Internship-II	0	0	20	10	30	70	100
2		Project-II	0	0	20	10	30	70	100
		TOTAL	0	0	40	20	160	140	300

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1.1. Undergraduate program:

S. No	Course	Duration	Eligibility for admission
1	B.Sc. (Hons) Medical Equipment Technology	4 years	Intermediate Bi.P.C (mathematics optional)/ Diploma (2yrs) holders (can directly be enrolled into 2nd year) /10+2 or equivalent/

1.2. Medium of Instruction:

English shall be the medium of instruction for all subjects of study and for examinations.

1.3. Duration of the Course

Duration details are mentioned under clause no. 1.1 of this booklet.

1.4 Examination Regulations

1.4.1 Attendance:

As per the MRV guidelines. 80% of attendance (physical presence) is mandatory.

Medical leave or other types of sanctioned leaves will not be counted as physical presence. Attendance will be counted from the date of commencement of the session to the last day of the closing of attendance before the final examination.

1.4.2 Internal Assessments:

a) Regular periodic assessment shall be conducted throughout the course. In each semester there will be two one-hour internal assessments (10 marks each) and a continuous assessment (10 marks). Thus, a total of 30 marks for the internal exam. (i.e., weightage for internal assessment shall be 30% of the total marks in each subject).

b) Exam pattern for internal assessment in each semester will be

(a) Essay question 1 no. (5 marks)

(b) Short questions 1 no. (2 marks)

(c) Very short question 3 nos. (each carries 1 mark i.e., 1 x 3 = 3 marks)

Thus, a total of 10 marks for one internal assessment

Two such internal examinations will be conducted.

(b) Continuous assessment of the student will be done. Students' overall attendance, performance in class, behaviour of the student, extra-curricular activities etc will be assessed. Continuous assessment carries 10 marks.

(d) Thus, a total of 30 marks for the internal examination. (10 + 10 + 10 = 30 marks). A candidate should secure a minimum of 40% marks in the internal assessment in each subject to be eligible to appear for the University examination

(e) For value added courses, only internal examination will be conducted. The minimum pass is 40% marks.

(f) For project both internal and external examination will be conducted.

1.4.3 University Examinations (External):

a) University Examination shall be conducted at the end of every semester.

b) A candidate who satisfies the requirement of attendance and internal assessment marks, as stipulated by the University shall be eligible to appear for the University Examination.

c) Examination will be of 3 hours duration (for theory). The question pattern for those subjects without practical examination (70 marks) will be (a) Three essay questions out of which the student should answer 2 questions each carrying 10 marks (i.e., 2 x 10 = 20 marks) (b) Eight short note questions out of which the student should attempt six questions, each carrying 5 marks (6 x 5 = 30 marks). (c) Ten very short questions each carrying 2 marks (i.e., 10 x 2 = 20 marks). Thus, a total of 70 marks.

d) The question pattern for practical examination (a) Spotters/major practical/minor practical/Viva/practical record.

The minimum pass for internal assessment is 40% and for the University Examination is 50%. i.e., a student should score a total of 50% (adding the internal and external examination) to pass in each subject.

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YEAR I SEMESTER I

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Human Anatomy - I	4	-	-	4	30	70	100
2		Human Physiology - I	4	-	-	4	30	70	100
3		Medical Bio-chemistry	4	-	-	4	30	70	100
4		Sociology	2	-	-	2	30	70	100
5		English and Communication Skills	2	-	-	2	30	70	100
6		Basics of Computers	1	-	2	2	30	70	100
7		Human Anatomy - I Practical	-	-	4	2	30	70	100
8		Human Physiology - I Practical	-	-	4	2	30	70	100
9		Professionalism and values	1	-	-	1	100	-	100
TOTAL			**18**	**-**	**10**	**23**	**340**		**-**

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1.HUMAN ANATOMY–I

L/T/P/C

4/-/-/4

Learning Objectives:

- Understand the basic structure of the human body
- Study organization of cells, tissues, and organ systems
- Learn anatomy of musculoskeletal and cardiovascular systems
- Identify anatomical terminology and body planes

Learning Outcomes:
Students will be able to:

- Describe structure and organization of the human body
- Identify major organs and systems
- Apply anatomical knowledge in clinical contexts
- Use correct anatomical terminology

60 Hours

UNIT-I GENERAL ANATOMY AND HISTOLOGY (12 HRS)

General Anatomy:

- Fascia
- Muscles
- Bones
- Joints
- Vessels
- Nerve

General Histology:

- Epithelial
- Connective tissue
- Muscle
- Bone and cartilage
- Nerves and vessels
- Embryology

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UNIT-II UPPER EXTREMITY: (12HRS)

- Osteology: Clavicle, Scapula, Humerus, Radius, Ulna, Carpals, Metacarpals, Phalanges.
- Muscles: Origin, insertion, nerve supply, and actions.

UNIT-III UPPER EXTREMITY: (12 HRS.)

- Joints: Shoulder girdle, shoulder joint, elbow joints, radioulnar joint, wrist joint, and joints of the hand.

- Breast, pectoral region, axilla, cubital fossa, arch of the hand
- Brachial plexus, nerves of the upper extremity
- Blood vessels and lymphatic drainage

UNIT-IV CARDIO VASCULAR & RESPIRATORY ANATOMY (12 HRS)

- Thoracic wall
- Mediastinum
- Heart: Anatomy of heart, blood supply, nerve supply, conducting system, conducting System and major blood vessels
- Lungs: Anatomy of lungs, bronchial tree, pleura, bronchopulmonary segments, blood Supply, and nerve supply
- Diaphragm: Origin, insertion, nerve supply, and action, openings in the diaphragm.
- Intercostal muscles and accessory muscles of respiration: Origin, insertion, nerve supply, and action
- Ribs and sternum

UNIT-V :SYSTEMIC ANATOMY (12HRS)

1. Digestive system:
   List the parts of the digestive system
   Anatomy of the stomach, liver, gallbladder, spleen, pancreas, and intestines.
2. Urinary system:
   Anatomy of the kidney, urinary bladder
3. Endocrine system:
   Position and hormones secreted by each organ
4. Genital system:
   Male organs and female organs

Recommended Text Books

1. Human Anatomy-Snell
2. Anatomy- Chaurasia, Volume, and III
3. Neuroanatomy-Inderbir Singh
4. Human Anatomy- Kadasne, Volume, and III
5. Neuroanatomy— Vishrsam Singh
6. Human Anatomy- Datta

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2. HUMAN PHYSIOLOGY–I

L/T/P/C

4/-/-/4

Learning Objectives:

- Understand functions of major body systems
- Learn physiology of blood, cardiovascular, and respiratory systems
- Study homeostasis and body regulation mechanisms
- Correlate normal physiological processes with health

Learning Outcomes:
Students will be able to:

- Explain normal physiological functions of body systems
- Interpret basic physiological parameters
- Apply physiology knowledge to clinical situations
- Identify deviations from normal function

UNIT-I: GENERAL PHYSIOLOGY (12 Hrs)

1. Cell:

a. Structure of cell membrane
b. Fluid mosaic model
c. Lipid bi-layer
d. Functions of cell membrane

2. Transport across cell membrane

A. Basic mechanism of transport
a) Channel proteins
b) Carrier proteins

B. Methods of transport
a) Passive transport
b) Active transport

3. Body fluids

a) Intracellular fluid
b) Extracellular fluid
c) Body electrolytes
d) Regulation of body fluid volume
e) Homeostasis
f) Regulation of body function
g) Homeostatic regulatory mechanism
h) Blood:
1. Composition of blood & it's volume
2. Plasma
3. Hemopoiesis
a) Composition
b) Plasma protein

4. Erythrocytes

a) Normal count
b) Structure of RBC (shape & size)
c) Functions of RBC
d) Hemoglobin (Normal Value, Fate, Function)
e) Anemia & polycythemia
f) ESR & PCV

5. Leukocytes

a) Classification

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b) Functions of leukocytes

6. **Platelets**
   a) Normal count
   b) Functions of thrombocytes
   c) Blood Coagulation
   d) Bleeding time & clotting time
7. **Blood group**
   a) ABO system
   b) Landsteiner's law
   c) ABO incompatibility
   d) Rh system
   e) Rh incompatibility & erythroblastosis fetalis
8. **Blood transfusion**
   a) Collection & storage of blood
   b) Precautions
   c) Cross matching
   d) Hazards of blood transfusion

Nerve:

1. **Classification of neurons**
2. **Electrical activity of neuron**
   a) Resting membrane potential
   b) Action potential
3. **Propagation of nerve impulse**
4. **Properties of nerve fibers**
5. **Neuroglia - Types & functions**
6. **Nerve injury**
   a) Types of nerve injury
   b) Effect of nerve injury
   c) Regeneration of damaged nerve fiber

UNIT – II MUSCLE PHYSIOLOGY(12HRS)

1. **Classification**
2. **Properties of skeletal muscle**
3. **Structure of skeletal muscle**
   a) Sarcomere
   b) Sarcotubular system
   c) Neuromuscular junction & disease affecting it
4. **Excitation-Contraction coupling**
5. **Mechanism of muscle contraction**
6. **Functions of skeletal muscle**
7. **Types of muscle contractions**
8. **Red & white muscles**
9. **Rigor mortis, muscular dystrophy, altered muscle tone, muscle cramp, atrophy, EMG**

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UNIT III– CARDIOVASCULAR SYSTEM (12HRS)

1. **Structure of heart & blood vessels**
2. **Properties of cardiac muscle**
3. **Origin & spread of cardiac impulse**

4. **Cardiac cycle & heart sounds**
5. **Cardiac output**
    a) Related terms
    b) Regulation of cardiac output
    c) Circulatory shock
    d) Pulse & Heart rate and it's regulation
6. **Blood pressure**
    a) Definitions
    b) Factors controlling & influencing BP
    c) Regulation of BP
7. **Regional circulation**
    d) Coronary circulation
    e) Cerebral circulation
8. **Normal ECG.**

UNIT – IV RESPIRATORY SYSTEM (12 hrs)

1. **Introduction, structure & function of RS**
    a) Upper respiratory tract
    b) Lower respiratory tract
    c) Respiratory membrane
2. **Mechanism of breathing**
    a) Mechanics of breathing
    b) Respiratory pressure change
    c) Compliance
    d) Surfactant
3. **Respiratory volumes & capacities**
4. **Pulmonary ventilation & Dead space**
5. **Transport of respiratory gases**
6. **Nervous & chemical regulation of respiration**
7. **Pulmonary function test - direct & indirect method**
8. **Physiological changes with altitude & acclimatization**

UNIT V– EXERCISE PHYSIOLOGY (12HRS)

1. Basal Metabolic Rate & Respiratory Quotient
2. Energy metabolism
3. Fatigue
4. Oxygen debt
5. Acute cardiovascular changes during exercise; difference between mild, moderate & severe exercise.
6. Concept of endurance
7. Acute respiratory changes during exercise
8. Concept of training/conditioning; effects of long-term exercise/training on the CVS & RS
9. Body temperature regulation during exercise
10. Hormonal & metabolic effects during exercise
11. Exercise for muscle strength, power, endurance and there effects on it. Physical fitness & its components

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Recommended Text Books

1. Textbook on Medical Physiology-Guyton
2. Textbook of Physiology-AK Jain (for MBBS students)
3. Human Physiology-C.C. Chatterjee
4. Essentials of Medical Physiology- Sembulingam, K.
5. Comprehensive Textbook of Medical Physiology:Vol-1&2 -Pal, Gopal Krishna
6. Physiology: Prep Manual for Undergraduates-Joshi, Vijaya D.
7. Practical Physiology-Joshi, Vijaya D.

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3. BIOCHEMISTRY–I

L/T/P/C
4/-/-/4

Learning Objectives:

- Understand basic biochemical components of the body
- Learn metabolism of carbohydrates, proteins, and lipids
- Study enzymes, vitamins, and hormones
- Understand biochemical basis of diseases

Learning Outcomes:
Students will be able to:

- Explain biochemical processes in the human body
- Interpret basic biochemical laboratory reports
- Relate biochemical changes to disease conditions
- Apply biochemical knowledge in clinical practice

(60hrs)

Unit I: CARBOHYDRATE CHEMISTRY (12HRS)

- Definition, general classification with examples
- Composition and function of Monosaccharides and Polysaccharides
- Anomers, Epimers, Enantiomers, Mutarotation
- Glycosaminoglycan's (mucopolysaccharides)

Lipid Chemistry

- Definition, classification with examples.
- Classification and Functions of Fatty Acids, Phospholipids, Lipoproteins
- Structure and function of cholesterol
- Sources and functions of ketone bodies

UNIT-II: AMINO ACIDS (12HRS)

Aminoacid Chemistry

- Definition, Classification of Amino Acids with Examples.
- Definition, Classification of Proteins with Examples
- Structural organization of proteins
- Biologically important peptides
- NUCLEIC ACIDS AND NUCLEOTIDE CHEMISTRY
- Composition and Function of Nitrogen bases, Nucleosides, Nucleotides
- Structure and Function of DNA
- Structure, Types, and Functions of RNA
- Differences between DNA and RNA

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UNIT-III ENZYMES (12HRS)

ENZYMES

- Definition, Classification of Enzymes with Examples
- Active site, Enzyme specificity.
- Factors affecting enzyme activity
- Enzyme inhibition
- Iso enzymes and their clinical significance, creatine kinase, ALP

Vitamins

- Definition, Classification
- Fat-soluble Vitamins-Sources, RDA, Functions, and Deficiency.
- Water-soluble Vitamins-Sources, RDA, Functions, and Deficiency

UNIT-IV: INTERMEDIARY METABOILISM (12HRS)

- Glycolysis
- TCA cycle
- B-oxidation of fatty acids (Palmitic acid)
- Ketone body formation and utilization, Urea cycle

UNIT-V (12HRS)

Mineral Metabolism

- Definition, Classification. Sources, RDA, Functions, and Deficiency of Calcium, Phosphorus, Iron, Sodium, Potassium

Clinical Biochemistry

- Normal and abnormal constituents of urine and blood and their clinical significance:
- Normal constituents:
- Organic: Urea, Uric acid, Creatinine
- Inorganic: Ca, phosphate, chloride, electrolytes
- Abnormal constituents:
- Glucose, Ketone bodies, Protein, Blood, Bile salts, Bile Pigments

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Recommended Text Books

1. Essentials of Biochemistry by U. Satya Narayana.
2. Textbook of Biochemistry for Medical Students. DM Vasudeva
3. Integrated textbook of Biochemistry Volume-land II.Indumathi.
4. Textbook of Biochemistry for Medical Students.MN Chatterjee and Rana Shinde.
5. Illustrated Biochemistry.
6. Essentials of Biochemistry. Pankaja Naik

4.SOCIOLOGY

L/T/P/C

2/-/-/2

Learning Objectives:

- Understand basic concepts of sociology and society
- Study social determinants of health
- Learn patient behavior and cultural influences
- Understand healthcare systems and social issues

Learning Outcomes:
Students will be able to:

- Explain social factors affecting health and illness
- Demonstrate understanding of patient behavior
- Communicate effectively in diverse social settings
- Apply sociological concepts in healthcare delivery

30 hours

UNIT 1 (6HRS)

1. Introduction

- Meaning- Definition, Nature and Scope of Sociology
- Methods of Sociological Investigations, Case Study, Social Survey, Questionnaire, and Interview methods.
- Importance of its study with special reference to Health Care Professionals.

2. Social Factors in health and disease situations:

- Role of Social factors in health
- Role of social factors in illness
- Decision-making in taking treatment

UNIT II (6hrs)

1. Socialization:

- Definition and Meaning of Socialization
- Primary, Secondary, and Anticipatory socialization
- Agencies of Socialization

2. Social Groups:

- Definition and Features of Social Group
- Primary Social Group
- Secondary Social Group
- The role of Primary and Secondary Groups in Hospitals.

UNIT III (6hrs)

1. Family:

- The family, meaning, and definition
- Functions of the family
- Changing family patterns

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- Influence of Family on the individual's health, the effects of sickness in the family.

2. Community:

- Rural community: meaning and features- Health problems of the rural community.
- Urban community: meaning and features - Health problems in urban areas.

UNIT IV (6hrs)

1. Culture and Health:

- Concept of Health
- Concept of Culture
- Cultural factors affecting Health and diseases

2. Social Change:

- Meaning of social change
- Factors of social change
- Human adaptation and social change
- Social Planning and Health

UNIT V (6hrs)

1. Social Problems:

- Population explosion
- Juvenile delinquency
- Alcoholism
- Unemployment
- Poverty
- Problems of women

2. Social Security:

- Social security and social legislation

Recommemded Text Books

1. Principles of Sociology --- C.N. Shankar Rao

2. Sociology for physiotherapy students--K.P. Neeraja

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5.ENGLISH AND COMMUNICATION SKILLS

L/T/P/C

2/-/-/2

COURSE OBJECTIVES

- To enhance the lexical and grammatical skills of the learners.
- To develop reading competencies for academic and professional requirements.
- To write effectively to meet professional needs.
- To hone speaking and listening skills.
- To enhance empathy and other vital interpersonal skills of the learners

COURSE OUTCOMES:

- Construct grammatically correct sentences with appropriate vocabulary.
- Analyse, interpret, and synthesise a diverse range of profession-specific concepts through better comprehension of the text.
- Draft various types of written communication pieces useful to their professional lives.
- Understand and apply norms of scientific communication and positive interpersonal communication.
- Listen effectively and speak fluently in formal and informal situations, especially in their workplace.

(30 hrs)

UNIT1: Sympathy (Poem) by Charles Mackay (6hrs)

Reading-Reading and its importance, techniques of effective reading.

Writing-Paragraph Writing (Topic sentence, Supporting sentences, and Conclusion) Grammar - Parts of Speech (Parsing), Articles

ELCSLAB

CALLLAB : Phonetics- Vowel Sounds (Monophthongs and Diphthongs)

Listening-Introduction to listening, Purpose of Listening, and Barriers to effective listening

UNIT2: A Birthday Letter by Jawaharlal Nehru

Reading-Skimming and Scanning

Writing-Letter writing (Requests, Leave applications, Purchase letters, Letters in correspondence with medical insurance companies)

Grammar- Phrase, Clause and Sentence; Prepositions

ELCSLAB

CALLLAB: Phonetics- Consonant Sounds

Listening-Listening for gist and specific information

UNIT3: The secret of work by Swami Vivekananda (6hrs)

Reading-Making inferences and predictions

Writing-E-mail writing

Grammar-Tenses, Reported speech vocabulary–food and life style, instrument & equipment

ELCSLAB

CALLLAB: Intonation

Listening- Listening and identifying facts and opinions

ICSLAB: Speaking-Role Plays (OET) (Giving and taking instructions, Interacting with and explaining processes, conditions and instructions to the patients and their attenders,

UNIT4: All the world's a stage (Poem) by William Shakespeare (6hrs)

Reading-Reading for explicit and implicit meaning

Writing-Short essays: 2-ParagraphEssay, Thesis Statement

Grammar-Subject-Verbal agreement, Degrees of Comparison

ELCSLAB

CALLLAB: Consonant Clusters

Listening-Listen-Comprehend- Speak, Health Care

UNIT5: Sister Nivedita: Calcutta's Angel of Mercy (Article/Essay) by MonidipaDey (6hrs)

Writing-Report writing (Analysing tests and Reporting patient condition) Grammar– Voice, If conditionals

Vocabulary-Health, Wellness, Medical Vocabulary/Terminology

ELCSLAB

CALLLAB: Past Tense Markers and Plural Markers

Listening- Listening tasks from OET and IELTS

MALLA REDDY VISHWAVIDYAPEETH (Deemed to be University)

RECOMMENDED TEXT BOOKS

1. Practical English Usage by Michael Swan. OUP. 1995. On Writing Well by William Zinsser, Harper Resource Book. 2001. Cambridge English for Nursing by Virginia Allum and Patricia McGarr. CUP. 2010. English for Nursing by Ross Wright and Bethany Cagnol.Pearson.2001.
2. English for Nursing- 2 by Maris Spada Symonds and Ross Wright. Pearson. 2001. Every day English for International nurses by Joy Parkinson and Chris Brooker. Elsevier. 2004. Oxford English for Career Nurses by Tony Grice. Oxford University Press. 2007.
    a. English for Nurses by Vijaya Laxmi Naidu. Nirali Prakashan. 2008.

MALLA REDDY VISHWAVIDYAPEETH (Deemed to be University)

6.BASICS OF COMPUTERS

L/T/P/C

1/0/2/3

LEARNING OBJECTIVES

- To understand all components of a computer, different working environments, and computer operations.
- To learn how to create different types of Word documents, MS Excel manipulations, and PowerPoint documents.
- To understand basic requirements of computer network hardware, software, and its network architecture.

COURSE OUTCOMES:

- At the end of the course, the student will be able
- Tounderstandperipheralsofthecomputerhowitworksandunderstandvarious languages of the computer.
- To create any kind of presentations for presenting their knowledge anywhere in the form of a document or PPT.
- To create Excel sheets to save data and process the data efficiently.
- To understand basic requirements of computer network hardware, software, and its network architecture.

30 hours

UNIT–I (6HRS)

Introduction to computers--Definition of Computer-Characteristics of Computer Components of Computer Hardware–Memories–RAM and ROM–MB, GB, their conversions – Software: Application Software and Systems software- Data and Information –Different computer languages- Number systems- Binary and decimal conversions.

UNIT–II (6HRS)

MS Word: Typing text in MS Word–Manipulating text¬ text–formatting text–using different font sizes, bold, italic– bullets and numbering –Pictures, Aligning the text and justify– choosing paper size– adjusting margins– header and footer, inserting page numbers in a doc– printing a file with options– using spell check and grammar–find and replace– mail merge– insert tables in a document.

UNIT–III (6HRS)

MSEXCEL: Creating MS Excel – Cell editing, using formulas and functions, manipulating data with Excel–using sort function to sort numbers and alphabets–drawing graphs and charts using data in Excel.

MSPOWERPOINT: Slide transition and animation-slides with sounds–inserting clip arts– Pictures, tables, and graphs.

UNIT–IV (6HRS)

Introduction to Computer Networks: Introduction, Computer Network Devices(Hubs, Switches, Routers, Gateway, Bridge, Modems, Wireless Access Points, Firewalls & NIC), Types of computer Networks (LAN, MAN&WAN), Network Topologies(Star, Ring, Mesh, Tree, Hybrid Topologies), Internet Based Applications, Advantages & Disadvantages of Computer Networks, E-Mail, Components of E-Mail, Attaching Files in E-mail, Different Search Engines

UNIT–V (6HRS)

Introduction to Artificial Intelligence & ML: History of AI, Sub Areas of AI, Applications of Healthcare, Benefits of AI in Healthcare, Challenges of AI in Healthcare, Introduction to Machine Learning, Applications of Machine Learning, Machine Learning Algorithms, Real-world Machine Learning Use Cases.

Recommended Text Books

1. Computer Fundamentals by Goel, Anita Pearson
2. Computer Fundamentals: Concepts, Systems & Applications-8thEditionbyPritiSinha, Pradeep K., Sinha
3. MS-Office2010TrainingGuidebyProf.SatishJain, M. Geetha, Computer Networks, Andrews Stanenbaum, 5th Edition, Pearson Education
4. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, Third Edition, Pearson Education
5. Hands-on Machine Learning with Scikit-Learn, Keras, and Tensor Flow, Aurelien Geron-O'Reilly, 2nd Edition.

7. HUMAN ANATOMY- I PRACTICAL

L/T/P/C

-/-/4/2

Human anatomy practicals for physiotherapy students are essential for understanding the structure of the human body, its systems, and their functional relationships. These practicals focus on giving students hands-on experience in identifying anatomical structures, learning dissection techniques, and understanding the musculoskeletal, nervous, and cardiovascular systems, all of which are vital for effective physiotherapy practice.

Learning Objectives:

- Identify anatomical structures through models/specimens
- Develop observation and identification skills
- Understand practical aspects of anatomy
- Correlate theory with practical knowledge

Learning Outcomes:
Students will be able to:

- Identify major anatomical structures
- Demonstrate basic dissection/model study skills
- Correlate anatomical structures with functions
- Apply anatomical knowledge in clinical practice

Gross Specimens/Spotters (30 Hrs)

Upper Extremity

Identify the spotter-(Cross section of shoulder Joint, Elbow Joint, Wrist complex, Hand)

Identify the bone- upper extremity bones (Scapula, Clavicle, Humerus, Radius and Ulna, Carpals, Metacarpals, and Phalanges), including side determination.

Surface Anatomy of the Upper Extremity–upper extremity bones and muscles

Myology-(cadaveric spotter) Spotters of the upper extremity muscles, including the origin, insertion, blood supply, and nerve supply

Spotters of Blood vessels (Pro funda Brachii, Brachial, Radial, Ulnar). Spotter of
Nerves (Axillary, Musculocutaneous, Radial, Median, Ulnar) Structure and Parts of the
Breast-Spotter Cardio-vascular and Respiratory Anatomy Gross Specimen of Heart,
Lung Spotters of the Bronchial tree, Bronchopulmonary segments
Myology-(Diaphragm, Intercostal muscles and Accessory Muscles) Systemic Anatomy
Gross Specimen/Spotter (Stomach, Liver, Gall Bladder, Spleen, Pancreas, Intestines, Kidney, Uterus)

Cross-section of the Kidney

Spotters of Glands- (Pituitary Gland, Thyroid Gland, Adrenal Gland, Parathyroid, Pineal Gland)

8.HUMAN PHYSIOLOGY–I PRACTICAL L

L/T/P/C

-/-/4/2

Learning Objectives:

- Perform basic physiological experiments
- Learn measurement of vital parameters
- Understand normal physiological values
- Develop laboratory skills

Learning Outcomes:
Students will be able to:

- Measure and record physiological parameters (BP, pulse, etc.)
- Perform basic laboratory experiments
- Interpret normal physiological data
- Maintain accuracy and safety in lab practices

Human Physiology Practical for Basic Clinical Skills Development (30 hrs)

- These practicals typically align with the theoretical aspects of physiology and help students apply concepts to real-world clinical scenarios. Key Areas Covered in Human Physiology for this semester include the following.-
- Determination of blood group,
- Estimation of haemoglobin concentration,
  Peripheral pulse determination,
- Auscultation of heart sounds,
- Determination of blood pressure,
  Auscultation of breath sounds,
- Assessment of respiratory rate,
  Anthropometric assessment (BMI&WHR)

9.PROFESSIONALISM AND VALUES

L/T/P/C

1/-/-/1

Course Objectives

After completion of the course, students will be able to:

1. Understand the meaning and significance of professionalism and values.
2. Develop ethical and responsible behavior in academic and workplace settings.
3. Apply professional values in communication and teamwork.
4. Recognize the importance of integrity, leadership, and social responsibility.
5. Build positive attitudes and professional competencies for career development.

UNIT I: INTRODUCTION TO PROFESSIONALISM AND HUMAN VALUES (4 HOURS)

- Meaning and concepts of professionalism
- Human values and their importance
- Personal values vs professional values
- Ethics, morals and principles
- Characteristics of a professional
- Importance of value-based education

UNIT II: PROFESSIONAL ETHICS AND INTEGRITY (4 HOURS)

- Professional ethics and code of conduct
- Honesty and integrity
- Accountability and responsibility
- Ethical decision-making
- Academic ethics and plagiarism awareness
- Ethical dilemmas in professional life

UNIT III: COMMUNICATION AND INTERPERSONAL VALUES (4 HOURS)

- Effective communication skills
- Respect and empathy
- Teamwork and collaboration
- Professional etiquette
- Conflict resolution
- Workplace behavior and discipline

UNIT IV: LEADERSHIP AND SOCIAL RESPONSIBILITY (4 HOURS)

- Leadership qualities
- Time management and self-discipline
- Social responsibility and civic values
- Community engagement
- Environmental ethics and sustainability
- Service learning concepts

UNIT V: PROFESSIONAL DEVELOPMENT AND WORKPLACE READINESS (4 HOURS)

- Personality development
- Positive attitude and emotional intelligence
- Stress management and work-life balance
- Career ethics and workplace culture
- Lifelong learning and professional growth

Reference Books

1. **R.S. Naagarazan** – *Professional Ethics and Human Values*, New Age International Publishers.

I year II semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Fundamentals of medical equipment	2	-		2	30	70	100
2		Biomedical instrumentations -1	3	-		3	30	70	100
3		Mechanics of medical devices	2	-		2	30	70	100
4		Medical device basics	2	-		2	30	70	100
5		Equipment Basics - Practical	-	-	2	1	30	70	100
6		Clinical postings	-	-	18	9	30	70	100
7		Health and Well Being	1	-	-	1	100	-	100
	TOTAL		**10**		**20**	**20**	**280**	**420**	**700**

1. Fundamentals of Medical Equipment

L/T/P/C
2/0/0/2

COURSE OBJECTIVES

1. Understand the basics of medical equipment technology and healthcare systems.
2. Learn the classification and functions of medical devices.
3. Study the operation of monitoring, therapeutic, and laboratory equipment.
4. Develop skills in testing, calibration, and maintenance procedures.
5. Understand safety standards and patient protection practices.

COURSE OUTCOMES

1. Explain the types and uses of medical equipment.
2. Describe the working principles of common medical devices.
3. Perform basic troubleshooting of medical equipment.
4. Apply calibration and maintenance procedures.
5. Follow safety protocols in healthcare settings.

30 hrs

UNIT I: INTRODUCTION TO MEDICAL EQUIPMENT TECHNOLOGY (10 hrs):

Overview of healthcare technology and role of medical equipment technologists; Classification of medical devices and equipment used in hospitals; Basics of operation, function, clinical applications, and categories of medical instruments (diagnostic, therapeutic, and monitoring); Medical terminology and device terminology

Study of common equipment including: Monitoring devices: ECG monitors, blood pressure monitors, pulse oximeters

UNIT II: THERAPEUTIC DEVICES (10 Hrs):

Infusion pumps, ventilators, suction units

UNIT III: LABORATORY EQUIPMENT (10 Hrs):

Centrifuges, analyzers Operation principles, components, and basic troubleshooting methods for these devices Calibration, Testing, and Maintenance: Routine testing and calibration procedures for medical devices; Safety protocols while handling electrical and high-voltage equipment; Preventive and corrective maintenance practices; Keeping equipment logs and documentation

Safety, Standards & Patient Protection: Electrical safety in hospitals

Precautions for patient and operator safety

Handling risks like shock, vibration, radiation

Standards for maintenance and equipment safety practices

RECOMMENDED TEXT BOOKS

1. Introduction to Biomedical Equipment Technology by Joseph J. Carr & John M. Brown
2Handbook of Biomedical Instrumentation by R. S. Khandpur
3. Biomedical Instrumentation and Measurements by Leslie P. Cromwell, Fred J. Weibell & Erich A. Pfeiffer
4. Medical Instrumentation: Application and Design by John G. Webster

BIOMEDICAL INSTRUMENTATIONS-I

L/T/P/C
3/0/0/3

Course Objectives

1. To understand the basics of biomedical instrumentation systems.
2. To learn the principles of bioelectric signals and electrodes.
3. To study biomedical sensors and transducers.
4. To understand signal measurement and patient monitoring systems.
5. To gain knowledge of diagnostic equipment and safety standards.

Course Outcomes

1. Explain the fundamentals of biomedical instrumentation.
2. Describe different bioelectric signals and electrodes.
3. Identify biomedical sensors and transducers for applications.
4. Demonstrate knowledge of monitoring and recording systems.
5. Apply electrical safety principles in healthcare settings.

60 Hrs.

UNIT-I FUNDAMENTALS OF BIOMEDICAL INSTRUMENTATION (15 HRS)

Introduction to biomedical instrumentation
Basic medical measurement systems
Components of a medical instrumentation system
Static and dynamic characteristics of biomedical instruments
Classification of biomedical instruments (diagnostic, therapeutic, monitoring)
Overview of human physiology basics needed for signals (cell structure, membrane potentials)

UNIT II- BIOELECTRIC SIGNALS & ELECTRODES (15 HRS)

Origin and nature of bioelectric signals
Resting potential and action potential
Characteristics of ECG, EEG, EMG, EOG, ERG
Types of electrodes (surface, needle, micro)
Electrode-electrolyte interface half-cell potential, polarization
Electrode-skin impedance and motion artifacts
Transducers and Sensors in Biomedical Applications:
Classification of transducers
Characteristics and performance criteria of sensors
Transducers for biomedical use (resistive, inductive, capacitive, piezoelectric, photoelectric, thermistor)
Selection criteria and application examples
Bioelectric Signal Measurement & Recording Systems: Amplifiers for biomedical signals (differential, isolation)
ECG: lead configurations, waveforms, artifacts
EEG: electrode systems, recording techniques
EMG: recording and interpretation
Photoplethysmography, spirometry, blood pressure transducers

UNIT III - PATIENT MONITORING SYSTEMS (15 HRS):

Heart rate monitoring; Respiration rate measurement; Blood pressure
monitoring techniques; Pulse oximetry; Microprocessor applications in monitoring

UNIT IV DIAGNOSTIC & IMAGING EQUIPMENT INTRODUCTION: (15 HRS)

X-ray generation and basic components; Ultrasonic
imaging principles; CT / MRI concepts overview; Nuclear medicine basics
Safety Standards & Electrical Safety: Electrical safety in medical environments; Shock hazards (micro and macro); Protection of patients and equipment

Recommended Text Books

1. Handbook of Biomedical Instrumentation by R. S. Khandpur
2. Biomedical Instrumentation and Measurements by Leslie P. Cromwell, Fred J. Weibell & Erich A. Pfeiffer
3. Medical Instrumentation: Application and Design by John G. Webster

3.MECHANICS OF MEDICAL DEVICES

L/T/P/C
2/0/0/2

Course Objectives

1. Understand the basic concepts and classification of medical devices.
2. Explain the principles of biomechanics and tissue mechanics.
3. Apply mechanical design concepts in medical equipment development.
4. Analyze mechanical systems used in healthcare devices and support systems.
5. Understand safety standards, testing methods, and regulatory requirements for medical devices.

Course Outcomes

1. Classify medical devices and describe their clinical applications.
2. Explain biomechanical properties and mechanical behavior of biological tissues.
3. Apply mechanics principles in the design and selection of medical devices.
4. Evaluate the functioning of mechanical components in healthcare equipment.
5. Assess device performance, safety, reliability, and compliance with standards.

30 Hrs

UNIT-I: INTRODUCTION TO MEDICAL DEVICES & MECHANICS (5 Hrs):
Definition and classification of medical devices; Role of mechanics in medical equipment design and performance; Overview of clinical applications and device environments

UNIT-II: FUNDAMENTALS OF BIOMECHANICS (5 Hrs)::
Mechanical properties of biological tissues (bone, muscle, cartilage); Concepts:
stress, strain, elasticity, viscoelasticity; Load-deformation behavior in organs and tissues

UNIT-III: MECHANICS IN DEVICE DESIGN (5 Hrs)::
Mechanical design principles for medical devices; Motion, force, and power transmission in device mechanisms; Material selection for mechanical strength and biocompatibility

UNIT-IV: MECHANICAL SYSTEMS IN MEDICAL EQUIPMENT (5 Hrs)::
Mechanics of prostheses and orthoses; Mechanical components in hospital equipment (e.g., wheelchair design, patient lifts); Mechanical considerations in life support systems

UNIT-V: BIO-MECHANICAL DEVICE PERFORMANCE (5 Hrs)::
Load testing and failure analysis; Safety factors and reliability; Physical performance evaluation of mechanical devices

UNIT-VI: STANDARDS, SAFETY & REGULATORY BASICS (5 Hrs):
Medical device mechanical safety standards (ISO/IEC); Testing protocols and compliance procedures

Recommended Text Books
1. Biomechanics of Medical Devices by Dhanjoo N. Ghista
2. Internal Bio-Mechanics / Introductory Biomechanics in "Medical Instrumentation: Application and Design" by John G. Webster

4. MEDICAL DEVICE BASICS

L/T/P/C
2/0/0/2

Course Objectives

1. Understand the fundamentals and classifications of medical devices used in healthcare.
2. Explain the operating principles of common medical equipment and diagnostic devices.
3. Learn the basics of biomedical measurements, sensors, and signal acquisition systems.
4. Understand safety practices, standards, and patient protection measures in medical devices.
5. Develop basic knowledge of maintenance, troubleshooting, and regulatory requirements of medical devices.

Course Outcomes

After completion of the course, students will be able to:

1. Identify and classify medical devices based on function, application, and risk category.
2. Explain the working principles of common medical and diagnostic equipment.
3. Describe the role of biosensors, transducers, and biomedical signal measurement techniques.
4. Apply basic safety, sterilization, and quality standards in healthcare technology use.
5. Perform routine checks, identify minor faults, and understand regulatory and maintenance procedures.

30 Hours

UNIT I: INTRODUCTION TO MEDICAL DEVICES (5 HRS):
Definition and scope of medical devices; Role of medical devices in healthcare delivery systems; Types and classification of medical devices (by use, risk class)

UNIT II: BASIC PRINCIPLES OF OPERATION OF COMMON DEVICES (5 HRS):
Vital sign monitors (ECG, pulse oximeter); Infusion pumps; Suction devices; Autoclaves and sterilization equipment; Diagnostic devices

UNIT III: BIOMEDICAL MEASUREMENTS & BIOSENSORS (5 HRS):
Basics of bio-signal measurement (ECG, EEG, blood pressure); Transducers and sensors used in medical devices; Signal acquisition and conditioning fundamentals

UNIT IV: SAFETY, STANDARDS & PATIENT PROTECTION (5 HRS):
Electrical safety in medical devices; Infection control and sterilization principles; Safety standards (e.g., basic regulatory frameworks and quality control)

UNIT V: INTRODUCTION TO MAINTENANCE & TROUBLESHOOTING (5 HRS):
Routine checks and preventive measures; Handling minor faults

under supervision; Reporting procedures for device malfunction

UNIT VI: REGULATORY OVERVIEW (5 HRS):
Basics of medical device regulation and classification (India/Global context); Quality management systems (concept of ISO 13485 and risk management)

Recommended Text Books
1. Medical Device Technologies: A Systems Based Overview Using Engineering Standards by Gail Baura, Ph.D.
2, Essential Guide to Medical Equipment Principles by David Mulvey
3. Biomedical Technology and Devices by James E. Moore Jr. & Duncan J. Maitland

5. EQUIPMENT BASICS-PRACTICAL

L/T/P/C
0/0/2/1

Practical Sessions:
Hands-on operation with common devices: ECG, pulse oximeter, Suction devices, Autoclaves and sterilization equipment, Diagnostic devices.
Basic tests, calibration, and simple functional checks of common devices
Safety drills and device handling best practices

Recommended Text Books
1. Medical Device Technologies: A Systems Based Overview Using Engineering Standards by Gail Baura, Ph.D.
2, Essential Guide to Medical Equipment Principles by David Mulvey
3. Biomedical Technology and Devices by James E. Moore Jr. & Duncan J. Maitland

6. CLINICAL POSTINGS

L/T/P/C
0/0/18/9

Clinical Laboratory:
Lab equipment maintenance and quality control checks of Hematology analyzer; Biochemistry analyzer; Centrifuge; Microscope; Blood gas analyzer.
Central Sterile Services Department (CSSD)
Sterilization equipment functioning and infection control of Autoclave, Sterilizers and ETO sterilization units

7.HEALTH AND WELL-BEING

L/T/P/C

1/-/-/1

Course Description:

This course explores the holistic approach to health and well-being, focusing on physical, mental, and social aspects. Students will learn about health promotion strategies, the importance of physical activity, nutrition, mental health awareness, and stress management. The course also addresses the impact of lifestyle choices and societal factors on overall health.

Learning Objectives:

- To understand concepts of physical, mental, and social health.
- To promote healthy lifestyle practices.
- To develop stress management and coping strategies.
- To create awareness about preventive healthcare.

Learning Outcomes:

- Explain components of health and well-being.
- Adopt healthy lifestyle and preventive practices.
- Demonstrate stress management techniques.
- Promote health awareness in the community.

(15hrs)

UNIT I (1HR)

Introduction to Health and Well-being:

Overview of Health and Well-being

Concepts

Dimensions of health: Physical, mental, social, and emotional. The impact of lifestyle choices on health

UNIT II (1HR)

Physical Health and Fitness: Importance of physical activity for overall health

Types of exercise: Aerobic, strength, flexibility, and balance creating a personal fitness plan

UNIT III (1HR)

Nutrition and Healthy Eating

Basics of nutrition: Macronutrients and micronutrients. Healthy eating habits and food groups. Impact of nutrition on physical and mental health.

UNIT IV (1HR)

Mental Health and Emotional Well-being

Understanding mental health: Definitions, stigma, and myths

Key aspects of emotional well-being

Building emotional resilience

UNIT V (1HR)

Stress Management Techniques

Understanding stress and its effects on health

Mindfulness and relaxation techniques

Time management for stress reduction

UNIT VI (2HRS)

Sleep and Recovery

Importance of sleep for physical and mental health

Sleep hygiene and healthy sleep habits

Impact of sleep deprivation on overall well-being

UNIT VI (2HRS)

Social Health and Relationships

The role of social connections in well-being

Healthy relationships: Communication, boundaries, and support

Community involvement and social well-being

UNIT VIII (2HRS)

Substance Use and Addiction

The impact of alcohol, tobacco, and drugs on health

Understanding addiction and treatment options

Preventive measures and harm reduction strategies

UNIT IX (2HRS)

Chronic Diseases and Prevention

Common chronic diseases (e.g., diabetes, heart disease)

Risk factors and lifestyle modifications for prevention

Screening, early detection, and health monitoring

UNIT X (2HRS)

Building Healthy Habits

The psychology of habit formation

Strategies for adopting and maintaining healthy habits

Overcoming barriers to healthy behaviour changes

Reference Textbook

Health and Wellness" by S. L. Kaskutas & K. A. A. Nielson

YEAR II SEMESTER III

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Medical Device Safety	3			3	30	70	100
2		Imaging Equipment	3			3	30	70	100
3		Biomedical Instrumentation – II	3			3	30	70	100
4		Healthcare Administration	3			3	30	70	100
5		Practical: Equipment Safety and Maintenance			4	2	30	70	100
6		Clinical Postings			14	7	30	70	100
7		Soft Skills Development	1			1	100		100
TOTAL			**13**		**18**	**22**	**280**	**420**	**700**

Year II/ Semester III

1. MEDICAL DEVICE SAFETY

L/T/P/C

3/0/0/3

Course Objectives

1. To understand the concepts and importance of medical device safety in healthcare.
2. To identify different types of hazards associated with medical equipment and hospitals.
3. To explain electrical safety principles and protective measures in medical devices.
4. To familiarize students with medical device safety standards and regulatory requirements.
5. To develop knowledge of safety testing, risk management, and incident control practices.

Course Outcomes

After completion of the course, students will be able to:

1. Identify healthcare hazards and explain their impact on medical device safety.
2. Describe electrical safety concepts and protective systems used in hospitals.
3. Interpret medical device standards, regulations, and safety symbols.
4. Perform basic safety testing and apply risk assessment methods.
5. Explain radiation safety, infection control, and incident management procedures.

60 Hrs

UNIT I: INTRODUCTION TO MEDICAL DEVICE SAFETY AND HEALTHCARE HAZARDS (12 HRS)

- Definition and scope of medical device safety
- Importance of safety in healthcare systems
- Classification of medical devices based on risk
- Sources of hazards in hospitals
- Types of hazards:
  - Electrical hazards
  - Mechanical hazards
  - Thermal hazards
  - Biological hazards
  - Radiation hazards
- Human factors and user-related errors
- Safety culture in healthcare organizations

UNIT II: ELECTRICAL SAFETY IN MEDICAL EQUIPMENT (12 HRS)

- Basic electrical concepts and physiological effects of electric current
- Macroshock and microshock
- Leakage current and grounding concepts
- Classes of medical equipment (Class I, II, III)
- Types of applied parts (Type B, BF, CF)
- Protective devices:
  - Fuses

  - Circuit breakers
  - Isolation transformers
  - Ground fault interrupters
- Electrical safety requirements in hospitals

UNIT III: MEDICAL DEVICE STANDARDS AND REGULATORY SAFETY REQUIREMENTS (12 HRS)

- Introduction to safety standards
- Overview of international standards:
  - IEC 60601 series
  - ISO standards for medical devices
- Hospital safety policies
- Documentation and compliance requirements
- Biomedical equipment safety regulations
- Medical device labeling and safety symbols
- National and international regulatory authorities

UNIT IV: SAFETY TESTING AND RISK MANAGEMENT (12 HRS)

- Principles of safety testing
- Preventive maintenance and safety inspections
- Electrical safety analyzers and test equipment
- Leakage current testing
- Ground resistance testing
- Functional safety checks
- Introduction to risk management process
- Hazard identification and risk assessment methods

UNIT V: RADIATION, INFECTION CONTROL AND INCIDENT MANAGEMENT(12 HRS)

- Radiation safety principles:
  - X-ray safety
  - CT and nuclear medicine safety basics
- Personal protective equipment
- Radiation dose limits and monitoring
- Infection control in medical devices
- Sterilization and disinfection concepts
- Incident reporting systems
- Medical equipment failure investigation and corrective action

2. IMAGING EQUIPMENT

L/T/P/C

3/0/0/3

Course Objectives

1. To understand the basic principles of medical imaging and radiation physics.
2. To study the construction and operation of X-ray and fluoroscopy systems.
3. To learn the principles and applications of ultrasound imaging equipment.
4. To understand the working of CT, MRI, and nuclear imaging systems.
5. To develop knowledge of imaging equipment management, safety, and quality assurance.

Course Outcomes

After completing the course, students will be able to:

1. Explain the principles of medical image formation and radiation interactions.
2. Describe the components and operation of X-ray and digital imaging systems.
3. Differentiate ultrasound transducers and imaging modes with their applications.
4. Explain the functioning and safety aspects of CT, MRI, and nuclear imaging systems.
5. Apply quality assurance, maintenance, and image management concepts in medical imaging equipment.

60 Hrs.

UNIT I: FUNDAMENTALS OF MEDICAL IMAGING AND RADIATION PHYSICS (12 HRS)

- Introduction to medical imaging and diagnostic modalities
- Electromagnetic spectrum and medical imaging applications
- Basic radiation physics
- X-ray production and properties
- Interaction of radiation with matter
- Attenuation, absorption, scattering, photoelectric effect, Compton effect
- Radiation units and measurements
- Image quality parameters:
  - Contrast
  - Resolution
  - Noise
  - Signal-to-noise ratio
- Radiation hazards and biological effects

UNIT II: X-RAY IMAGING EQUIPMENT AND FLUOROSCOPY (12 HRS)

- History and development of X-ray systems
- Components of X-ray equipment:
  - X-ray tube
  - Tube housing
  - High-voltage generator
  - Collimators
  - Grids
- Conventional radiography systems
- Digital radiography and computed radiography
- Fluoroscopy systems and image intensifiers
- Flat panel detectors

- Mammography equipment—basic principles and applications
- Basic quality control procedures

UNIT III: ULTRASOUND IMAGING EQUIPMENT (12 HRS)

- Principles of ultrasound physics
- Piezoelectric effect
- Generation and detection of ultrasound waves
- Components of ultrasound imaging systems
- Types of transducers:
  - Linear
  - Convex
  - Phased array
- Modes of ultrasound imaging:
  - A-mode
  - B-mode
  - M-mode
  - Doppler ultrasound
- Color Doppler and applications
- Artifacts in ultrasound imaging
- Preventive maintenance and safety considerations

UNIT IV: COMPUTED TOMOGRAPHY (CT) AND MAGNETIC RESONANCE IMAGING (MRI) EQUIPMENT

COMPUTED TOMOGRAPHY

- Principles of CT imaging
- CT scanner components
- Data acquisition system
- Generations of CT scanners
- Spiral and multislice CT
- Image reconstruction concepts
- CT safety and maintenance

Magnetic Resonance Imaging

- Principles of nuclear magnetic resonance
- MRI instrumentation:
  - Magnets
  - Gradient coils
  - RF coils
  - Data acquisition system
- MRI image formation
- Pulse sequences (basic introduction)
- MRI safety and hazards

UNIT V: NUCLEAR MEDICINE IMAGING, PACS AND EQUIPMENT MANAGEMENT (12 HRS)

- Fundamentals of nuclear medicine imaging
- Gamma camera and scintillation detector principles
- PET and SPECT imaging systems
- PACS (Picture Archiving and Communication System)
- DICOM standards
- Imaging equipment installation requirements

- Calibration and quality assurance procedures
- Preventive maintenance and troubleshooting
- Regulatory standards in imaging departments

RECOMMENDED REFERENCE BOOKS

1. Introduction to Biomedical Equipment Technology – Joseph J. Carr & John M. Brown
2. The Essential Physics of Medical Imaging – Jerrold T. Bushberg, J. Anthony Seibert, Edwin Leidholdt Jr., John Boone
3. Biomedical Instrumentation and Measurements – Leslie Cromwell, Fred Weibell, Erich Pfeiffer
4. Handbook of Biomedical Instrumentation – R.S. Khandpur

3. BIOMEDICAL INSTRUMENTATION – II

L/T/P/C

3/0/0/3

Course Objectives

1. Understand the principles and applications of patient monitoring systems.
2. Explain the working of respiratory and critical care equipment.
3. Describe the operation of therapeutic and surgical devices.
4. Learn the fundamentals of biomedical imaging instrumentation.
5. Develop knowledge of equipment maintenance, calibration, and safety practices.

Course Outcomes

After completing the course, students will be able to:

1. Explain the principles and functions of patient monitoring systems and physiological measurements.
2. Identify and describe respiratory and critical care equipment and their applications.
3. Demonstrate understanding of therapeutic and surgical equipment operation.
4. Explain the basic principles and safety aspects of biomedical imaging systems.
5. Apply maintenance, troubleshooting, calibration, and safety procedures for biomedical equipment.

UNIT I: PATIENT MONITORING SYSTEMS AND PHYSIOLOGICAL MEASUREMENT SYSTEMS (12 HRS)

- Overview of patient monitoring systems
- Bedside, central, and telemetry monitoring systems
- Measurement principles of physiological variables
- Blood pressure measurement: direct and indirect methods
- Pulse measurement and pulse monitoring instruments
- Temperature monitoring systems and transducers
- Respiration rate measurement techniques
- Multiparameter monitors: components and operation
- Alarm systems and monitoring standards
- Introduction to ICU monitoring systems

UNIT II: RESPIRATORY AND CRITICAL CARE EQUIPMENT (12 HRS)

- Anatomy and physiology of respiratory system (overview)
- Pulmonary function testing instruments
- Spirometer: types and working principles
- Nebulizers and humidifiers
- Oxygen therapy equipment
- Ventilators: classification and working principles
- Modes of ventilation
- CPAP and BiPAP systems
- Suction apparatus and respiratory support devices
- Maintenance and safety considerations of respiratory equipment

UNIT III: THERAPEUTIC AND SURGICAL EQUIPMENT (12 HRS)

- Electrotherapy equipment and principles
- Cardiac pacemakers: external and implantable
- Defibrillators: types and operation
- Electrosurgical units (ESU): principles and applications
- Diathermy equipment: shortwave, microwave, ultrasonic
- Infusion pumps and syringe pumps
- Dialysis equipment: principle and instrumentation
- Safety considerations in therapeutic equipment

UNIT IV: BIOMEDICAL IMAGING INSTRUMENTATION (12 HRS)

- Fundamentals of medical imaging systems
- X-ray instrumentation: generation and components
- Computed Tomography (CT): instrumentation and principles
- Ultrasound imaging systems
- Magnetic Resonance Imaging (MRI): basic instrumentation
- Nuclear medicine instrumentation overview
- Image acquisition and display systems
- Applications and safety precautions in imaging equipment

UNIT V: BIOMEDICAL EQUIPMENT MAINTENANCE, SAFETY AND CALIBRATION (12 HRS)

- Preventive and corrective maintenance concepts
- Calibration procedures for biomedical instruments
- Equipment performance testing
- Electrical safety in hospitals
- Medical equipment grounding and leakage current measurements
- Biomedical equipment management systems
- Troubleshooting techniques
- Documentation and maintenance records
- Introduction to regulatory standards for medical equipment

RECOMMENDED REFERENCE BOOKS

1. **Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer** — *Biomedical Instrumentation and Measurements*, Prentice Hall.
2. **John G. Webster and Amit J. Nimunkar** — *Medical Instrumentation: Application and Design*, Wiley India.
3. **Khandpur R.S.** — *Handbook of Biomedical Instrumentation*, McGraw Hill Education.
4. **Joseph J. Carr and John M. Brown** — *Introduction to Biomedical Equipment Technology*, Pearson Education.

4. HEALTHCARE ADMINISTRATION

L/T/P/C

3/0/0/3

Course Objectives

1. To understand the structure and functions of healthcare systems and organizations.
2. To learn principles of hospital administration and management practices.
3. To develop knowledge of healthcare quality and accreditation systems.
4. To understand human resource and financial management in healthcare institutions.
5. To gain knowledge of healthcare information systems, ethics, and legal responsibilities.

Course Outcomes

1. Describe healthcare delivery systems and hospital organizational structures.
2. Apply management principles in healthcare administration and decision-making.
3. Explain quality assurance, patient safety, and accreditation standards in healthcare.
4. Demonstrate understanding of human resource and financial management concepts.
5. Interpret healthcare information systems and legal and ethical healthcare practices.

UNIT I: INTRODUCTION TO HEALTHCARE ADMINISTRATION AND HEALTHCARE SYSTEMS (12 HRS)

- Concept, scope and importance of healthcare administration
- Evolution of healthcare services
- Healthcare delivery systems in India
- Public and private healthcare sectors
- Levels of healthcare: Primary, Secondary and Tertiary care
- Organizational structure of hospitals
- Departments and functions of hospitals
- Role of administrators in healthcare organizations
- Healthcare team and interdisciplinary coordination

UNIT II: PRINCIPLES OF HOSPITAL ADMINISTRATION AND MANAGEMENT (12 HRS)

- Principles and functions of management
- Planning, organizing, directing and controlling
- Leadership and decision making
- Communication in healthcare organizations
- Hospital administration and departmental management
- Time management and conflict management
- Materials management in hospitals
- Inventory control and supply chain concepts

UNIT III: HEALTHCARE QUALITY MANAGEMENT AND ACCREDITATION (12 HRS)

- Concepts of quality in healthcare
- Quality assurance and quality improvement
- Indicators of healthcare quality
- Total Quality Management (TQM)
- Patient safety principles
- Accreditation systems in healthcare
- National Accreditation Board for Hospitals (NABH) standards
- Biomedical equipment quality management concepts
- Infection control and risk management

UNIT IV: HUMAN RESOURCE AND FINANCIAL MANAGEMENT IN HEALTHCARE (12 HRS)

- Human resource management in hospitals
- Recruitment and staffing
- Training and performance appraisal
- Staff welfare and motivation
- Healthcare budgeting
- Hospital financial management basics
- Sources of hospital finance
- Cost concepts in healthcare services
- Resource allocation and utilization

UNIT V: HEALTHCARE INFORMATION SYSTEMS, LEGAL AND ETHICAL ISSUES (12 HRS)

- Medical records and documentation systems
- Electronic Health Records (EHR)
- Hospital Information Systems (HIS)
- Telemedicine and digital healthcare
- Health statistics and reporting systems
- Legal aspects in healthcare administration
- Patient rights and responsibilities
- Medical ethics and professional conduct
- Biomedical waste management regulations

RECOMMENDED REFERENCE BOOKS

1. **S. L. Goel & Kumar R.** – *Hospital Administration and Management*
2. **B. M. Sakharkar** – *Principles of Hospital Administration and Planning*
3. **C. M. Francis & Mario C. De Souza** – *Hospital Administration*
4. **A. T. Kearney** – *Handbook of Healthcare Administration and Management*

5. PRACTICAL: EQUIPMENT SAFETY AND MAINTENANCE

L/T/P/C

0/0/2/1

Course Objectives

1. To identify biomedical safety symbols and hazard signs used in healthcare equipment.
2. To develop safe handling practices using personal protective equipment.
3. To understand basic electrical measurements and testing procedures.
4. To train students in preventive maintenance and calibration techniques.
5. To develop skills in inspection, troubleshooting, and maintenance documentation.

Course Outcomes

1. Identify biomedical safety symbols and follow safety protocols during equipment handling.
2. Perform electrical measurements using a multimeter and conduct safety tests.
3. Carry out grounding, insulation, and leakage current testing of medical equipment.
4. Perform preventive maintenance and servicing of common medical devices.
5. Troubleshoot equipment faults and maintain proper service records.

20 Hrs

1. Identification of biomedical safety symbols and hazard signs.
2. Use of personal protective equipment in equipment handling.
3. Measurement of voltage, resistance and continuity using multimeter.
4. Leakage current testing of medical equipment. Grounding and insulation testing.
5. Preparation of preventive maintenance checklist.
6. Calibration of temperature and pressure measuring devices.
7. Maintenance of ECG machine.
8. Inspection and servicing of suction apparatus.
9. Preventive maintenance of infusion pumps.
10. Battery replacement and testing.
11. Troubleshooting common medical equipment faults.
12. Preparation of equipment maintenance records.

RECOMMENDED REFERENCE BOOKS

1. Biomedical Equipment Technology and Healthcare by R. S. Khandpur, PHI Learning Pvt. Ltd.
2. Introduction to Biomedical Equipment Technology by Joseph J. Carr and John M. Brown, Pearson Education.
3. Medical Instrumentation: Application and Design by John G. Webster, Wiley.
4. A Practical Guide to Biomedical Equipment Technology by Khandpur R.S..

6. CLINICAL POSTINGS

L/T/P/C

0/0/14/7

Posting Areas:

1. Biomedical Engineering Department,
2. Clinical Engineering and Equipment Maintenance Unit,
3. Intensive Care Unit (ICU), Operation Theater (OT),
4. Emergency and Trauma Care Unit, Radiology Department,
5. CT Scan Unit, MRI Unit,
6. Ultrasound Department,
7. Cardiology Unit/Cath Lab,
8. Equipment Safety and Testing Section, and Hospital Administration/Biomedical Asset Management Unit.

Common Objectives:

1. To provide exposure to the hospital environment and biomedical equipment management systems.
2. To understand the operation, applications, and safety aspects of medical equipment used in various clinical departments.
3. To observe preventive maintenance, troubleshooting, calibration, and equipment performance verification procedures.
4. To understand medical equipment safety standards and quality assurance practices.
5. To develop skills in equipment documentation, inventory management, and healthcare administration processes.
6. To familiarize students with clinical workflows and interdisciplinary coordination in healthcare settings.
7. To enhance practical knowledge related to installation, maintenance, and management of biomedical equipment.

7. STRESS MANAGEMENT

L/T/P/C

1/-/-/1

Learning Objectives:

- To understand the concept, causes, and types of stress.
- To identify physical, emotional, and behavioral responses to stress.
- To learn various stress management and coping techniques.
- To develop skills for maintaining mental well-being and resilience.
- To promote a balanced lifestyle in personal and professional life.

Learning Outcomes:

- Explain the causes and effects of stress on health.
- Identify personal stressors and recognize stress symptoms.
- Apply effective stress management techniques such as relaxation, time management, and coping strategies.
- Demonstrate improved emotional control and resilience.
- Maintain a healthy balance between personal and professional responsibilities.

(15 hrs)

UNIT I (3 hrs)

- Introduction to Stress and Its Effects Definition of stress: Eustress vs. Distress Types of stress: Acute vs. Chronic

- The biology of stress (fight-or-flight response, hormones)
- Short-term and long-term effects on physical and mental health: The role of perception and coping mechanisms

UNIT II (3 hrs)

- Identifying Stressors and Personal Stress Responses
- Internal vs. external stressors (work, relationships, environment) Identifying stress patterns (thoughts, behaviors, physical reactions) Emotional regulation and its role in stress management
- The Stress Process: How stress develops and escalates

UNIT III (3 hrs)

- Coping Strategies and Stress Relief Techniques
- Problem-focused. emotion-focused coping
- Cognitive Behavioral Therapy(CBT)techniques forstress
- Relaxationtechniques(deepbreathing,progressivemusclerelaxation)Timemanagement and organization as stress-relief tools
- Developing a personal coping plan

UNIT IV (2 hrs)

- Lifestyle Changes for Managing Stress: The role of physical activity and exercise, SleephygieneanditsconnectiontostressNutritionanditsimpactonmentalhealthSocial support and healthy relationships, Mindfulness and meditation practices

UNIT V (2 hrs)

- Stress ManagementatWork and School
- Managing work and school stress: Time management, prioritization, pressure environments and deadlines
- Building resilience and avoiding burnout
- The importance of taking breaks and practicing self-care

UNIT VI (2 hrs)

- Building Long-Term Stress Resilience
- Resilience theory and how to bounce back from adversity, developing a growth mindset to handle challenges. Building emotional intelligence to cope with stress. Integrating stress management into daily life

RECOMMENDED TEXT BOOKS

Stress Management: From Basic Science to Best Practice

II year IV semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Advanced Biomedical Equipment	4			4	70	30	100
2		Diagnostic Equipment	3			4	70	30	100
3		Calibration and Quality Control	3			3	70	30	100
4		Biomedical Sensors and Transducers	3			3	70	30	100
5		Practical – Diagnostic Equipment Maintenance			4	2	70	30	100
6		Clinical Postings			12	6	70	30	100
7		Environmental awareness	1				100		100
TOTAL			**14**		**16**	**22**	**520**	**180**	**700**

Year III/ Semester IV

1. ADVANCED MEDICAL EQUIPMENT

L/T/P/C

4/0/0/4

Course Objectives

1. To understand the principles and operation of advanced patient monitoring and critical care equipment.
2. To learn the working and applications of modern diagnostic and medical imaging systems.
3. To study therapeutic and surgical equipment used in healthcare settings.
4. To gain knowledge of laboratory and specialized biomedical equipment and their maintenance.
5. To understand emerging healthcare technologies, equipment management, and quality standards.

Course Outcomes

1. Explain the functioning of advanced patient monitoring and critical care devices.
2. Describe the principles and operation of diagnostic and imaging equipment.
3. Demonstrate knowledge of therapeutic and surgical equipment applications and safety.
4. Apply calibration, troubleshooting, and maintenance procedures for biomedical equipment.
5. Analyze emerging biomedical technologies and implement equipment management practices.

80 Hrs.

UNIT I: ADVANCED PATIENT MONITORING AND CRITICAL CARE EQUIPMENT (16 HOURS)

- Multiparameter patient monitoring systems
- Advanced physiological parameter measurement techniques
- Central monitoring systems and telemetry
- Defibrillators: principles, types and operation
- Ventilators: modes, components and control systems
- Infusion pumps and syringe pumps
- ICU equipment integration systems
- Calibration and maintenance procedures

UNIT II: ADVANCED DIAGNOSTIC AND IMAGING EQUIPMENT (16 HOURS)

- Principles of medical imaging systems
- Computed Tomography (CT): components and operation
- Magnetic Resonance Imaging (MRI): instrumentation and safety
- Ultrasound imaging systems and Doppler principles
- Digital radiography and fluoroscopy systems
- Positron Emission Tomography (PET) and SPECT overview
- Imaging equipment quality assurance and maintenance

UNIT III: THERAPEUTIC AND SURGICAL EQUIPMENT (16 HOURS)

- Electrosurgical units: principles and applications
- Surgical laser systems and safety measures
- Lithotripsy equipment

- Diathermy equipment and applications
- Dialysis equipment: hemodialysis and peritoneal dialysis systems
- Anesthesia workstations and gas delivery systems
- Troubleshooting and preventive maintenance

UNIT IV: LABORATORY AND SPECIALIZED BIOMEDICAL EQUIPMENT (16 HOURS)

- Automated hematology analyzers
- Biochemistry analyzers
- Blood gas analyzers
- Molecular diagnostic equipment
- Flow cytometry principles and instrumentation
- Advanced microscopy systems
- Equipment for intensive laboratory diagnostics
- Maintenance and calibration procedures

UNIT V: EMERGING BIOMEDICAL TECHNOLOGIES AND EQUIPMENT MANAGEMENT (16 HOURS)

- Telemedicine equipment and applications
- Robotic systems in healthcare
- Wearable biomedical devices
- Artificial intelligence in medical equipment
- Smart sensors and Internet of Medical Things (IoMT)
- Equipment networking and interoperability
- Biomedical equipment lifecycle management
- Regulatory standards and quality assurance

Recommended Reference Books

1. **Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer** — *Biomedical Instrumentation and Measurements* (2nd Edition), Pearson Education.
2. **John G. Webster and Amit J. Nimunkar** — *Medical Instrumentation: Application and Design* (4th Edition), Wiley India.
3. **Joseph J. Carr and John M. Brown** — *Introduction to Biomedical Equipment Technology* (4th Edition), Pearson.
4. **R.S. Khandpur** — *Handbook of Biomedical Instrumentation* (3rd Edition), McGraw Hill Education.

2. DIAGNOSTIC EQUIPMENT

L/T/P/C

3/0/0/3

Course Objectives

1. To understand the fundamentals of diagnostic equipment and biomedical instrumentation.
2. To learn the principles and operation of electrodiagnostic devices.

3. To study the working of imaging and laboratory diagnostic equipment.
4. To gain knowledge of sensors, signal acquisition, and safety concepts in medical devices.
5. To develop skills in maintenance, calibration, and quality assurance of diagnostic equipment.

Course Outcomes

After completion of the course, students will be able to:

1. Explain the basic principles and components of biomedical diagnostic instruments.
2. Describe the operation of ECG, EEG, EMG, and other electrodiagnostic equipment.
3. Demonstrate understanding of imaging and laboratory diagnostic systems.
4. Identify safety measures, signal processing methods, and troubleshooting techniques in diagnostic devices.
5. Apply calibration, preventive maintenance, and quality assurance practices for healthcare equipment.

60 Hrs

UNIT I: INTRODUCTION TO DIAGNOSTIC EQUIPMENT AND BIOMEDICAL INSTRUMENTATION (12 HOURS)

- Introduction to diagnostic equipment in healthcare systems
- Classification of medical equipment
- Functional blocks of biomedical instruments
- Physiological signal acquisition systems
- Sensors and transducers used in diagnosis
- Amplifiers and signal conditioning circuits
- Sources of artifacts and noise reduction techniques
- Basic electrical safety concepts in diagnostic devices

UNIT II: ELECTRODIAGNOSTIC EQUIPMENT (12 HOURS)

Electrocardiograph (ECG)

- Cardiac electrophysiology
- Principles and lead systems
- ECG machine components and operation
- Recording techniques and interpretation basics
- Calibration and troubleshooting

Electroencephalograph (EEG)

- Brain electrical activity
- EEG electrodes and recording systems
- Components and operation

Electromyography (EMG)

- Principles and instrumentation
- Clinical applications

Holter monitoring systems

- Principles and uses

UNIT III: IMAGING DIAGNOSTIC EQUIPMENT (12 HOURS)

X-ray Equipment

- Production of X-rays
- Components of X-ray systems
- X-ray tube and control circuits
- Safety measures

Ultrasound Imaging Equipment

- Physics of ultrasound
- Transducers and image formation
- Doppler principles

Computed Tomography (CT)

- Basic principles
- Components and image acquisition

Magnetic Resonance Imaging (MRI)

- Basic physics
- Instrumentation and imaging principles

UNIT IV: LABORATORY DIAGNOSTIC EQUIPMENT (12 HOURS)

Hematology analyzers

- Principles and operation

Blood chemistry analyzers

- Instrumentation and applications

ELISA readers and microplate systems

- Working principles

Spectrophotometers

- Components and instrumentation

Centrifuges

- Principles and maintenance

Microscopes

- Diagnostic applications

UNIT V: MAINTENANCE, CALIBRATION AND QUALITY ASSURANCE OF DIAGNOSTIC EQUIPMENT (12 HOURS)

- Equipment installation procedures
- Acceptance testing
- Calibration methods
- Preventive maintenance schedules
- Common equipment faults and troubleshooting
- Documentation and inventory management
- Quality assurance protocols
- Biomedical equipment safety standards
- Infection control measures during maintenance

Recommended Reference Books

1. Handbook of Biomedical Instrumentation – R. S. Khandpur, McGraw Hill Education.
2. Introduction to Biomedical Equipment Technology – Pearson Education.
3. Biomedical Instrumentation and Measurements – Prentice Hall.
4. Medical Instrumentation: Application and Design – Wiley Publications.

3. CALIBRATION AND QUALITY CONTROL

L/T/P/C

3/0/0/3

Course Objectives

1. To introduce fundamental concepts of calibration and measurement systems.
2. To explain quality assurance and quality control principles in healthcare technology.
3. To familiarize students with calibration standards and regulatory requirements.
4. To develop understanding of calibration procedures for biomedical equipment.
5. To train students in quality assurance programs, documentation, and reporting practices.

Course Outcomes

After completion of the course, students will be able to:

1. Explain basic concepts of calibration, measurement errors, and traceability.
2. Differentiate quality assurance and quality control practices in healthcare systems.
3. Describe calibration standards, accreditation systems, and regulatory requirements.
4. Apply calibration procedures for common biomedical instruments and equipment.
5. Prepare quality documentation, calibration reports, and corrective action records.

60 Hrs

UNIT I: INTRODUCTION TO CALIBRATION AND QUALITY CONCEPTS (10 HOURS)

- Definition and importance of calibration
- Concepts of accuracy, precision, sensitivity, resolution and uncertainty
- Errors in measurement: systematic and random errors
- Traceability in calibration
- Need for calibration in medical equipment
- Quality concepts in healthcare technology
- Introduction to quality assurance (QA) and quality control (QC)

UNIT II: CALIBRATION STANDARDS AND REGULATORY REQUIREMENTS (10 HOURS)

- National and international calibration standards
- Reference standards and working standards
- Calibration hierarchy and traceability chain
- Introduction to ISO standards relevant to biomedical equipment
- Overview of accreditation systems
- Documentation and record maintenance

UNIT III: CALIBRATION OF BIOMEDICAL INSTRUMENTS (15 HOURS)

Calibration principles and procedures for:

- Physiological monitoring equipment
- ECG machines
- Blood pressure monitoring devices
- Pulse oximeters
- Defibrillators
- Infusion and syringe pumps
- Electrosurgical units
- Temperature measuring devices

UNIT IV: QUALITY CONTROL PROCEDURES IN MEDICAL EQUIPMENT (15 HOURS)

- Quality control protocols
- Functional performance testing
- Acceptance testing and commissioning tests
- Preventive maintenance and performance verification
- Equipment performance indicators
- Electrical safety and QC checks
- QC schedules in hospitals

UNIT V: QUALITY ASSURANCE PROGRAMS AND DOCUMENTATION (10 HOURS)

- Quality assurance programs in hospitals
- Total Quality Management (TQM) concepts
- Clinical engineering role in quality systems
- Documentation and report preparation
- Calibration certificates and reporting formats
- Incident reporting and corrective actions

Recommended Reference Books

1. **Joseph J. Carr and John M. Brown** – *Introduction to Biomedical Equipment Technology*, Pearson Education.
2. **Richard Aston** – *Principles of Biomedical Instrumentation and Measurement*, Merrill Publishing.
3. **Khandpur R.S.** – *Biomedical Instrumentation: Technology and Applications*, McGraw Hill Education.
4. **Webster J.G. and Albert Cook** – *Clinical Engineering: Principles and Applications*, Prentice Hall.

4. HOSPITAL EQUIPMENT MANAGEMENT

L/T/P/C

2/0/0/2

Course Objectives

1. To understand the principles of hospital equipment management and healthcare technology systems.
2. To learn equipment planning, procurement, and commissioning procedures in hospitals.
3. To develop knowledge of inventory, asset, and maintenance management practices.
4. To understand quality assurance, safety, and risk management for medical equipment.
5. To apply financial, regulatory, and life-cycle concepts in equipment management.

Course Outcomes

After completion of the course, students will be able to:

1. Explain the concepts and functions of hospital equipment management systems.
2. Apply procedures for equipment planning, procurement, and installation.
3. Manage inventory systems and maintenance activities for medical equipment.
4. Evaluate quality assurance and safety practices related to healthcare equipment.
5. Analyze financial, legal, and regulatory aspects of medical equipment management.

UNIT I: INTRODUCTION TO HOSPITAL EQUIPMENT MANAGEMENT (6 HOURS)

- Introduction to healthcare technology management
- Scope and objectives of hospital equipment management
- Equipment life cycle concept
- Roles and responsibilities of biomedical engineers and equipment technologists
- Organizational structure of hospital engineering departments
- Hospital equipment management systems

UNIT II: EQUIPMENT PLANNING AND PROCUREMENT (8 HOURS)

- Assessment of equipment needs in hospitals
- Equipment planning process
- Preparation of technical specifications
- Tendering procedures and purchase policies
- Vendor evaluation and selection
- Installation planning and acceptance testing

- Equipment commissioning procedures

UNIT III: INVENTORY AND ASSET MANAGEMENT (8 HOURS)

- Equipment inventory systems
- Asset coding and classification
- Equipment tracking and utilization monitoring
- Computerized Maintenance Management Systems (CMMS)
- Equipment replacement planning
- Equipment condemnation and disposal policies
- Equipment utilization indicators

UNIT IV: MAINTENANCE MANAGEMENT (8 HOURS)

- Preventive maintenance concepts
- Corrective and breakdown maintenance
- Scheduled maintenance procedures
- Annual maintenance contracts (AMC) and comprehensive maintenance contracts (CMC)
- Calibration concepts and schedules
- Maintenance documentation and records
- Outsourcing of maintenance services

UNIT V: QUALITY ASSURANCE AND SAFETY MANAGEMENT (5 HOURS)

- Principles of quality assurance in hospitals
- Equipment performance evaluation
- Risk management for medical devices
- Electrical safety and operational safety
- Infection control related to equipment handling
- Accreditation standards related to equipment management

UNIT VI: FINANCIAL AND REGULATORY ASPECTS (5 HOURS)

- Equipment budgeting and cost analysis
- Cost-effectiveness and cost-benefit analysis
- Life-cycle costing
- Equipment audit procedures
- Medical equipment regulations and standards
- Documentation and legal requirements

Recommended Reference Books

1. Dyro JF. *Clinical Engineering Handbook.* Academic Press; 2nd Edition.
2. Cohen T. *Medical Equipment Management for Hospitals.* Biomedical Engineering Publications.
3. Carr JJ, Brown JM. *Introduction to Biomedical Equipment Technology.* Pearson Education.
4. Bronzino JD. *The Biomedical Engineering Handbook.* CRC Press.

5. BIOMEDICAL SENSORS AND TRANSDUCERS

L/T/P/C

3/0/0/3

Course Objectives

1. To introduce the fundamentals and classifications of biomedical sensors and transducers.
2. To explain the principles and characteristics of physical transducers and signal conversion methods.
3. To develop understanding of physiological sensors used for biosignal acquisition.
4. To describe the application of sensors in diagnostic and therapeutic medical equipment.
5. To familiarize students with advanced biosensors and emerging healthcare sensing technologies.

Course Outcomes

After completion of the course, students will be able to:

1. Explain the types, characteristics, and performance parameters of biomedical sensors and transducers.
2. Describe the working principles and applications of various physical transducers.
3. Identify sensors used for acquiring physiological and biomedical signals.
4. Analyze the role of sensors in medical diagnostic and therapeutic devices.
5. Discuss modern biosensor technologies, wearable sensors, and IoMT applications.

UNIT I: FUNDAMENTALS OF BIOMEDICAL SENSORS AND TRANSDUCERS (10 HOURS)

- Introduction to sensors and transducers
- Definition, classification, and applications
- Primary and secondary transducers
- Active and passive transducers
- Analog and digital transducers
- Measurand and measurement systems
- Sensor selection criteria
- Performance characteristics:
    - Sensitivity
    - Range
    - Resolution
    - Accuracy
    - Precision
    - Repeatability
    - Drift
    - Hysteresis
    - Linearity

UNIT II: PHYSICAL TRANSDUCERS AND SIGNAL CONVERSION PRINCIPLES (12 HOURS)

- Resistive transducers:
    - Potentiometers
    - Strain gauges

  - Thermistors
- Inductive transducers:
  - LVDT
  - Variable reluctance sensors
- Capacitive transducers
- Piezoelectric transducers
- Photoelectric transducers
- Hall effect sensors
- Principles of signal conversion and conditioning

UNIT III: PHYSIOLOGICAL SENSORS AND BIOSIGNAL ACQUISITION (12 HOURS)

- Biopotential electrodes:
  - Surface electrodes
  - Needle electrodes
  - Microelectrodes
- ECG sensors
- EMG sensors
- EEG sensors
- Blood pressure sensors
- Temperature sensors
- Respiratory sensors
- Pulse sensors

UNIT IV: BIOMEDICAL SENSORS IN DIAGNOSTIC AND THERAPEUTIC EQUIPMENT (13 HOURS)

- Sensors in patient monitoring systems
- Sensors used in ventilators
- Pulse oximetry sensors
- Ultrasound transducers
- Blood flow sensors
- Pressure transducers
- Sensors used in infusion pumps
- Sensors in dialysis equipment
- Sensors used in imaging equipment

UNIT V: ADVANCED BIOSENSORS AND EMERGING TECHNOLOGIES (13 HOURS)

- Biosensors: principles and classification
- Enzyme biosensors
- Immunosensors
- Optical biosensors
- Fiber optic sensors
- Wearable biomedical sensors
- Smart sensors and MEMS technology
- Nano sensors in healthcare
- Internet of Medical Things (IoMT) applications

6. PRACTICAL – DIAGNOSTIC EQUIPMENT MAINTENANCE

L/T/P/C

0/0/4/2

Learning Objectives

Upon completion of this practical course, students will be able to:

1. Understand the principles of operation and maintenance requirements of diagnostic medical equipment.
2. Identify major components and subsystems of commonly used diagnostic equipment.
3. Perform routine inspection and preventive maintenance procedures for diagnostic devices.
4. Demonstrate skills in equipment installation checks, calibration, and performance verification.
5. Apply electrical and operational safety practices during equipment handling and maintenance.
6. Identify common equipment faults and participate in troubleshooting procedures.
7. Maintain service records, maintenance logs, and equipment documentation.
8. Develop competency in quality assurance procedures and functional testing of diagnostic systems.
9. Understand equipment lifecycle management and maintenance scheduling.
10. Follow standard operating procedures and professional practices in healthcare technology maintenance.

80 Hrs

Practicals to be Performed

1. Identification of major components and block diagrams of diagnostic equipment.
2. Preparation and interpretation of preventive maintenance schedules.
3. Inspection and maintenance of ECG machine and troubleshooting procedures.
4. Functional verification and maintenance of patient monitoring systems.
5. Preventive maintenance procedures for ultrasound equipment.
6. Study and maintenance checks of X-ray system components.
7. Observation and documentation of CT/MRI equipment maintenance workflow.
8. Calibration and performance verification of diagnostic equipment.
9. Demonstration of electrical safety testing using biomedical safety analyzers.
10. Leakage current and grounding measurements for medical equipment.
11. Fault identification and troubleshooting exercises using simulated case scenarios.
12. Preparation of equipment service reports and maintenance documentation.
13. Study of quality assurance procedures for diagnostic imaging equipment.
14. Equipment installation and acceptance checklist preparation.
15. Inventory management and equipment history card preparation.
16. Case study presentation on diagnostic equipment failure analysis.
17. Demonstration of equipment cleaning, care, and handling procedures.
18. Functional testing and performance assessment of selected diagnostic devices.
19. Observation of hospital biomedical equipment maintenance practices.
20. Mini-project/maintenance audit of selected diagnostic equipment systems.

7. CLINICAL POSTINGS

L/T/P/C

0/0/12/6

Posting Departments

- Biomedical Engineering Department
- Clinical Engineering and Equipment Maintenance Unit
- Intensive Care Unit (ICU)
- Operation Theater (OT)
- Emergency and Trauma Care Unit
- Clinical Laboratory Services
- Radiology Department
- Diagnostic Imaging Unit
- Calibration and Quality Control Unit
- Central Sterile Services Department (CSSD)
- Equipment Procurement and Asset Management Section
- Hospital Administration/Biomedical Equipment Management Unit

Common Learning Objectives

1. To provide exposure to the functioning and workflow of biomedical equipment in various hospital departments.
2. To understand the operation and clinical applications of advanced biomedical and diagnostic equipment.
3. To observe calibration procedures and quality control practices used for medical equipment performance evaluation.
4. To develop understanding of biomedical sensors and transducers used in monitoring and diagnostic systems.
5. To familiarize students with preventive maintenance, troubleshooting, and equipment safety practices.
6. To understand biomedical equipment inventory, procurement, utilization, and maintenance management systems.
7. To observe documentation procedures, service records, and equipment management protocols in healthcare institutions.
8. To enhance practical knowledge and professional skills related to clinical engineering and hospital equipment management.

Recommended Reference Books

1. **John G. Webster** – Medical Instrumentation: Application and Design, Wiley Publications.
2. **R.S. Khandpur** – Handbook of Biomedical Instrumentation, McGraw Hill Education.
3. **D. Patranabis** – Sensors and Transducers, PHI Learning.
4. **Leslie Cromwell, Fred Weibell & Erich Pfeiffer** – Biomedical Instrumentation and Measurements, Pearson Education.

9.ENVIRONMENTAL AWARENESS

L/T/P/C

1/-/-/1

Learning Objectives:

- Understand environmental issues and sustainability
- Learn impact of environment on health
- Study pollution, waste management, and conservation
- Promote environmental responsibility

Learning Outcomes:
Students will be able to:

- Explain environmental factors affecting health
- Demonstrate awareness of pollution and control measures
- Apply principles of waste management in healthcare
- Promote environmentally responsible practices

30 hours

UNIT 1 INTRODUCTION TO ENVIRONMENTAL AWARENESS (3 HRS)

What is environmental awareness?

The importance of environmental education.

Key environmental concepts: ecosystems, biodiversity, sustainability.

Historical perspective on environmental awareness.

UNIT 2 EARTH'S ECOSYSTEMS AND BIODIVERSITY (3 HRS)

What are ecosystems?

Types of ecosystems: forests, oceans, wetlands, etc.

Importance of biodiversity.

Threats to biodiversity: habitat loss, invasive species, climate change.

UNIT 3 POLLUTION AND ITS IMPACT (3 HRS)

Types of pollution: air, water, soil, noise, and light pollution.

Causes and effects of pollution on health and ecosystems.

Case studies of major pollution events.

UNIT 4 CLIMATE CHANGE AND GLOBAL WARMING (3 HRS)

The science of climate change.

Greenhouse effect and human contributions.

Impacts of climate change: rising temperatures, sea levels, extreme weather.

Mitigation and adaptation strategies.

UNIT 5 RESOURCE CONSERVATION (3 HRS)

Renewable vs. non-renewable resources.

The importance of conserving water, energy, and other resources.

Techniques for conservation: recycling, energy efficiency, and water-saving practices.

UNIT 6 SUSTAINABLE AGRICULTURE AND FOOD SYSTEMS (3 HRS)

Environmental impact of conventional farming practices.

Sustainable agriculture: organic farming, permaculture, and agroecology.

The role of diet in environmental sustainability.

UNIT 7 WASTE MANAGEMENT (3 HRS)

Types of waste: municipal, industrial, hazardous, electronic.

The 3 Rs: Reduce, Reuse, Recycle.

Landfills, incineration, and composting.

Zero waste lifestyle.

UNIT 8 WATER CONSERVATION AND MANAGEMENT (3 HRS)

The global water crisis: causes and consequences.

Water management practices and policies.

The importance of clean water for all living organisms.

UNIT 9 ENVIRONMENTAL POLICY AND LEGISLATION (3 HRS)

Global environmental treaties: Paris Agreement, Kyoto Protocol.

National environmental policies and regulations.

Role of NGOs, governments, and individuals in policy development.

UNIT 10 GREEN TECHNOLOGIES AND INNOVATIONS (3 HRS)

Introduction to renewable energy sources (solar, wind, hydro, etc.).

Electric vehicles and sustainable transportation.

Innovations in waste-to-energy and sustainable agriculture.

The Role of Individuals in Environmental Protection

How individual actions impact the environment.

Eco-friendly lifestyles: reducing waste, sustainable consumption, green travel.

Community action and grassroots movements.

Reference Textbook

Environmental Science: A Global Concern" by William P. Cunningham & Mary Ann Cunningham

YEAR III SEMESTER V

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Telemedicine and Digital Healthcare Systems	2			2	70	30	100
2		Therapeutic Equipment	3			3	70	30	100
3		Operation and Maintenance of ICU Equipment	3			3	70	30	100
4		Equipment Troubleshooting	3			3	70	30	100
5		Medical Equipment Networking and Informatics	3			3	70	30	
6		Practical – ICU Equipment Management			4	2	70	30	100
7		Clinical Postings			10	5	100		100
8		Interpersonal Communication	01			01	100		100
		TOTAL	**15**		**14**	**22**	**620**	**180**	**800**

III year/V Semester

1. TELEMEDICINE AND DIGITAL HEALTHCARE SYSTEMS

L/T/P/C

2/0/0/2

Course Objectives

1. To introduce the concepts, scope, and applications of telemedicine and digital healthcare.
2. To explain communication technologies and networking systems used in healthcare services.
3. To familiarize students with telemedicine system architecture and related equipment.
4. To provide knowledge of health informatics, EHR, EMR, and healthcare data standards.
5. To develop understanding of emerging technologies, security, and legal aspects in digital healthcare.

Course Outcomes

After completion of the course, students will be able to:

1. Explain the principles, types, and applications of telemedicine in healthcare.
2. Describe healthcare communication systems and networking technologies.
3. Identify telemedicine hardware, software, and operational workflows.
4. Apply concepts of health informatics and electronic health record systems.
5. Analyze emerging trends, cybersecurity, and regulatory issues in digital healthcare.

30 hrs

UNIT I: INTRODUCTION TO TELEMEDICINE AND DIGITAL HEALTHCARE (8 HOURS)

- Definition, scope, and evolution of telemedicine
- Need and importance of telemedicine in modern healthcare
- Types of telemedicine:
  - Real-time (synchronous)
  - Store-and-forward
  - Remote patient monitoring
  - Mobile health (mHealth)
- Telehealth versus telemedicine
- Applications:
  - Teleradiology
  - Telepathology
  - Telecardiology
  - Tele-ICU
  - Teleconsultation
- Advantages and limitations

UNIT II: TELECOMMUNICATION AND NETWORKING IN HEALTHCARE (8 HOURS)

- Fundamentals of healthcare communication systems
- Data transmission concepts and communication modes
- Telecommunication technologies:

  - Wired communication
  - Wireless communication
  - Internet-based systems
- Basics of:
  - LAN
  - WAN
  - Wi-Fi
  - Bluetooth
  - Cellular networks
  - Satellite communication
- Audio, video and image transmission requirements in telemedicine
- Network quality considerations:
  - Bandwidth
  - Latency
  - Reliability

UNIT III: TELEMEDICINE SYSTEM ARCHITECTURE AND EQUIPMENT (8 HOURS)

- Components of telemedicine systems
- Hardware components:
  - Cameras
  - Medical peripherals
  - Digital diagnostic devices
  - Workstations
  - Telemedicine carts
- Software platforms and user interfaces
- Telemedicine workflow and operational models
- Integration of biomedical equipment with telemedicine systems
- Installation and maintenance requirements

UNIT IV: HEALTH INFORMATICS AND ELECTRONIC HEALTH RECORDS (8 HOURS)

- Introduction to healthcare informatics
- Electronic Health Records (EHR) and Electronic Medical Records (EMR)
- Hospital Information System (HIS) overview
- Health information standards:
  - DICOM
  - HL7
  - FHIR concepts
- Data management and interoperability
- Clinical decison support systems

UNIT V: EMERGING TRENDS, SECURITY AND REGULATIONS (8 HOURS)

- Remote patient monitoring systems
- Wearable medical devices and Internet of Medical Things (IoMT)
- Artificial Intelligence in digital healthcare
- Cloud computing applications in healthcare
- Data privacy and cybersecurity principles
- Ethical and legal issues in telemedicine
- National telemedicine guidelines and implementation challenges
- Future trends in digital healthcare

Recommended Reference Books

1. **Rashid L. Bashshur & Gary W. Shannon** – *History of Telemedicine: Evolution, Context and Transformation*
2. **Norris A.C.** – *Essentials of Telemedicine and Telecare*
3. **Marilyn H. O'Hara** – *Telemedicine and E-Health Services, Policies and Applications*

2. THERAPEUTIC EQUIPMENT

L/T/P/C

3/0/0/3

Course Objectives

1. To understand the principles and classification of therapeutic equipment.
2. To learn electrical safety standards and patient protection methods.
3. To study the operation of electrotherapy and surgical therapeutic devices.
4. To understand cardiac, respiratory, and advanced therapeutic systems.
5. To develop skills in testing, maintenance, and troubleshooting of therapeutic equipment.

Course Outcomes

After completion of the course, students will be able to:

1. Explain the categories and applications of therapeutic equipment.
2. Apply electrical safety practices and standards in healthcare devices.
3. Describe the working principles of electrotherapy and surgical equipment.
4. Operate and maintain cardiac, respiratory, and dialysis devices.
5. Perform testing, calibration, troubleshooting, and quality assurance procedures.

60 Hrs

UNIT I: INTRODUCTION TO THERAPEUTIC EQUIPMENT AND ELECTRICAL SAFETY (10 HRS)

- Overview of therapeutic equipment
- Classification of therapeutic devices
- Role of therapeutic equipment in healthcare
- Physiological principles involved in therapy devices
- Electrical hazards in therapeutic systems
- Patient safety standards
- Leakage current and grounding
- Safety regulations and standards for therapeutic equipment
- Preventive maintenance concepts

UNIT II: ELECTROTHERAPY AND PHYSIOTHERAPY EQUIPMENT (10 HRS)

- Principles of electrotherapy
- Low-frequency and medium-frequency therapeutic currents
- Transcutaneous Electrical Nerve Stimulation (TENS)
- Interferential therapy equipment
- Muscle stimulators
- Short-wave diathermy equipment
- Microwave diathermy equipment
- Ultrasound therapy equipment

- Infrared and ultraviolet therapy devices
- Construction, operation and troubleshooting

UNIT III: SURGICAL THERAPEUTIC EQUIPMENT (10 HRS)

- Principles of electrosurgery
- High-frequency surgical currents
- Electrosurgical generators
- Monopolar and bipolar electrosurgery systems
- Electrosurgical accessories
- Harmonic scalpel
- Radiofrequency ablation systems
- Cryosurgery equipment
- Laser surgery systems
- Safety measures in surgical therapeutic systems
- Maintenance and calibration procedures

UNIT IV: CARDIAC AND RESPIRATORY THERAPEUTIC EQUIPMENT (10 HRS)

- Cardiac pacemakers
- Temporary and permanent pacemakers
- Implantable cardioverter defibrillator (ICD)
- External defibrillators
- Automated External Defibrillator (AED)
- Respiratory therapy devices
- Nebulizers
- Ventilators—basic concepts and modes
- Continuous Positive Airway Pressure (CPAP) systems
- Oxygen concentrators

UNIT V: DIALYSIS AND ADVANCED THERAPEUTIC EQUIPMENT (10 HRS)

- Principles of dialysis
- Hemodialysis machine
- Peritoneal dialysis equipment
- Components and operation
- Water treatment systems in dialysis
- Safety and monitoring systems
- Infusion pumps and syringe pumps
- Deep Brain Stimulators
- Lithotripsy systems
- Hyperbaric oxygen therapy equipment
- Robotic therapeutic systems

UNIT VI: EQUIPMENT MANAGEMENT, TESTING AND TROUBLESHOOTING (10 HRS)

- Performance verification of therapeutic equipment
- Calibration concepts
- Acceptance testing procedures
- Preventive maintenance schedules
- Troubleshooting methods
- Documentation and service records
- Quality assurance in therapeutic equipment
- Biomedical equipment management systems

REFERENCE BOOKS

1. Carr J. J. and Brown J. M., *Introduction to Biomedical Equipment Technology*, Pearson Education.
2. Khandpur R. S., *Handbook of Biomedical Instrumentation*, McGraw-Hill Education.
3. Webster J. G. and Albert M. Cook, *Medical Instrumentation: Application and Design*, Wiley Publications.
4. Joseph J. Carr and John M. Brown, *Biomedical Equipment Technology and Management*, Pearson Publications.

3.OPERATION AND MAINTENANCE OF ICU EQUIPMENT

L/T/P/C

3/0/0/3

Course Objectives

1. To understand ICU structure, workflow, and safety requirements.
2. To study the principles and operation of patient monitoring systems.
3. To learn the functioning of ventilators and respiratory support devices.
4. To develop skills in operating and maintaining critical care therapeutic equipment.
5. To understand maintenance management and quality assurance of ICU equipment.

Course Outcomes

1. Explain ICU setup, safety measures, and infection control practices.
2. Operate and troubleshoot patient monitoring equipment effectively.
3. Demonstrate the use and maintenance of ventilators and respiratory support devices.
4. Perform operation, calibration, and troubleshooting of ICU therapeutic equipment.
5. Apply maintenance, quality assurance, and equipment management practices in ICU settings

60 Hrs

UNIT I: INTRODUCTION TO ICU SYSTEMS AND SAFETY (10 HOURS)

- Overview of Intensive Care Units: types and functions
- ICU workflow and biomedical equipment requirements
- Layout planning and environmental requirements
- Medical gas systems in ICU
- Electrical safety in ICU environments
- Patient safety and infection control practices
- Biomedical waste management in critical care units
- Documentation and maintenance records

UNIT II: PATIENT MONITORING EQUIPMENT (12 HOURS)

- Multiparameter patient monitor: principles and components
- ECG monitoring system
- SpO_2 monitoring
- Non-invasive and invasive blood pressure monitoring
- Temperature monitoring systems
- Capnography and respiratory monitoring
- Alarm systems and alarm management
- Calibration and troubleshooting of monitoring devices

UNIT III: VENTILATORS AND RESPIRATORY SUPPORT EQUIPMENT (12 HOURS)

- Principles of mechanical ventilation
- Types of ventilators
- Components of ventilator systems
- Modes of ventilation
- Humidifiers and nebulizers
- Oxygen therapy devices
- Preventive maintenance of ventilators
- Ventilator troubleshooting and fault analysis

UNIT IV: CRITICAL CARE THERAPEUTIC EQUIPMENT (14 HOURS)

- Syringe pumps: operation and maintenance
- Infusion pumps
- Defibrillators
- External pacemakers
- Suction apparatus
- Dialysis equipment used in ICU
- Sequential Compression Devices (SCD)
- Crash cart equipment overview
- Functional verification and calibration procedures

UNIT V: MAINTENANCE MANAGEMENT AND QUALITY ASSURANCE OF ICU EQUIPMENT (12 HOURS)

- Preventive maintenance schedules
- Predictive and corrective maintenance
- Equipment inventory and asset management
- Breakdown maintenance procedures
- Calibration protocols
- Equipment acceptance testing
- Quality assurance programs
- Accreditation standards relevant to ICU equipment
- Equipment lifecycle management

RECOMMENDED REFERENCE BOOKS

1. **Joseph J. Carr and John M. Brown** – *Introduction to Biomedical Equipment Technology*, Pearson Education.
2. **Richard Aston** – *Principles of Biomedical Instrumentation and Measurement*, Merrill Publishing.
3. **Khandpur R.S.** – *Handbook of Biomedical Instrumentation*, McGraw Hill Education.
4. **Leslie Cromwell, Fred Weibell, Erich Pfeiffer** – *Biomedical Instrumentation and Measurements*, Prentice Hall.

4. EQUIPMENT TROUBLESHOOTING

L/T/P/C

3/-/0/3

Course Objectives

1. To understand principles and methods of medical equipment troubleshooting.
2. To identify electrical and electronic faults in healthcare devices.
3. To develop skills in using diagnostic tools and test instruments.
4. To analyze faults in diagnostic, imaging, and laboratory equipment.
5. To understand software, networking, and maintenance management issues.

Course Outcomes

After completion of the course, students will be able to:

1. Apply systematic troubleshooting methods for medical equipment failures.
2. Identify and diagnose electrical and electronic component faults.
3. Operate diagnostic and calibration instruments effectively.
4. Troubleshoot common issues in biomedical and diagnostic equipment.
5. Manage software, networking, and maintenance-related problems in healthcare technology.

60 Hrs

UNIT I: INTRODUCTION TO EQUIPMENT TROUBLESHOOTING AND DIAGNOSTIC APPROACH (10 HOURS)

- Concept and importance of troubleshooting in healthcare technology
- Types of equipment failures
- Fault diagnosis methodology
- Troubleshooting flowcharts and decision trees
- Root cause analysis techniques
- Safety precautions during troubleshooting
- Documentation and service records

UNIT II: ELECTRICAL AND ELECTRONIC FAULT DIAGNOSIS (10 HOURS)

- Basic troubleshooting of electrical systems
- Power supply failures
- Grounding and electrical leakage problems
- Identification of component failures:
    - Resistors
    - Capacitors
    - Diodes
    - Transistors
    - Integrated circuits
- Signal tracing techniques
- PCB fault identification

UNIT III: TEST INSTRUMENTS AND DIAGNOSTIC TOOLS (10 HOURS)

- Principles and applications of troubleshooting tools
- Digital multimeter operation
- Oscilloscope applications

- Electrical safety analyzer
- Defibrillator analyzer
- Patient simulator
- Biomedical calibration instruments
- Software diagnostic tools

UNIT IV: TROUBLESHOOTING OF DIAGNOSTIC EQUIPMENT (12 HOURS)

Troubleshooting methods for:

- ECG equipment
- Patient monitors
- Pulse oximeters
- Defibrillators
- Infusion and syringe pumps
- Suction apparatus
- Spirometers

Common symptoms, probable causes, and corrective actions

UNIT V: TROUBLESHOOTING OF IMAGING AND LABORATORY EQUIPMENT (10 HOURS)

Troubleshooting principles in:

- X-ray systems
- Ultrasound equipment
- CT systems
- Laboratory analyzers
- Centrifuges
- Microscopes
- Blood gas analyzers

Error codes and corrective measures

UNIT VI: SOFTWARE, NETWORKING AND MAINTENANCE MANAGEMENT (8 HOURS)

- Software-related failures in medical devices
- Firmware and operating system issues
- Medical equipment networking problems
- Communication interface troubleshooting
- Maintenance logs and reporting systems
- Case studies in equipment troubleshooting

Recommended Reference Books

1. Carr JJ, Brown JM. *Introduction to Biomedical Equipment Technology*. 4th Edition. Pearson Education.
2. Joseph J. Carr and John M. Brown. *Biomedical Instrumentation Technology and Applications*. Prentice Hall.
3. Khandpur RS. *Biomedical Instrumentation: Technology and Applications*. 3rd Edition. McGraw Hill Education.

4. Cohen B. *Medical Devices and Systems*. CRC Press.

5. MEDICAL EQUIPMENT NETWORKING AND INFORMATICS

L/T/P/C

3/0/0/3

Course Objectives

1. To understand fundamentals of computer networks and healthcare informatics.
2. To learn principles of medical device communication and connectivity.
3. To study healthcare networking standards and interoperability concepts.
4. To understand hospital information systems and healthcare data management.
5. To gain knowledge of cybersecurity, telemedicine, and emerging healthcare technologies.

Course Outcomes

1. Explain basic networking concepts and healthcare informatics applications.
2. Describe communication methods and connectivity of medical devices.
3. Interpret healthcare standards such as DICOM, HL7, and interoperability frameworks.
4. Demonstrate understanding of HIS, EHR, RIS, LIS, and healthcare databases.
5. Apply concepts of cybersecurity, telemedicine, and IoMT in healthcare systems.

60 Hrs

UNIT I: FUNDAMENTALS OF COMPUTER NETWORKS AND MEDICAL INFORMATICS (12 HOURS)

- Introduction to computer systems and networking
- Components of data communication systems
- Types of networks: LAN, WAN, MAN, WLAN
- Network topologies and transmission media
- OSI and TCP/IP models
- Concepts of healthcare informatics
- Role of informatics in healthcare delivery

UNIT II: MEDICAL DEVICE COMMUNICATION AND CONNECTIVITY (12 HOURS)

- Principles of biomedical equipment communication
- Wired and wireless communication technologies
- Serial communication and USB interfaces
- Communication ports and protocols
- Network-enabled medical devices
- Device integration in clinical environments
- Data acquisition and signal transmission concepts

UNIT III: MEDICAL NETWORKING STANDARDS AND INTEROPERABILITY (12 HOURS)

- Need for standards in healthcare communication
- Introduction to DICOM

- Introduction to HL7
- IEEE standards related to medical devices
- PACS concepts and architecture
- Interoperability in healthcare systems
- Data exchange and integration challenges

UNIT IV: HOSPITAL INFORMATION SYSTEMS AND HEALTHCARE DATA MANAGEMENT (12 HOURS)

- Hospital Information System (HIS)
- Electronic Medical Records (EMR)
- Electronic Health Records (EHR)
- Radiology Information System (RIS)
- Laboratory Information System (LIS)
- Data storage and database fundamentals
- Clinical decision support systems

UNIT V: CYBERSECURITY, TELEMEDICINE AND EMERGING TRENDS (12 HOURS)

- Data privacy and confidentiality in healthcare
- Security threats in networked medical systems
- Basics of cybersecurity in hospitals
- Medical device risk management
- Introduction to telemedicine systems
- Internet of Medical Things (IoMT)
- Artificial intelligence applications in healthcare informatics
- Future trends in connected healthcare systems

6. PRACTICAL - ICU EQUIPMENT MANAGEMENT

L/T/P/C

-/-/4/2

Learning Objectives

1. To understand the functions, components, and clinical applications of equipment used in Intensive Care Units (ICU).
2. To develop skills in identification, setup, operation, and handling of ICU equipment.
3. To understand routine inspection, preventive maintenance, and troubleshooting procedures for critical care devices.
4. To gain practical knowledge of equipment safety checks and performance verification methods.
5. To understand calibration principles and quality assurance procedures for ICU equipment.
6. To develop competency in equipment documentation and maintenance records.
7. To familiarize students with safety standards and patient safety practices associated with ICU equipment.
8. To enhance problem-solving skills related to common equipment faults and corrective measures.

Practicals to be Performed

1. Identification and study of components and functions of ICU equipment.
2. Demonstration and setup of multiparameter patient monitoring systems.
3. Study of ECG, SpO_2, NIBP, temperature, and respiration monitoring modules.
4. Observation and handling of mechanical ventilator systems and accessories.
5. Study of ventilator modes and alarm systems.
6. Demonstration of infusion pumps and syringe pumps.
7. Setup and functional verification of defibrillators.
8. Study and operation of suction apparatus and oxygen delivery systems.
9. Electrical safety inspection of ICU equipment.
10. Measurement and interpretation of leakage current and grounding concepts.
11. Preventive maintenance checklist preparation for ICU devices.
12. Calibration and performance verification procedures of selected ICU equipment.
13. Documentation of equipment breakdown and service reports.
14. Study of ICU equipment troubleshooting and fault identification.
15. Case study and maintenance report preparation for ICU equipment.
16. Biomedical equipment inventory and asset labeling exercise.
17. Demonstration of patient safety precautions during equipment use.
18. Quality assurance procedures for critical care devices.
19. Preparation of equipment maintenance logbook.
20. Viva voce and practical competency assessment

7. CLINICAL POSTINGS

L/T/P/C

-/-/10/5

Posting Departments

- Biomedical Engineering Department
- Clinical Engineering and Equipment Maintenance Unit
- Intensive Care Unit (ICU)
- Critical Care Unit (CCU)
- Operation Theater (OT)
- Emergency and Trauma Care Unit
- Telemedicine Unit
- Hospital Information System (HIS) / Medical Informatics Department
- Radiology and Digital Imaging Department
- Central Monitoring and Networking Unit
- Equipment Troubleshooting and Service Section
- Physiotherapy and Therapeutic Equipment Unit
- Biomedical Equipment Calibration and Quality Assurance Section
- Hospital Administration / Biomedical Asset Management Department

Common Learning Objectives

- To provide practical exposure to the operation, applications, and management of medical equipment used in different hospital departments.
- To understand installation, functioning, and maintenance procedures of therapeutic and critical care equipment.
- To observe troubleshooting techniques and corrective maintenance practices for biomedical devices.
- To understand the implementation and applications of telemedicine systems and digital healthcare technologies in clinical settings.

- To develop knowledge of medical equipment networking, healthcare informatics, and data management systems.
- To gain exposure to safety procedures, quality assurance practices, and preventive maintenance protocols.
- To understand interdisciplinary coordination and workflow involved in biomedical equipment management within healthcare facilities.
- To develop documentation skills related to equipment service records, maintenance reports, and clinical equipment inventory systems.

Recommended Reference Books

1. Khandpur R.S. – *Handbook of Biomedical Instrumentation*, McGraw Hill Education.
2. Shortliffe E.H., Cimino J.J. – *Biomedical Informatics: Computer Applications in Health Care and Biomedicine*, Springer.
3. Hoyt R.E., Yoshihashi A. – *Health Informatics: Practical Guide for Healthcare and Information Technology Professionals*, Lulu Publications.
4. Keith J. Dreyer, David S. Hirschorn, James H. Thrall, Andrew J. Mehta – *PACS: A Guide to the Digital Revolution*, Springer.

8. INTERPERSONAL COMMUNICATION

L/T/P/C

1/-/-/1

Learning Objectives:

- To develop effective verbal and non-verbal communication skills.
- To enhance patient interaction and counseling abilities.
- To improve teamwork and professional relationships.
- To manage conflicts and emotional situations in healthcare settings.

Learning Outcomes:

- Communicate clearly and effectively with patients and colleagues.
- Demonstrate active listening and empathy.
- Handle difficult conversations and conflicts professionally.
- Exhibit strong interpersonal and teamwork skills.

(15hrs)

UNIT I (1HR)

- Introduction to Interpersonal Communication
- Overview of interpersonal communication theory.
- Key principles: sender, message, receiver, feedback, noise .Importance of communication in daily life.

UNIT II (1HR)

- Verbal Communication

- The role of language in communication.
- Choosing words carefully: Clarity, precision, and ambiguity.
  Influence of culture and context on verbal communication.

UNIT III (1HR)

- Non-Verbal Communication
- Body language, facial expressions, and gestures. Space, posture, and touch in communication.
- The role of non-verbal cues in conveying emotions

UNIT IV (1HRS)

- Listening Skills
- Types of listening: Active, passive, reflective. Barriers to effective listening.
- Developing empathy through listening.

UNIT V (1HR)

- Self-Disclosure and Relationship Development: The importance of self-disclosure in relationships. The Johari Window model.
- How self-disclosure affects trust and intimacy.

UNIT VI (2HRS)

- Conflict in Interpersonal Communication Types of conflict: Productivevs. destructive. Conflict management styles.
- Strategies for resolving conflict in healthy ways.

UNIT VII (2HRS)

- Cultural and Gender Differences in Communication
- Cultural influences on communication styles .Gender communication differences.
- Strategies for effective cross-cultural communication.

UNIT VIII (2HRS)

- Communication in Close Relationships
- Communication patterns in romantic relationships, family, and friendships.
- Managing expectations and maintaining healthy communication in intimate relationships.

UNIT IX (2HRS)

- Communication in the Workplace
- Interpersonal communication in professional settings.
- Navigating professional relationships and maintaining boundaries. Communication and leadership.

UNIT X (2HRS)

- Digital Communication
- The role of technology in interpersonal communication. The impact of social media on relationships.
- Pros and cons of digital communication tools.
- The Ethics of Communication
- Ethical dilemma in communication.
- Honesty, transparency, and privacy in conversations.
  Balancing openness with respect for others' boundaries.

RECOMMENDED TEXT BOOKS

"Interpersonal Communication: Everyday Encounters"(Author:JuliaT.Wood,9thEdition

III year VI Semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1		Medical Equipment Planning, Installation and Testing	4			4	70	30	100
2		Public Health and Medical Equipment	3			3	70	30	100
3		Healthcare Technology Management and Quality Assurance	3			3	70	30	100
4		Medical Equipment Regulations and Safety Standards	3			3	70	30	100
5		Practical – Advanced Equipment Management			4	2	70	30	100
6		Clinical postings			12	6	70	30	100
7		Soft skill development	01			01	100		100
TOTAL			**14**		**16**	**22**	**520**	**180**	**700**

Year III/Semester VI

1. MEDICAL EQUIPMENT PLANNING, INSTALLATION AND TESTING

L/T/P/C

2/-/-/2

Course Objectives

1. To understand the principles and stages of medical equipment planning in healthcare facilities.
2. To develop knowledge of hospital infrastructure and site preparation requirements.
3. To understand procurement processes and technology assessment methods for medical equipment.
4. To learn procedures for installation, commissioning, and acceptance testing of medical devices.
5. To apply safety standards, maintenance planning, and post-installation management practices.

Course Outcomes

1. Explain the stages and methods involved in medical equipment planning and need assessment.
2. Interpret infrastructure requirements for equipment installation and facility planning.
3. Prepare equipment specifications and understand procurement workflows.
4. Perform installation documentation, commissioning, and acceptance testing procedures.
5. Apply standards, safety regulations, and maintenance strategies for effective equipment management.

40 Hrs

UNIT I: INTRODUCTION TO MEDICAL EQUIPMENT PLANNING (10 HOURS)

- Concept and scope of medical equipment planning
- Role of biomedical engineers in healthcare technology planning
- Classification of medical equipment
- Healthcare technology life cycle
- Equipment inventory systems
- Needs assessment methodologies
- Demand forecasting in hospitals
- Equipment utilization studies
- Technology assessment concepts

UNIT II: HOSPITAL INFRASTRUCTURE AND FACILITY PLANNING (12 HOURS)

- Hospital planning principles
- Levels of healthcare facilities and equipment requirements
- Space planning and workflow considerations
- Site preparation requirements
- Electrical requirements and load estimation
- Earthing and electrical safety
- Medical gas pipeline systems
- HVAC requirements
- Water supply systems

- Environmental considerations for medical devices

UNIT III: MEDICAL EQUIPMENT PROCUREMENT AND TECHNOLOGY ASSESSMENT (12 HOURS)

- Procurement cycle of medical equipment
- Equipment specifications and technical documentation
- Tender preparation process
- Vendor selection criteria
- Cost-benefit analysis
- Health technology assessment
- Equipment replacement policies
- Regulatory requirements
- Import and purchasing procedures
- Budgeting and financial planning

UNIT IV: EQUIPMENT INSTALLATION AND COMMISSIONING (16 HOURS)

- Installation principles and procedures
- Site readiness checklist
- Pre-installation inspection
- Equipment unpacking and handling precautions
- Installation sequence and protocols
- Utility connections
- Calibration requirements
- Commissioning procedures
- User training during installation
- Installation documentation
- Common installation errors and troubleshooting

Case studies:

- Imaging equipment installation
- ICU equipment setup
- Laboratory equipment installation

UNIT V: ACCEPTANCE TESTING AND PERFORMANCE EVALUATION (14 HOURS)

- Concepts of acceptance testing
- Performance verification methods
- Electrical safety testing
- Functional testing procedures
- Calibration verification
- Measurement uncertainty
- Quality control procedures
- Test instruments used in biomedical engineering
- Documentation and reporting
- Preventive action procedures

UNIT VI: STANDARDS, SAFETY AND POST-INSTALLATION MANAGEMENT (16 HOURS)

- Medical device standards overview
- Risk management principles
- Electrical safety standards
- IEC and ISO standards relevant to medical devices

- Accreditation requirements
- Documentation and record maintenance
- Preventive maintenance planning
- Equipment audit procedures
- Equipment downtime analysis
- Disposal and replacement planning

Recommended Reference Books

1. **Joseph J. Carr & John M. Brown** — *Introduction to Biomedical Equipment Technology*, 4th Edition, Pearson Education.
2. **Khandpur R.S.** — *Handbook of Biomedical Instrumentation*, 3rd Edition, McGraw Hill Education.
3. **Webster J.G. and Albert M. Cook** — *Clinical Engineering: Principles and Practices*, Prentice Hall.
4. **Dyro Joseph F.** — *Clinical Engineering Handbook*, Elsevier Academic Press.

2. PUBLIC HEALTH AND MEDICAL EQUIPMENT

L/T/P/C

3/-/-/3

Course Objectives

1. To understand the concepts and structure of public health and healthcare systems.
2. To study the role and classification of medical equipment in healthcare facilities.
3. To develop knowledge of healthcare technology planning and equipment management.
4. To understand the application of medical equipment in public health programs.
5. To learn safety, quality assurance, and regulatory practices in healthcare technology.

Course Outcomes

After completion of the course, students will be able to:

1. Explain public health concepts and healthcare delivery systems.
2. Identify medical equipment requirements in various healthcare settings.
3. Apply principles of equipment planning, procurement, and maintenance.
4. Describe the use of medical technologies in public health programs.
5. Demonstrate understanding of safety standards, quality assurance, and disaster management practices.

60 Hrs

UNIT I: INTRODUCTION TO PUBLIC HEALTH AND HEALTHCARE SYSTEMS (12 HOURS)

- Definition, concepts and scope of public health
- Evolution of public health systems
- Determinants of health and disease
- Levels of healthcare delivery:
  - Primary healthcare
  - Secondary healthcare

  - Tertiary healthcare
- Structure of healthcare systems in India
- National Health Mission (NHM)
- Public health programs and healthcare infrastructure
- Role of biomedical technology in public health

UNIT II: MEDICAL EQUIPMENT IN PUBLIC HEALTH FACILITIES (12 HOURS)

- Classification of healthcare technologies
- Medical equipment requirements in:
  - Primary Health Centres (PHC)
  - Community Health Centres (CHC)
  - District hospitals
  - Mobile healthcare units
- Essential equipment lists and standardization
- Equipment selection criteria
- Equipment utilization and inventory systems
- Equipment life cycle management

UNIT III: HEALTHCARE TECHNOLOGY PLANNING AND EQUIPMENT MANAGEMENT (12 HOURS)

- Principles of healthcare technology assessment
- Equipment planning and forecasting
- Procurement process:
  - Need assessment
  - Specifications preparation
  - Tendering process
  - Vendor selection
- Installation and commissioning
- Equipment maintenance strategies:
  - Preventive maintenance
  - Corrective maintenance
- Asset management systems

UNIT IV: PUBLIC HEALTH PROGRAMS AND MEDICAL EQUIPMENT APPLICATIONS (12 HOURS)

- Medical equipment in maternal and child health services
- Equipment used in immunization programs
- Screening equipment in national health programs
- Diagnostic devices for communicable diseases
- Telemedicine and digital health technologies
- Role of portable and point-of-care devices in rural healthcare
- Healthcare information systems and electronic health records

UNIT V: SAFETY, REGULATIONS, QUALITY ASSURANCE AND DISASTER MANAGEMENT (12 HOURS)

- Medical device regulations and standards
- Healthcare accreditation concepts
- Quality assurance in healthcare technology
- Infection prevention and biomedical waste management
- Risk management and equipment safety
- Emergency preparedness and disaster management
- Medical equipment management during epidemics and disasters

- Ethical and legal considerations in healthcare technology

Recommended Reference Books

1. **World Health Organization (WHO)** – *Medical Equipment Maintenance Programme Overview*
2. Biomedical Equipment Technology and Healthcare Management by R. S. Khandpur
3. Introduction to Public Health by Mary-Jane Schneider
4. Health Care Technology Management: A Systematic Approach by World Health Organization

3. HEALTHCARE TECHNOLOGY MANAGEMENT AND QUALITY ASSURANCE

L/T/P/C

2/-/-/2

Course Objectives

1. To understand the concepts and scope of Healthcare Technology Management (HTM).
2. To learn medical equipment planning, assessment, and procurement procedures.
3. To develop knowledge of equipment maintenance and lifecycle management.
4. To understand quality assurance systems and healthcare standards.
5. To gain knowledge of safety regulations, risk management, and medical device standards.

Course Outcomes

After completion of the course, students will be able to:

1. Explain the principles and organizational structure of Healthcare Technology Management.
2. Participate in medical equipment planning, specification development, and procurement activities.
3. Apply maintenance strategies and lifecycle management practices for healthcare equipment.
4. Describe quality assurance methods and accreditation systems in healthcare settings.
5. Implement safety guidelines, risk management practices, and regulatory standards in healthcare technology.

40 Hrs

UNIT I: INTRODUCTION TO HEALTHCARE TECHNOLOGY MANAGEMENT (12 HOURS)

- Concept and scope of Healthcare Technology Management (HTM)
- Evolution and importance of HTM in healthcare delivery
- Role of biomedical engineers and medical equipment technologists
- Components of healthcare technology systems
- Medical equipment lifecycle concept
- Inventory management of medical equipment
- Healthcare organizational structure and technology departments

UNIT II: MEDICAL EQUIPMENT PLANNING AND PROCUREMENT (12 HOURS)

- Technology assessment and selection criteria
- Need assessment in hospitals
- Equipment planning process
- Budgeting and financial considerations
- Technical specifications and tender preparation
- Procurement procedures and vendor selection

- Installation and commissioning procedures
- Documentation requirements

UNIT III: EQUIPMENT MAINTENANCE AND TECHNOLOGY LIFECYCLE MANAGEMENT (12 HOURS)

- Maintenance management systems
- Preventive, predictive, corrective, and breakdown maintenance
- Equipment calibration and performance verification
- Maintenance contracts (AMC/CMC)
- Computerized Maintenance Management Systems (CMMS)
- Equipment replacement and obsolescence management
- Asset utilization analysis

UNIT IV: QUALITY ASSURANCE IN HEALTHCARE TECHNOLOGY (12 HOURS)

- Concepts of quality and quality assurance
- Quality management systems in healthcare
- Total Quality Management (TQM)
- Quality indicators and performance monitoring
- Accreditation systems and standards
- Internal and external quality audits
- Clinical engineering quality assurance programs

UNIT V: REGULATORY STANDARDS, SAFETY AND RISK MANAGEMENT (12 HOURS)

- Medical device regulations and standards
- Risk management principles in healthcare technology
- Patient safety and equipment safety standards
- Incident reporting and adverse event monitoring
- Electrical safety and radiation safety guidelines
- Biomedical waste management and infection control measures
- National and international regulatory agencies

Recommended Reference Books

1. **Management of Medical Technology: Theory, Practice and Cases** – Management of Medical Technology: Theory, Practice and Cases by Joseph D. Bronzino
2. **Clinical Engineering Handbook** – Clinical Engineering Handbook by Joseph F. Dyro
3. **Biomedical Equipment Technology and Healthcare Management** – Biomedical Equipment Technology and Healthcare Management by Khandpur R.S.
4. **Introduction to Biomedical Equipment Technology** – Introduction to Biomedical Equipment Technology by Joseph J. Carr and John M. Brown

4. MEDICAL EQUIPMENT REGULATIONS AND SAFETY STANDARDS

L/T/P/C

3/-/-/3

Course Objectives

1. To understand medical device regulations and regulatory authorities.
2. To learn classification and approval processes of medical devices.
3. To understand quality systems and international regulatory standards.
4. To develop knowledge of medical equipment safety and risk management.
5. To understand regulatory compliance and post-market surveillance practices.

Course Outcomes

1. Explain medical device classifications and regulatory frameworks.
2. Apply quality management principles and documentation standards.
3. Identify equipment hazards and follow safety standards.
4. Perform basic risk assessment and safety testing procedures.
5. Describe compliance requirements and post-market monitoring systems.

60 Hrs

UNIT I: INTRODUCTION TO MEDICAL DEVICE REGULATIONS AND REGULATORY BODIES (12 HOURS)

- Introduction to medical device regulations
- Classification of medical devices based on risk categories
- Need and importance of regulatory frameworks
- Overview of healthcare technology regulations
- National and international regulatory agencies:
  - Central Drugs Standard Control Organization (CDSCO) – India
  - U.S. Food and Drug Administration (FDA)
  - European CE marking system
  - International Medical Device Regulators Forum (IMDRF)
- Regulatory approval pathways for medical devices
- Medical Device Rules (India)

UNIT II: QUALITY SYSTEMS AND REGULATORY STANDARDS (12 HOURS)

- Quality management concepts in healthcare technology
- Good Manufacturing Practices (GMP)
- Quality assurance and quality control principles
- Documentation and record maintenance
- ISO standards related to medical devices:
  - ISO 13485
  - ISO 9001
  - IEC standards overview
- Audits and accreditation procedures
- Device lifecycle documentation

UNIT III: MEDICAL EQUIPMENT SAFETY STANDARDS (12 HOURS)

- Concepts of medical equipment safety
- Hazards associated with biomedical equipment
- Electrical, mechanical, radiation, and biological hazards
- Safety standards for healthcare facilities
- Overview of IEC 60601 standards
- Safety classifications of medical equipment
- Leakage currents and patient protection concepts
- Grounding and isolation techniques

UNIT IV: RISK MANAGEMENT AND SAFETY TESTING (12 HOURS)

- Principles of risk management in healthcare devices
- Hazard identification and risk analysis
- Introduction to ISO 14971
- Failure modes and effects analysis (FMEA)
- Safety inspection and preventive maintenance
- Electrical safety testing methods
- Equipment calibration and performance verification
- Documentation of safety testing

UNIT V: REGULATORY COMPLIANCE AND POST-MARKET SURVEILLANCE (12 HOURS)

- Device labeling requirements
- Unique Device Identification (UDI) concepts
- Adverse event reporting systems
- Recall procedures and field corrective actions
- Post-market surveillance systems
- Medical equipment incident investigation
- Cybersecurity and software safety considerations in medical devices
- Ethical and legal considerations in medical equipment usage

Recommended Reference Books

1. Webster J.G., and Albert M. Cook, *Clinical Engineering: Principles and Practices*, Prentice Hall.
2. Joseph J. Carr and John M. Brown, *Introduction to Biomedical Equipment Technology*, Pearson Education.
3. Richard C. Fries, *Reliable Design of Medical Devices*, CRC Press.
4. Theodore R. Kucklick, *The Medical Device R&D Handbook*, CRC Press.

5. PRACTICAL – ADVANCED EQUIPMENT MANAGEMENT

L/T/P/C

-/-/4/2

80 Hrs

Learning Objectives

1. To understand the functions, components, and clinical applications of equipment used in Intensive Care Units (ICU).
2. To develop skills in identification, setup, operation, and handling of ICU equipment.
3. To understand routine inspection, preventive maintenance, and troubleshooting procedures for critical care devices.
4. To gain practical knowledge of equipment safety checks and performance verification methods.
5. To understand calibration principles and quality assurance procedures for ICU equipment.
6. To develop competency in equipment documentation and maintenance records.
7. To familiarize students with safety standards and patient safety practices associated with ICU equipment.
8. To enhance problem-solving skills related to common equipment faults and corrective measures.

Practicals to be Performed

1. Identification and study of components and functions of ICU equipment.

2. Demonstration and setup of multiparameter patient monitoring systems.
3. Study of ECG, SpO_2, NIBP, temperature, and respiration monitoring modules.
4. Observation and handling of mechanical ventilator systems and accessories.
5. Study of ventilator modes and alarm systems.
6. Demonstration of infusion pumps and syringe pumps.
7. Setup and functional verification of defibrillators.
8. Study and operation of suction apparatus and oxygen delivery systems.
9. Electrical safety inspection of ICU equipment.
10. Measurement and interpretation of leakage current and grounding concepts.
11. Preventive maintenance checklist preparation for ICU devices.
12. Calibration and performance verification procedures of selected ICU equipment.
13. Documentation of equipment breakdown and service reports.
14. Study of ICU equipment troubleshooting and fault identification.
15. Case study and maintenance report preparation for ICU equipment.
16. Biomedical equipment inventory and asset labeling exercise.
17. Demonstration of patient safety precautions during equipment use.
18. Quality assurance procedures for critical care devices.
19. Preparation of equipment maintenance logbook.
20. Viva voce and practical competency assessment.

5. CLINICAL POSTINGS

L/T/P/C

-/-/12/6

COMMON LEARNING OBJECTIVES

1. To understand hospital biomedical engineering services and medical equipment management systems.
2. To observe medical equipment planning, procurement, installation, acceptance testing, and commissioning procedures.
3. To gain exposure to preventive maintenance, calibration, and performance verification practices of medical equipment.
4. To understand quality assurance procedures and standards applied in healthcare technology management.
5. To observe implementation of medical equipment regulations, safety standards, and risk management practices.
6. To understand healthcare technology documentation, inventory systems, and equipment lifecycle management.
7. To gain exposure to public health settings and understand the role of medical equipment in community healthcare services.
8. To understand accreditation requirements, biomedical audits, and quality improvement processes in hospitals.
9. To develop professional skills in communication, reporting, teamwork, and ethical practices within healthcare environments.
10. To integrate theoretical knowledge with practical applications in clinical and healthcare technology settings.

POSTING DEPARTMENTS

- Biomedical Engineering Department
- Clinical Engineering and Equipment Maintenance Unit

- Medical Equipment Planning and Procurement Section
- Installation and Commissioning Unit
- Equipment Calibration and Testing Laboratory
- Quality Assurance and Biomedical Audit Unit
- Intensive Care Unit (ICU)
- Operation Theater (OT)
- Emergency and Trauma Care Unit
- Radiology Department
- Central Sterile Supply Department (CSSD)
- Hospital Administration Department
- Public Health Department / Community Healthcare Center
- Accreditation and Quality Management Cell

7. SOFT SKILLS DEVELOPMENT

L/T/P/C

1/-/-/1

Learning Objectives:

- To enhance communication and interpersonal skills.
- To develop leadership and teamwork abilities.
- To improve problem-solving and decision-making skills.
- To build professional behavior and confidence.

Learning Outcomes:

- Communicate effectively in professional settings.
- Demonstrate teamwork and leadership qualities.
- Apply critical thinking in problem-solving.
- Exhibit professionalism and ethical behavior.

20 Hrs

UNIT 1 (2 HRS)

Introduction to Soft Skills: Definition of Soft Skills. Hard skills: The importance of soft skills in the workplace

Key soft skills: communication, teamwork, adaptability, problem-solving, leadership, etc. Activities: Icebreakers, group discussions on soft skills in the workplace.

Assignment: Self-assessment on current soft skills

UNIT 2 (2 HRS)

Communication Skills

The communication process: sender, message, receiver, feedback, active listening techniques

Body language and non-verbal cues. Effective speaking: tone, clarity, and pacing. Email and phone communication etiquette

Activities: Role-playing scenarios (e.g., client interaction, conflicted solution)

Assignment: Practice active listening and send an email incorporating effective communication principles.

UNIT 3 (2 HRS)

Emotional Intelligence (EQ): What is emotional intelligence? (Self-awareness, self- Regulation, motivation, empathy, and social skills) Recognizing and managing your emotions, Understanding others' emotions and building empathy, Developing emotional resilience

Activities: Emotional intelligence quizzes, group discussion on handling emotional stressful situations

Assignment**:** Journaling emotional responses and reflection on EQ practices.

UNIT 4 (2 HRS)

Teamwork and Collaboration Roles and dynamics within teams Effective communication in teams Conflict resolution in teams

Building trust and fostering a collaborative environment. Activities: Team exercises, problem-solving tasks, and brainstorming sessions

Assignment: Work on a team project or task, and present in class.

UNIT 5 (2 HRS)

Conflict Resolution Sources of conflict (miscommunication, differing priorities, etc.)

Conflict resolution strategies (e.g negotiation, mediation, compromise). The role of active listening in resolving conflicts Managing personal emotions during conflict. Activities: Case studies, role-playing conflict resolution scenarios

Assignment: Reflect on a personal or professional conflict and propose a resolution strategy**.**

UNIT 6 (2 HRS)

Time Management and Personal Organization

The importance of time management in personal and professional success. Prioritization techniques (e.g., Eisenhower Matrix, ABCDE method)

Tools for time management (digital calendars, to-do lists, Pomodoro technique), setting SMART goals

Managing procrastination and avoiding distractions. Activities: Time-blocking exercises, goal-setting workshop

Assignment: Create a personal time management plan and track daily productivity for a week.

UNIT 7 (2 HRS)

Leadership and Influence

Types of leadership (e.g., transformational, transactional, servant leadership)Leadingbyexample: qualities of effective leaders

Building and maintaining team morale. The art of persuasion and influence. Activities: Leadership style assessment, group discussions on leadership challenges. Assignment: Write a reflection on a leader you admire and why.

UNIT 8 (2 HRS)

Public Speaking and Presentation Skills: Overcoming Fear of Public Speaking

Structuring a presentation (opening, body, and conclusion), Effective use of visual aids (PowerPoint, etc.)

Engaging the audience through storytelling, eye contact, and body language Activities: Group presentations, peer feedback sessions, impromptu speaking exercises Assignment: Prepare and deliver a short presentation (5-7minutes) on a topic of choice. Assessment and Evaluation:

Recommended Text Books

The 7 Habits of Highly Effective People" by Stephen R.Covey

IV year /VII semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	MARK		TOTAL MARKS
							INT	EXT	
1		Internship-I	0	0	40	20	30	70	100
2		Project-I	-	-	2	1	100	-	100
		TOTAL	**0**	**0**	**42**	**21**	**230**	**70**	**300**

Year IV/Semester VIII

S. NO	SUBJECT CODE	SUBJECT	L	T	P	C	MARKS		TOTAL MARKS
							INT	EXT	
1		Internship-II	0	0	20	10	30	70	100
2		Project-II	0	0	20	10	30	70	100
		TOTAL	**0**	**0**	**40**	**20**	**160**	**140**	**300**