

**STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA  
TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES**

DISCIPLINE: DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY										SEMESTER: 3 <sup>RD</sup>		
SL NO	SUBJECT CODE	SUBJECT	PERIODS			EVALUATION SCHEME						
			L	T	P	INTERNAL EXAM			END SEM EXAM	TERM WORK	PRACTICAL EXAM	TOTAL MARKS
						TA	CT	Total				
<b>THEORY</b>												
1.	MLT 301	HUMAN ANATOMY & PHYSIOLOGY	4	-	-	10	20	30	70			100
2.	MLT 302	HAEMATOLOGY AND BODY FLUIDS	4	-	-	10	20	30	70			100
3.	MLT 303	BIOMEDICAL INSTRUMENTATION-I	4	-	-	10	20	30	70			100
4.	ELT 321	BASIC ELECTRICAL AND ELECTRONICS	4	-	-	10	20	30	70			100
5.	CST 321	COMPUTER PROGRAMMING IN – C	4	-	-	10	20	30	70			100
<b>PRACTICAL/TERM WORK</b>												
6.	MLP 301	HUMAN ANATOMY & PHYSIOLOGY LAB	-	-	4					25	25	50
7.	MLP 302	HAEMATOLOGY AND BODY FLUIDS LAB	-	-	4					25	25	50
8.	ETP 321	BASIC ELECTRICAL AND ELECTRONICS LAB	-	-	4					25	25	50
9.	CSP 321	COMPUTER PROGRAMMING IN – C LAB	-	-	4					25	25	50
10.	MLP 303	PROFESSIONAL PRACTICE I	-	-	3					25	25	50
<b>GRAND TOTAL</b>			<b>20</b>	<b>-</b>	<b>19</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>350</b>	<b>125</b>	<b>125</b>	<b>750</b>

Total Contact hours per week: 39

Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assessment, CT- Class test

Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50%

## HUMAN ANATOMY & PHYSIOLOGY

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	MLT 301	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### OBJECTIVES:

1. To provide overview of the human body structure, function of different organs, systems in the human body.
2. To apply the knowledge of human anatomy and physiology in medical Lab as well as biomedical engineering field.

### DETAIL SUBJECT CONTENT

1. **Scope** of Anatomy and Physiology.
2. **Various terms used in Anatomy.**
3. **Cells and Tissues:** Cell Theory, Cell-shape, Structure, Organelles and functions, Tissues-Types, Structure Function, Distribution.
4. **Structure and function of Skeleton.** Classification of Joints and their function, Joint disorder.
5. **Muscles:**Types,Functional characteristics of muscle tissue, Function of muscle, Gross anatomy of skeletal muscle,Microscopic anatomy of muscle, Smooth muscle, Types of smooth muscle, Muscular system, Major skeletal muscle of the body.
6. **Structure and functions of various parts of the Heart.** Arterial and Venous systems with special reference to the names and positions of main Arteries and Veins. Brief information about Cardiovascular disorder.
7. **Structure and functions of various parts of respiratory system.** Physiology of respiration.
8. **Physiology of Skeletal Muscle fiber:** Generation of action potential, Neuromuscular junction and nerve stimulation,depolarization,refractory period, Muscle fiber contraction, Muscle twitch, Muscle tone: energy for muscle contraction.
9. **Nervous system:**Neuron-Neurophysiology,Resting membrane potential, Action potential, Nerve impulse transmission,Synapse,Brain waves,Consciousness,Sleep and sleep –awake cycle, Sleep pattern, Overview of ANS.

10. **Structure and functions of various parts of Urinary system.**Micturation, Physiology of urine formation.

11. **Endocrine glands and Hormones.** Location of the glands, their Hormones and functions.Pituitary, Thyroid, Adrenal and Pancreas.

12. **Elementary knowledge** of structure and functions of the organs of smell, taste, ear, eye and skin. Physiology of pain.

13. **Structure and functions of various parts of human reproductive system.**

**LEARNING RESOURCES:**

**REFERENCE BOOKS**

Sl no	AUTHOR	BOOKS	PUBLISHER
01	Elaine N.Marieb	Human Anatomy Physiology	
02	Rose & Wilson	Anatomy & Physiology	
03	C.Chatarjee	Human Physiology	
04	Guyton & Hall	Medical Physiology	
05	Berman & Mahapatra	Medical Physiology	

## HAEMATOLOGY AND BODY FLUIDS

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	MLT 302	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### OBJECTIVES:

1. To study of Blood and introduction of body fluids.
2. To provide knowledge of hematology.
3. To apply the knowledge of hematology in biomedical instruments.

### DETAIL SUBJECT CONTENT

1. **Blood** :composition and function of blood, Blood plasma,Source and function of plasma proteins, Formed elements, collection of blood,Anticoagulants-EDTA,Trisodium citrate,Oxalates,Sodium Fluoride, Heparin(Uses and disadvantages)
2. **Erythrocytes**: Structural characteristics,Hemoglobin-structure and function, Function of erythrocytes, Production of erythrocyte.Fate and destruction of erythrocytes,Erythrocyte disorders-Anemia, Low hemoglobin, Abnormal hemoglobin,Thalassemas,Sickle-cell anemia, Counting chamber, Total count of RBC,Estimation of Hb,ESR,PCV,MCV,MCH,MCHC,Color index.
3. **Leucocytes and Platelets**: Types and their Structural characteristics, Production of WBC,Function of WBC,DC,Total count of WBC,Lecocytosis,Platelets- characteristics,Function of Platelet,Production of Platelet,Coagulation factors,Coagulation steps,Total count of Platelet,BT,CT .
4. **Blood Banking**: Storage, Collection, Blood grouping, Rh factor, Blood transfusion.
5. **CSF**:Transudata and Exudates, Source of CSF,Composition of CSF,Indication for collection of CSF,Meningitis,Collection of CSF,Physical, Chemical and Microscopical examination.
6. **Body fluids**: Body water content, Fluid compartments-ICF, ECF, Plasma, IF, Composition of body fluids, Composition of ICF AND ECF.

7. **Urine:** Collection and preservation of Urine, Physical, Chemical and Microscopical examination.
8. **Semen:** Collection of semen, Physical, Chemical examination- Volume, Viscosity, Relation, Microscopical examination –sperm morphology, sperm count, Motility.

**LEARNING RESOURCES:**

**REFERENCE BOOKS**

Sl no	AUTHOR	BOOKS	PUBLISHER
01	Elaine N. Marieb	Human Anatomy Physiology	
02	Rose & Wilson	Anatomy & Physiology	
03	C. Chatterjee	Human Physiology	
04	K.L. Mukarjee	Medical Laboratory Technology	
05	V.H. Talib	Medical Laboratory Technology	
06	P. Chakraborty & G. Chakraborty	Practical Pathology	
07	Rambik Sood	Medical Laboratory Technology	

## BIOMEDICAL INSTRUMENTATION-I

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	MLT 303	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### OBJECTIVES:

1. To provide the basic knowledge of Instrumentation system and introduction to biomedical instrumentation.
2. To apply the knowledge of Transducer and sensors in biomedical instrumentation.

### DETAIL SUBJECT CONTENT

1. **Fundamental of Medical Instrumentation:** Fundamental of Instrumentation, Different types of Medical Instrument, General diagram of biomedical instrumentation system. Measurand, Transducer/Sensor, Signal Conditioner, Display system, Alarm, data storage, data transmission, Performance requirements of Medical instrumentation system.
2. **Bioelectrical Potential and Electrodes:** Biopotential-Resting membrane potential, Action potential, Sources of Bio-signals, Electrode-Function of Electrodes, Electrode metals, General classification of Electrodes, Surface electrode, Needle electrodes, Microelectrode and their uses, Electrode-Tissue interface, Metal-Electrolyte, Polarisation, Skin contact impedance, Introduction to different Bio-signals.
3. **Bio-Transducer:** Transducer-classification of Transducer, Bio- Transducer, Factors for Bio-Transducer, Overview of Transducer characteristics: Static characteristics- Accuracy, Precision, Resolution, Sensitivity, Drift, Linearity, Threshold, Hysteresis, Span, Dynamic characteristics, Zero order system, First order system, Displacement, Position and Motion Transducer: Working and uses of Potentiometric, Variable Capacitive, Variable Inductive Transducer, LVDT. Pressure Transducer: LVDT Pressure Transducer, Strain Gauge, Transducer for body temperature: Thermocouple, Electrical resistance Thermometer, Thermistors, P-N junction, Chemical thermometry: Photoelectric Transducer: Photovoltaic cell, Photoemissive cells, Piezoelectric transducer.
4. **Sensor:** Optical fiber sensor: structure and working principle of optical fiber, Types of optical fiber sensors-Photometric sensor, Physical sensor, Chemical sensors: Biosensors: Introduction, Dissolved O<sub>2</sub> sensor and their application, Glucose sensor, pH sensor.

**LEARNING RESOURCES:****REFERENCE BOOKS**

Sl no	AUTHOR	BOOKS	PUBLISHER
01	R.S.Khandpur	Hand book of Biomedical Insrtumentation	
02	Cromwell	Biomedical Instrumentation & measurement	
03	C.Raja Rao & S.K.Guha	Principle of Medical Electronic & Biomedical Insrtumentation	
04	A.K.Sawhney	Electrical & Electronics Measurement & Instrumentation	
05	J.G.Webster	Medical Instrument	

## BASIC ELECTRICAL AND ELECTRONICS

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	ELT 321	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### OBJECTIVES:

1. To provide the basic knowledge of Electrical Engg and brief introduction to basic Electronics.
2. To apply the knowledge of basic Electrical in biomedical instrumentation.

### DETAIL SUBJECT CONTENT

1. **Fundamental of Electrical Engineering:** Concept of power supply system, Introduction to single phase and three phase systems, Inter connections of three phase systems, Phase voltage, Line voltage, Phase current, Line current and their relation, Power transmitted by a three phase line, Active power, Apparent power, Average power, Star and delta connection and their conversion, Faraday's law of electromagnetic induction, Lenz' law, idea of field and armature of rotating machines.
2. **Network Analysis:** Active and passive network-Balanced and unbalanced network-Symmetrical and asymmetrical network-T and Pie network and their conversion-Simple problems Characteristics impedance-propagation constant and image impedance-Open and short circuit impedance and their relation to Characteristics impedance,KCL,KVL,Voltage divider Rule,Current divider Rule,Mesh analysis,Nod analysis,Thevenin's theorem-Norton's theorem-Maximum Power Transform theorem-Superposition theorem-Simple problems,Basic idea of passive filter,Attenuator,Equalizer,Transmission line.
3. **DC Machines:** Construction and classification of DC machines.-EMF Equation of DC generator-Field applications of Shunt, Series and Compound wound generators-Principle of operation of D.C, Motors, Back e.m.f, Voltage and Current equation, Speed and Torque equations(no deduction) Simple problems, Speed control: Shunt motors-field control, armature resistance control, Series motors- field control, armature resistance control.
4. **AC Machines:** Basic idea of 3 phase system-Essential parts, Types and principle of operation, Definitions and mathematical expressions (without deductions) of synchronous speed, Actual motor speed, Slip and motor current frequency-Simple problems-Alternators.
5. **Transformer:** Basic principles, Essential parts and types, E.M.F. equation(no deduction), Transformation ratio, Voltage ratio, and current ratio-Simple problems. Behavior of transformers under no-load and load conditions(explanations without phasor diagram)-Losses and efficiency-Auto transformer-Principle, advantages, field of application.



6. **Special Semiconductor Devices:** Construction, Operation and characteristics of UJT-Equivalent circuit-UJT as relaxation oscillator, Construction, Operation and characteristics of SCR, SCRS, DIAC, TRIAC and their uses.
7. **Optoelectronics and Ics:** Elementary ideas of LED, LCD, Photodiode, Phototransistor and solar cell and their applications Basic idea of Ics-Classification : Linear Ics, SSI, MSI, LSI and VLSI

#### REFERENCE BOOKS

Sl no	AUTHOR	BOOKS	PUBLISHER
01	BLTheraja	Electrical Technology	
02	BLTheraja	Basic Electronics	
03	D P Kothari	Basic electrical engineering	
04	V.K.Meheta	Principle of Electronics	
05	S. Chowdhury	Basic Electronics	
06	D Chattopadhyay	Basic Electronics	
07	Prof D.Dey Roy	Basic Electronics	

## COMPUTER PROGRAMMING IN C

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	CST 321	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

### DETAIL SUBJECT CONTENT

- 1. Introduction to computer Programming:** Concept of programming, Overview of different programming languages, concept of Algorithm and flow chart, Language Translators, Compiler.
- 2. Fundamental of C Language:** Background of C, Steps of C Program execution, Process of compiling and running a C program, Compiling and linking, Basic structure of C. programme, Character set, Key words, Identifier, Constant, Header file, Library functions.
- 3. Data types and variables:** Data types and their size, Variable, Declaration of variable, Operators, Expression, Operator precedence and associativity, Type of conversion.
- 4. Input/output functions and statements:** scanf(), print(), formatted i/o function, Escape sequences, Assignment statement, Writing user-friendly program, Character input/output functions- getchar(), putchar(), getch(), putch(), getche(), gets(), puts(), clrscr()
- 5. Control statements:** Decision making and branching: if, if-else, Nested if-else statements with example, goto and break statement, Switch-case statements with example, Loop control structure: Loop control statements, for Loop, Nested for along with examples, While loop, do-while Loop with example, Comparison of Loop control structures.
- 6. Array:** Array, One-dimensional and their declaration, Initialization and access values, Two – dimensional array their declaration, Initialization and access values, Programs using array.
- 7. String:** String, String manipulation functions- strlen(), strcpy(), strcmp(), Reading/writing strings.
- 8. Pointer:** Concept of pointer, Pointer declaration and initialization, accessing variables through pointer, Pointer and array.
- 9. Structure and union:** Concept of structure, Structure members, Structure variable, Declaration and initialization of structure, Union, , Declaration and initialization of Union, Difference between structure and union.

**10. Overview of file handling:** Concept of file handling in C, Different types of files, Command line arguments, File handling functions.

**LEARNING RESOURCES:**

**REFERENCE BOOKS**

Sl no	AUTHOR	BOOKS	PUBLISHER
01	T Joyprovoon	Programming with C	
02	Balaguruswami	Programming in ANCI	
03	Y.Kanetkar	Let us C	
04	Byron Gottfried	Programming with C	

## PRACTICALS

### HUMAN ANATOMY AND PHYSIOLOGY LAB

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	MLP 301	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P/W	Term Work	25
Maximum marks:	50	End Semester Examination:	25

#### List of experiments

Sl No	Experiment
01	Determination of anatomical position and plane.
02	Identification of Human skeleton
03	Identification of bones of Human Skull
04	Identification of bones of Human vertebral column
05	Identification of bones of Human thorax
06	Identification of bones of Human pectoral girdle and upper limbs
07	Identification of bones of Human pelvic girdle and lower limbs
08	Identification of different types of joints
09	Identification of different parts Human digestive system
10	Identification of different parts Human cardiovascular system
11	Identification of different parts Human pulmonary system
12	Identification of different parts Human urinary system
13	Identification of surface anatomy of Heart-Lungs
14	Identification of different parts Human special senses –Eye,Ear. Nose
15	Identification of different parts Human reproductive system

## HAEMATOLOGY AND BODY FLUIDS LAB

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	MLP 302	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P/W	Term Work	25
Maximum marks:	50	End Semester Examination:	25

### List of experiments

Sl No	Experiment
01	Collection of venous blood
02	Estimation of Hb
03	Estimation of ESR
04	Estimation of total count of RBC
05	Estimation of PVC,MCV,MCHC,Color index
06	Estimation of total count of WBC
07	Estimation of total count of Platelets
08	Determination of blood group(ABO) & Rh factor
09	Determination of BT, CT
10	Separation of cell and plasma
11	Determination of PT
12	Collection of Urine & routine examination
13	Collection of Semen& analysis(Physical,Chemical & Microscopical examination)
14	Demonstration of collection of CSF
15	CSF analysis

## BASIC ELECTRICAL AND ELECTRONICS

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	ETP 321	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P/W	Term Work	25
Maximum marks:	50	End Semester Examination:	25

### List of experiments

Sl No	Experiment
01	Identification of common assembly tools.
02	Identification and use of Multimeter.
03	Identification and use of function generator and Oscilloscope.
04	Study of constructional details of D.C.Machine.
05	Study of the constructional details of single phase capacitor motor.
06	Study of the constructional details of 3 phase induction motor.
07	Study of low power transformer.
08	Verification of KCL & KVL.
09	Verification of Thevenin's and Norton's theorem.
10	Verification of Maximum power Transfer theorem.
11	Design, wind and testing of low power transformer.
12	Identification and specification of Resister, Capacitor, Inductor, Relay, Switch, Batteries.
13	Identification and specification of diode, transistor, SCR, DIAC, TRIAC.
14	Identification and specification of LED, LCD, Photodiode, Phototransistors, Ic etc.
15	Study of Zener diode as a voltage regulator.

## COMPUTER PROGRAMMING IN C

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	CSP 321	Semester	3 <sup>rd</sup>
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P/W	Term Work	25
Maximum marks:	50	End Semester Examination:	25

### List of experiments

Sl No	Experiment
01	Execution of a sample C program to study the basic structure of C program
02	To be familiar with keywords and identifiers
03	To write program using Arithmetic, Relational, Logical and Assignment operators
04	To write program to implement increment and decrement operators and to find the greatest between two numbers using conditional operator.
05	To evaluate an expression to study operator precedence and associativity and to write a program using casting a value.
06	To use formatted scanf() and printf() functions for different types of data.
07	To find the roots of a quadratic equation. Find the greatest of three numbers using IF-ELSE and IF-ELSE IF statements.
08	Write a program and run using for loop.
09	Write a program and run using while loop.
10	Write a program and run using do- while loop
11	Write a program and run using single dimensional array.
12	Write a program and run using multi- dimensional array
13	Write a program and run using structure and union
14	Write a program and run using pointer.
15	Write a program and run to open, create, edit, close the file.

PROFESSIONAL PRACTICE-1

Name of the Course: Diploma in DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY			
Course code:	MLP 303	Semester	3 <sup>rd</sup>
Total Period:	45	Examination	4 hrs
Lab. periods:	3 P/W	Term Work	25
Maximum marks:	50	End Semester Examination:	25

**List of experiments**

Sl No	Experiment
1	To be familiar with the working of office packages-Word documentation,MS-Excel,PPT
2	Preparation of a note in MS-Word in the given topic.
3	Preparation of a sheet in MS-Excel in the given topic.
4	Preparation of presentation in MS-PPT in the given topic(Anatomy/Physiology/Biomedical)
5	To be familiar with the crating email id,e-mailing,searching and down loading.
6	Seminar presentation on a topic(Anatomy/Physiology/Biomedical)