West Bengal State Council of Technical, Vocational Education and Skill Development

(A Statutory Body under West Bengal Act XXVI of 2013)

Technical Education Division

[Diploma in Engineering & Technology]

Syllabus

of

Diploma in Medical Laboratory Technology

[MLT]

Part-II (3rd Semester)

Revised

2022

Syllabus of Human Anatomy & Physiology

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Human Anatomy & Physiology	Course Code:	MLTPC301
Course Category:	Theory; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	3	Contact Hr./Week	L-3: T-0 : P-0

Course Objective:

Sr. No	Course Objective
1	To provide overview of the human body structure and basic knowledge of functions of the different organs & system in the human body.
2	The content of the subject provides the basic knowledge of different physiological parameters.
3	To apply the knowledge of human Anatomy & Physiology in medical laboratory technology and as well as biomedical engineering field.

Course Content:

Unit	Topic	Hrs.
1	**An Overview of Anatomy & Physiology:** Topics of Anatomy – introduction to Regional, Systemic, Surface and Microscopicanatomy. Levels of Structural Organization; Anatomical Position, Anatomical Planes & sections, Anatomical Terms - Directional terms, Regional terms; Body cavities & Membranes; Abdominopelvic regions and quadrants; Other body cavities. Topics of Physiology, Survival Needs -Nutrients, oxygen, water, normal body temperature, Homeostasis, Introduction to organ & System.	3
2	**Cells and Tissues:** Cell, structure and function of cells, types of cell, cell shape, organelles & Functions; Structure of Cell membrane; Tissues - Types, Structure, Function , Distribution;	4
3	**Bones and Human Skeleton:** Bone -Classification of Bones; Function of bones, Bone Structure - Gross anatomy (bone marking and structure) and Microscopic anatomy - Compact bone, spongy bone; Chemical composition of Bone; Fracture, Repairing of bone; Human Skeleton - Axial and Appendicular skeleton; Skull; Vertebral Column; Thorax, Pectoral Girdle and Upper limb; Pelvic Girdle and lower limb; Joints: joints; Classification of Joints; Fibrous joints, Cartilaginous joints and Synovial Joints with example	7
4	**Muscles and Nervous System:** Muscle tissue; function of muscle; classification with example, Gross anatomy of Skeletal muscle; Microscopic anatomy of muscle; Physiology of muscle - Generation of Action potential, Overview of Nervous system; Organization of the Nervous system - CNS, PNS; Neurons - Structure, Classification, Function; Regions and organization of Brain, Gross anatomy and protection of Spinal Cord; Cranial nerves; ANS anatomy; Neurophysiology, Resting Membrane potential, Action potential, Nerve impulse Transmission,	6
5	**Respiratory System:** Overview of respiratory system, Lungs, Mechanism of Breathing, external & internal respiration, Lung Compliance, Respiratory Volumes, Respiratory capacities, Compositionof Alveolar gas, Transport of Respiratory gases by blood, Respiration Rate	4

6	**Digestive System:** Overview of digestive system; Structure and functions of different parts and accessory organs of digestive system, Process of digestion, absorption and metabolism	4
7	**Cardiovascular System and Lymphatic System:** Overview of cardiovascular system, Structure of heart, Electrophysiology of heart, overview of Composition & function of blood, Overview of blood circulation - Systemic & pulmonary; Systemic blood pressure, HR, Cardiac output. Structure and functions of lymph system.	4
8	**Excretory system:** Process of excretion, Overview of Urinary system, Kidney, Nephron , Mechanism of Urine formation, Diuretic, Renal Clearance, Urinary Bladder	3
9	**Endocrine System:** Overview of Endocrine system, Hormones, Major Endocrine Organs- Overview of Pituitary Gland, Thyroid gland, Parathyroid glands, Adrenal glands, Pancreas- Glucagon, insulin, Gonads, Thymus; Other hormones.	3
10	**Reproductive System:** Structure and function of different parts of reproductive system of male and female. Menstruation, ovulation, reproduction, menopause.	3
11	**Sense Organs:** Taste and Smell, The Eye and Vision – Structure of Eyeball, internal chambers and fluids, Overview of physiology of vision, Retina, Photoreception, light and Dark adaptation, Ear- Overview of structure of ear & Physiology of hearing,	4
Total Teaching Hrs. : (3 hrs. x 15 Weeks)		45
Assessment : **(**3hrs. x 2 Weeks)		06
Total: (3hrs. x 17 Weeks)		**51**

Course Outcomes (Cos):

COs	***Students would be able to***
CO1	State the anatomical terminology
CO2	Demonstrate the human skeleton system, bones and joints.
CO3	Explain the different systems with organs and their functions
CO4	Identify the different sense organs and their physiology.

End Semester Exam:

End Semester Exam Scheme (Weightage 60 %, FM – 60):								
Sr No	Question Type	Group	Unit No	No of question to be Set	No of question to be Answered	Allotted Marks	Total Marks	Time
1	**Objective Type:** MCQ/ Fill-in-the blanks	-	All	35	30	1 x 30	30	
2	**Short Answer Type:**	-	All	8	5	2 x 5	10	
3	**Subjective Type:**	A	1,2,3	3	Any **Four** taking at least **One** from each group	5 x 4	20	
		B	4,5,6,7	3				
		C	8, 9, 10,11	3				
	Total:						60	Hrs.

Reference Book:

Sr No	Book	Author	Publisher
1	Human Anatomy & Physiology	Elaine N Marieb	Pearson
2	Anatomy & Physiology	Rose & Willson	
3	Human Anatomy	A.K. Dutta	
4	Anatomy	A.Sahanuiza	
5	Human Physiology	C.C. Chatterjee	Medical Allied Agency
6	Medical Physiology	Guyton & Hall	Elsevier
7	Medical Physiology	Berman & Mahapatra	C.B. International

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Syllabus of Human Anatomy & Physiology Lab.

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Human Anatomy & Physiology Lab.	Course Code:	MLTPC301P
Course Category:	Sessional; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	1	Contact Hr./Week	L-0: T-0: P-2

Course Objective:

Sr. No	Course Objective
1	To determination of anatomical position & plane, anatomical terminology
2	To identify the Human Skeleton, bones & joints
3	To draw different systemic anatomy and identification of different organs with sketch.

Course Details:

Expt. No	Experiment	Hrs.
1	Determination of Anatomical Position & Plane, Anatomical terms,	
2	Determination of body cavities & Abdominopelvic regions & quadrants	
3	Identification of Human Skeleton	
4	Identification of bones of human skull	
5	Identification of bones of human vertebral column and thorax	
6	Identification of bones of human pectoral girdle & upper limbs, pelvic girdle & lower limbs	
7	Identification of different types of joints	
8	Identification of different muscles	
9	Identification of different parts of the circulatory system	
10	Identification of different parts of the respiratory system	
11	Identification of different parts of the digestive system	
12	Identification of different parts of endocrine and reproductive system	

13	Identification of different parts of excretory system	
14	Identification of different parts of nervous system	
15	Identification of different parts of sensory organs	
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(**2hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (Cos):

COs	***Students would be able to***
CO1	Demonstrate the anatomical position, plane and terms
CO2	Identify the human skeleton, bones, joints
CO3	Draw the different systems and organs with their functions.

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Syllabus of Hematology & Body Fluids

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Hematology & Body Fluids	Course Code:	MLTPC302
Course Category:	Theory; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	2	Contact Hr./Week	L-2: T-0 : P-0

Course Objective:

Sr. No	Course Objective
1	To study the blood composition & function and other body fluids.
2	To study the different hematological tests for diagnosis.
3	To study the pathological tests of urine, CSF & semen for diagnosis.
4	To apply the knowledge of hematology in biomedical Instrumentation

Course Details:

Unit	Topic	Hrs.
1	**Blood & its collection:** Introduction to hematology & other body fluids**.** Blood definition, Composition & function of blood, Blood Plasma, Source and function of Plasma proteins, formed elements, Collection of blood, Anticoagulants – EDTA, Tri-sodium citrate, Oxalates, Sodium fluoride, Heparin (Uses and disadvantages)	5
2	**Erythrocytes:** Erythrocytes- Structural characteristic, Hemoglobin- structure and function, Function of Erythrocytes, Production of Erythrocytes, Fate and Destruction of Erythrocytes, Erythrocyte disorders- Anemia, Low hemoglobin, Abnormal hemoglobin, Thalassemias,	5

	sickle-cellanemia; Counting Chamber, Total count of RBC, Estimation of Hb, ESR, PCV, MCV,MCH, MCHC, Color Index,	
3	**Leucocytes And Platelets:** Leucocytes- Types and their structural characteristic, production of WBC, Function of WBC, DC, Total count of WBC, Leukocytosis; Platelet – Characteristic, Function of Platelet, Production of Platelet, Coagulation Steps, Coagulation factors, Total count of platelet, BT, CT, P time,	7
4	**Blood Group & Blood Banking:** Function of blood bank, Blood collection & Storage for Blood banking, Tests: Blood grouping, Rh factor, cross matching & other test, Blood Transfusion, Blood components and anti-coagulants (CPDA, CPD etc.)	4
5	**CSF:** Transudate & Exudate, Source of CSF, Composition of CSF, Indication for collection of CSF, Meningitis, Collection of CSF, Physical, Microscopical and Chemical examinations	3
6	**Urine:** Collection and Preservation of Urine, Physical, Chemical and Microscopical examination.	3
7	**Semen Analysis:** Collection of Semen, Physical & Chemical examination- Volume, Viscosity, Relation; Microscopical Examination-Sperm Morphology, Sperm count, Motility	3
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(2** hrs. x 2 Weeks)		04
Total: (2 hrs. x 17 Weeks)		**34**

Course Outcomes (Cos):

COs	***Students would be able to***
CO1	State the composition, function and collection of blood.
CO2	Explain the different types of blood cells and their structure and clinical significance.
CO3	Demonstrate the different tests for diagnosis.
CO4	Explain the CSF, Urine and semen analysis.

End Semester Exam:

End Semester Exam Scheme (Weightage 60 %, FM – 60):								
Sr No	Question Type	Group	Unit No	No of question to be Set	No of question to be Answered	Allotted Marks	Total Marks	Time
1	**Objective Type:** MCQ/ Fill-in-the blanks	-	All	35	30	1 x 30	30	
2	**Short Answer Type:**	-	All	8	5	2 x 5	10	
3	**Subjective Type:**	A	1,2,3	4	Any **Four** taking at least **One** from each group	5 x 4	20	
		B	4, 5	2				
		C	6, 7	3				
	Total:						60	Hrs.

Reference Book:

Sr No	Book	Author	Publisher
1	Medical Laboratory Technology	Rambik Sood	
2	Medical Laboratory Technology	V. H. Talib	C.B.S
	Medical Laboratory Technology	Kanai Lal Mukherjee	Churchill Living Stone
3	Practical Pathology	P. Chakraborty & Gargi Chakraborty	New Central Book
4	Human Anatomy & Physiology	Elaine N Marieb	Pearson
5	Medical Physiology	Berman & Mahapatra	C.B. International

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Syllabus of Hematology & Body Fluids Lab.

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Hematology & Body Fluids Lab.	Course Code:	MLTPC302P
Course Category:	Sessional; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	1	Contact Hr./Week	P-2

Course Objective:

Sr. No	Course Objective
1	To handle the instrument use in hematology laboratory.
2	To perform routine blood test and interpret the result
3	To perform the CSF, Urine and semen analysis for diagnosis.

Course Details:

Expt. No	Experiment/ Job	Hrs.
1	Introduction to Hematology Laboratory & Instruments	
2	Collection of blood and separation of serum & plasma	
2	Estimation of Hemoglobin	
3	Estimation of ESR	
4	Estimation of Total Count of RBC	
5	Estimation of PCV, MCV, MCH, MCHC, Color index	
6	Estimation of Total Count of WBC	
7	Differential Count of WBC	
8	Estimation of Total Count of Platelet	
9	Determination of blood group(ABO) & Rh factor	
10	Determination of BT,CT	
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	
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(**2hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (COs):

COs	***Students would be able to***
CO1	Identify the instrument use in hematology laboratory.
CO2	Estimate the different clinical parameter of blood (hematological tests) with interpretation
CO3	Demonstrate collection of CSF and its examination
CO4	Analyze urine, semen for clinical diagnosis.

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Syllabus of Bio-Medical Instrumentation-I

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Bio-Medical Instrumentation-I	Course Code:	MLTPC303
Course Category:	Theory; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	3	Contact Hr./Week	L-3: T-0 : P-0

Course Objective:

Sr. No	Course Objective
1	To provide the basic knowledge of instrumentation system and introduction to biomedical instrumentation.
2	To develop the fundamental concept of bio-medical instrumentation.
3	To be familiar with the bio-potential & different electrodes for bio-medical application.
4	To know the working principle of transducers & sensors and their applications.
5	To apply the knowledge of transducer, sensors and bio-sensor in biomedical instrumentation.

Course Content:

Unit	Topic	Hrs.
1	**Fundamental of Medical Instrumentation:** Fundamental of Instrumentation, Different types of Medical instrument, General Block diagram of Biomedical Instrumentation system - Measurand, Transducer/Sensor, Signal conditioner, Display system, Alarm , data storage, data	07

	Transmission, Performance requirements of Medical Instrumentation System,	
2	**Bio-electric Potential and Bio-electrodes:** Bio-potential- Resting membrane potential, Action potential, Sources of Bio-signals, Electrode - Function of Electrodes, Electrode Metals, General Classification of bio-electrodes, Surface electrode, Needle electrodes, Microelectrodes and their uses, Electrode-Tissue Interface, Metal-Electrolyte & Electrolyte- tissue interface, Polarization, Skin Contact Impedance, Introduction to different Bio-signals,	12
3	**Bio-Transducer:** Transducer - Classification of Transducers, Bio-transducer, Factors for Bio-transducer, Overview of Transducer Characteristics: Static Characteristics- Accuracy, Precision, Resolution, Sensitivity, Drift, Linearity, Threshold, Hysteresis, Span, Dynamic Characteristic - Zero-order system, First-order-system, Displacement, Position and Motion Transducer : Working & 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 Transducers: Photovoltaic Cell, Photo emissive cells, Piezoelectric transducer,	20
4	**Sensor:** Optical fiber sensor: structure & Working principle of optical fiber, Types of Optical fiber Sensors - Photometric sensors, Physical sensor, chemical Sensors; Biosensors: introduction, Dissolved O2 Sensor and their application, Glucose Sensor, pH Sensor,	06
Total Teaching Hrs. : (3 hrs. x 15 Weeks)		45
Assessment : **(**3hrs. x 2 Weeks)		06
Total: (3hrs. x 17 Weeks)		**51**

Course Outcomes (COs):

COs	***At end of the course, students would be able to***
CO1	Explain the different types of medical instruments, basic block-diagram of the bio-medical instrumentation system and its functional components.
CO2	Demonstrate the bio-potential and electrodes used in medical instruments.
CO3	Explain working principle, construction of different transducers & sensor and their application in medical instrumentation.
CO4	State the application of optical fiber sensor and bio-sensor in medical field.

End Semester Exam:

End Semester Exam Scheme (Weightage 60 %, FM – 60):								
Sr No	Question Type	Group	Unit No	No of question to be Set	No of question to be Answered	Allotted Marks	Total Marks	Time
1	**Objective Type:** MCQ/ Fill-in-the blanks	-	All	35	30	1 x 30	30	
2	**Short Answer Type:**	-	All	8	5	2 x 5	10	
3	**Subjective Type:**	A	1	3	Any **Four** taking at least **One** from each group	5 x 4	20	
		B	2	3				
		C	3, 4	3				
	Total:						60	Hrs.

Reference Book:

Sr No	Book	Author	Publisher
1	Hand book of Biomedical Instrumentation	R. S. Khandpur	Tata Mc
2	Biomedical Instrumentation & Measurements	Cromwell	Pearson
3	Principle of Medical Electronic & Biomedical Instrumentation	C Raja Rao & S K Guha	
4	Electrical & Electronics Measurement & Instrumentation	A K Sawhney	Dhanpat Rai
5	Electronics Instrumentation	H S Kalsi	Tata Mc
6	Medical Instrument	J. G. Webster	

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Syllabus of Bio-Medical Instrumentation-I Lab.

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Bio-Medical Instrumentation-I Lab.	Course Code:	MLTPC303
Course Category:	Sessional; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	1	Contact Hr./Week	L-0: T-0 : P-2

Course Objective:

Sr. No	Course Objective
1	To be familiar with different types of electrodes used in bio-medical instrument & their application.
2	To study and verify the working principle of transducers & sensors.

Course Content:

Expt. No	Experiment	Hrs.
1	Study of ECG electrodes & their application.	
2	Study of EEG electrodes & their application	
3	Study of EMG electrodes & their application.	
4	Verify the working of potentiometric transducer & its application.	
5	Verify the working of capacitive transducer & their application	
6	Verify the working of LVDT & its application	
7	Verify the working of strain gauge & its application	
8	Verify the working of temperature sensor: Resistance Temperature Detector (RTD)/ Thermistor & its application.	
9	Verify the working of temperature sensor: Semiconductor based IC & its application.	
10	Verify the working of piezo-electric transducer & its application	
11	Verify the working of optical fiber & its application	
12	Verify the working of O_2 Sensor & its application	
13	Measurement of pH using pH Sensor.	

14	Measurement of blood glucose using glucose sensor.	
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(**2hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (COs):

COs	***Students would be able to***
CO1	Identify the different types of electrodes used in bio-medical instrument.
CO2	Demonstrate the working and construction of different types of transducers & sensors used in medical instruments.
CO3	Measure physical & chemical parameter.
CO4	Apply the transducer & sensor for designing a medical instrumentation.

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Syllabus of Analog Electronics

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Analog Electronics	Course Code:	MLTPC304
Course Category:	Theory; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	2	Contact Hr./Week	L-2: T-0 : P-0

Course Objective:

Sr. No	Course Objective
1	To acquire the basic knowledge of transistor biasing & stabilization
2	To know the different application of BJT
3	To be familiar with OPAMP, 555 timer IC and their applications
4	To be familiar with voltage regulator and power supply

Course Content:

Unit	Topic	Hrs.
1	**Transistor Biasing & Amplifier Circuits:** Biasing, need for bias stabilization, Selection of operating point, Biasing methods (emitter to base bias, fixed bias, collector to base bias, self-bias), dc load line. Stability & bias compensation: only concepts Thermal run away & its prevention, heat sinks. Multistage amplifiers- cascading of amplifiers (RC coupled CE configuration only), their gain, frequency response, input & output impedance, gain-bandwidth characteristics, distortion in amplifier: basic concepts & no deduction. Power amplifier: Class A, B, AB & C operation (only basic concepts, & graph). Tuned Amplifier	8

2	**Feedback network & Oscillators:** Feedback principle- positive & negative feedback concepts, amplifier without & with feedback, effect of negative feedback in amplifier gain, noise, distortion, input & output resistance. Oscillator: Classification of oscillators, principle of oscillation, damped & un-damped oscillation, use of positive feedback, Barkhausen criterion for oscillation. Different oscillator circuits: L-C tuned collector oscillator, R-C phase shift oscillator, Wien bridge oscillator, Hartley oscillator: only ckt. & relevant equations	5
3	**Differential amplifier:** Basic principle, common mode rejection ratio in differential amplifier, operation with differential input, operation with common mode signal, single ended & double ended differential amplifier. Constant current replacement for emitter resistance, dc level shifter, complementary output stage.	3
4	**Operational amplifier circuit:** Op-amp configurations (building blocks), op-amp parameters, characteristics of an ideal op-amp. Application of op-amp as – inverting amplifier, non-inverting amplifier, adder, subtractor, differentiator, integrator, unity gain buffer, comparator, sample & hold circuit, Logarithmic Amplifier, Schmitt trigger, instrumentation amplifier, IC 741 / OP 07 pin diagram. Active Filters: High pass, Low pass , Band pass & Band reject filters- only circuit description & operation (no deduction)	8
5	**Timer Circuits :** Principle of operation of electronic timer - Functional description of internal blocks of timer IC555 - Use of 555 timers in nonstable and astable mode - Principle of operation of digital timer	2
6	**Voltage Regulator & Power Supply:** Transistorised Voltage Regulator – Function of bleeder resistor-Series and shunt regulator using transistor-OP-Amp Regulator-IC Voltage Regulators Three terminal IC voltage Regulator- Concept of switch mode power supply- Block schematic description of uninterrupted power supply.	4
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : (**2**hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (COs):

COs	***Students would be able to***
CO1	Discuss the basic knowledge on various applications of BJT
CO2	Concept on the construction of linear ICs like Op-Amp and IC 555 timer
CO3	Design various real time circuits with analog devices
CO4	Explain the working principle of different electronic instruments

End Semester Exam:

End Semester Exam Scheme (Weightage 60 %, FM – 60):								
Sr No	Question Type	Group	Unit No	No of question to be Set	No of question to be Answered	Allotted Marks	Total Marks	Time
1	**Objective Type:** MCQ/ Fill-in-the blanks	-	All	35	30	1 x 30	30	

2	**Short Answer Type:**	-	All	8	5	2 x 5	10	
3	**Subjective Type:**	A	1,2,	3	Any **Four** taking at least **One** from each group	5 x 4	20	
		B	3,4	3				
		C	5,6	3				
	Total:						60	Hrs.

Reference Book:

Sr No	Book	Author	Publisher
1	Electronic Principles	Malvino	Tata McGraw-Hill
2	Electronic Devices and Circuits	Boylestad & Nashalsky	Prentice Hall of India
3	Electronic Devices and Circuits	S. Salivanan	Tata McGraw-Hill
4	Electronic Devices and Circuits	J.B. Gupta	S.K. Kataria & Sons
5	Electronic Devices and Circuits	Millman & Halkias	Tata McGraw-Hill
6	Electronic Fundamentals and Applications	Chattopadhyay & Rakhshit	New Age International

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Syllabus of Analog Electronics Lab.

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Analog Electronics Lab.	Course Code:	MLTPC304P
Course Category:	Sessional; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	1	Contact Hr./Week	L-0: T-0 : P-2

Course Objective:

Sr. No	Course Objective
1	To be familiar with the Transistor biasing and Amplifier
2	To acquire the basic knowledge of Oscillator
3	To be familiar with the OPAMP, 555 IC and their Application

Course Details:

Course Content of Biomedical Instrumentation-I Lab		
Expt. No	Experiment	Hrs.
1	Study of input & output characteristics of BJT	
2	Study of different biasing methods and draw the dc load line, determine the Q point	
3	Study of frequency response of R-C coupled amplifier	
4	Study of Wien bridge oscillator and R-C phase shift oscillator	
5	Use of op-amp as – Non-inverting amplifier, Inverting amplifier, Buffer, Adder, Differentiator, Integrator	
6	Study of Triangular wave generator using Op-Amp	

7	Study of Schmitt Trigger Circuit using Op-Amp	
8	Study of active filters:- a) High pass b) Low pass c) Band pass d) Band reject	
9	Study of Instrumentation amplifier using Op-Amp	
10	Study the characteristics of IC555 timer connected as: (a) astable multi-vibrator; (b) mono-stable multi- vibrator	
11	Study of IC operated voltage regulator	
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(**2hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (COs):

COs	***Students would be able to***
CO1	Study of various characteristics and parameters of BJT, Op-amp, IC555 timer
CO2	Construct various type of amplifiers and oscillators using BJT
CO3	Construct various application based circuits using Op-amp and IC555 timer
CO4	Construct IC operated voltage regulator

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Syllabus of Electrical & Electronics Measurement

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Electrical & Electronics Measurement	Course Code:	MLTPC305
Course Category:	Theory; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	2	Contact Hr./Week	L-2: T-0 : P-0

Course Objective:

Sr. No	Course Objective
1	To develop the fundamental concept of measurement
	To apply the basic circuit theorem to find the current, voltage in a circuit.
2	To understand the characteristics, construction and working principles of different measuring instruments
3	To use relevant measuring instrument in different electrical/electronic applications.

Course Content:

Unit	Topic Details	Hrs.
1	**Measurement Fundamentals:** Basic measurement system-components. Concept of Instruments. Static and dynamic characteristics of Instruments**.** Role of Units in measurements and different types of units – Definition of Errors and type of errors – Definition of Primary	4

	and Secondary Standards – Concept of Calibration.	
2	**Basic Circuit Theorem:** Kirchhoff's Law (KCL, KVL), Thevenin's, Norton's, Super position theorem and problems.	3
3	**Permanent Magnet Moving Coil Meter:** Theory of operation, working principle and construction of PMMC. Measurement of voltage, current and resistance. Loading effect, extension of range.	2
4	**Measurement of Voltage, Current, Energy & Power:** Principle of rectifier type instrument – Advantages and limitations. Thermocouple type instruments. Construction and working principle of electrodynamics wattmeter	2
5	**Electronic Voltmeter & Multi Meter:** Advantages of electronic voltmeter over ordinary voltmeter. Different types of Digital Multi Meter: Integration and successive approximation type.	2
6	**Impedance Bridge & Q-Meter:** DC Wheatstone Bridge and its application – AC bridge-balance –Detection and source of excitation – Maxwell's induction bridge – Hay's bridge – DeSauty bridge-Anderson bridge– Wien Bridge. Basic principle of Q-Meter and its working circuit. Basic principle and operation of RLC meter	4
7	**Cathode Ray Oscilloscope:** Block diagram of CRO, constructional features of CRT and principle of operation. Block schematic description of digital storage oscilloscope. Measurement of amplitude, frequency, time period by CRO	3
8	**Time & Frequency Measurement:** Block schematic description of digital frequency counter. Measurement of frequency by heterodyne method. Measurement of frequency and time period.	3
9	**Signal Generator:** Block schematic descriptions, specifications and uses of: Audio & Radio Frequency Signal Generator – Function Generator	2
10	**RF Power Measurement:** Bolometer – Method of power measurement – Balance Bridge Bolometer	2
11	**Distortion & Wave Analysis:** Basic working principle of Heterodyne Wave Analyzer, Harmonic Distortion Analyzer.	3
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : (**2**hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (Cos):

Cos	*At end of the course, students would be able to*
CO1	Explain the components, characteristics and working of a basic measurement system and measuring Instruments
CO2	Demonstrate the use of different types of measuring instruments for measuring voltage, current, power, time, frequency, Frequency Spectrum, Distortion & Wave Analysis
CO3	Sate uses of different types of electrical instruments for measuring various ranges of electrical parameters.
CO4	Analyze the wave.

End Semester Exam:

End Semester Exam Scheme (Weightage 60 %, FM – 60):								
Sr No	Question Type	Group	Unit No	No of question to be Set	No of question to be Answered	Allotted Marks	Total Marks	Time
1	**Objective Type:** MCQ/ Fill-in-the blanks	-	All	35	30	1 x 30	30	
2	**Short Answer Type:**	-	All	8	5	2 x 5	10	
3	**Subjective Type:**	A	1,2,3,4,	3	Any **Four** taking at least **One** from each group	5 x 4	20	
		B	5,6,7,8	3				
		C	9,10,11	3				
	Total:						60	Hrs.

Reference Book:

Sr No	Book	Author	Publisher
1	Electronic Instrumentation and Measurements	H.S. Kalsi	Mc Graw Hill
2	A Course In Electrical And Electronic Measurements And Instrumentation	A.K. Sawhney	Dhanpat Rai & Co
3	Modern Electronics Instrumentation & Measurement technique	Helfrick & Cooper	PHI
4	Electrical and Electronic Measurement and Instrumentation	R.K. Rajput	S.Chand and Co.
5	Electrical & Electronic Measurement &Instrumentation	Umesh Singha	Satya Pracashan
6	Electrical Technology	B. L. Theresa	

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Syllabus of Electrical & Electronics Measurement Lab.

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Electrical & Electronics Measurement Lab.	Course Code:	MLTPC305P
Course Category:	Sessional; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	1	Contact Hr./Week	L-0: T-0 : P-2

Course Objective:

Sr. No	Course Objective
1	Measure basic electrical parameters using measuring instruments
2	Identify analog and digital measuring instruments
3	Use relevant measuring instrument in different electrical/electronic applications

Course Content:

Expt. No	Experiment	Hrs.
1	Measurement of resistance, capacitance using multimeter.	
2	Basic Measurement of Voltage & current in the circuit using Multimeter	
3	Verification of KCL & KVL	
4	Verification of Thevenin's theorem.	
5	Verification of Norton's theorem.	
6	Measurement of frequency by CRO	
7	Measurement of time interval of a Waveform and phase shift between waveforms by CRO	
8	Study of DC Voltmeter	
9	Study of CRT	
10	Measurement of unknown inductance by Hay's Bridge	
11	Measurement of unknown inductance by Anderson Bridge	
12	Measurement of unknown capacitance by De Sauty bridge	
13	Measurement of unknown frequency by Wein Bridge	
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(**2hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (COs):

COs	***Students would be able to***
CO1	Identify the different measuring instruments and their use.
CO2	Measure the voltage, current, resistance, capacitance etc using multimeter/ measuring instruments
CO3	Apply different bridge circuit to measure unknown capacitance, inductance etc.
CO4	Analyze unknown frequency, amplitude and waveform phase shift by CRO/DSO

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Syllabus of Programming in C

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Electrical & Electronics Measurement	Course Code:	MLTPC306
Course Category:	Theory; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	2	Contact Hr./Week	L-2: T-0 : P-0

Course Objective:

Sr. No	Course Objective
1	To impart adequate knowledge on the need of programming languages and problem solving techniques
2	To provide exposure to problem-solving through C programming.
3	To apply the Programming knowledge in project work.

Course Details:

Unit	Topic	Hrs.
1	**Introduction to Computer Programming:** Concept of programming, Overview of different programming languages, Concept of Algorithm and flow chart, Language Translators, compiler,	2
2	**Fundamental of C Language:** Back ground of C, Steps of C Program Execution, Process of compiling and running a C program, Compiling and Linking, Basic structure of C program, Character set, Keywords, Identifier, Constant, Header file, Library functions,	3
3	**Data types & Variable:** Data types and their size, Variable, Declaration of variable, Operators,Expression, Operator precedence and associatively, Type Conversion	3
4	**Input/output Functions and statements:** scanf(), printf(), Formatted i/o function, Escape Sequences, Assignment statement, Writing user-friendly program, Character Input/output functions - getchar(), putchar(), getch(), putch(), getche(), gets(), puts(),clrscr(),	3
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-whileLoop with Example, Comparison of Loop control structures,	3
6	**Array and String:** Array, one-dimensional and their declaration, initialization and access values, two-dimensional array their declaration, initialization and access values, Programs using array. **String:** String, String manipulation functions - strlen(), strcpy(), strcat(), strcmp(), Reading/writingstrings,	5
7	**Pointer:** Concept of pointer, pointer declaration and initialization, accessing variables through pointer, pointer and array.	3
8	**User-defined Function:** Concept of User-defined function, Parameter passing techniques; Callingfunction , Called function, Recursive function, Scope and lifetime of variables in functions, difference between user-defined and library function, Function call: call by value and call by reference	3
9	**Structure and Union:** Concept of structure, structure members, structure variable, Declaration andInitialization of structure, Union, Declaration and initialization of union, difference between structure & union,	3
10	**Overview of File handling:** Concept of file handling in C, Different types of files, command linearguments, file handling functions,	2
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(**2 hrs. x 2 Weeks)		04
Total: (2 hrs. x 17 Weeks)		**34**

Course Outcomes (COs):

COs	*At end of the course, students would be able to*
CO1	Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and in view of using them in problem solving.
CO2	Apply various operations on derived data types like arrays and strings in problem solving.
CO3	Design and Implement of modular Programming and memory management using pointers.
CO4	Implement user defined data structures used in specific applications.

End Semester Exam:

End Semester Exam Scheme (Weightage 60 %, FM – 60):								
Sr No	Question Type	Group	Unit No	No of question to be Set	No of question to be Answered	Allotted Marks	Total Marks	Time
1	**Objective Type:** MCQ/ Fill-in-the blanks	-	All	35	30	1 x 30	30	
2	**Short Answer Type:**	-	All	8	5	2 x 5	10	
3	**Subjective Type:**	A	1,2,3,4	3	Any **Four** taking at least **One** from each group	5 x 4	20	
		B	5,6,7	3				
		C	8,9,10	3				
	Total:						60	Hrs.

Reference Book:

Sr No	Book	Author	Publisher
1	Programming with C	T Joyprovoon	Vikash Publishing house
2	Programming in ANCI	Balaguruswami	Tata Mc
3	Let us C	Y. Kanetkar	
4	Programming with c	Byron Gottfried	

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Syllabus of Programming in C Lab.

Course Introduction:

Program:	Medical Laboratory Technology	Semester:	3rd
Course Title:	Programming C & C++ Lab.	Course Code:	MLTPC306P
Course Category:	Sessional; Program Core	Full Marks & Duration:	100 ; 15 + 2 Weeks
Credit:	1	Contact Hr./Week	L-0: T-0 : P-2

Course Objective:

Sr. No	Course Objective
1	To develop the computer programming concept and fundamental of C language
2	To write programs in C to solve the problems.
3	To apply the knowledge of C programming in project work.

Course Content:

Expt. No	Experiment	Hrs.
1	To execute a sample C program to study the basic structure of C program.	
2	To write program using Arithmetic, Relational, Logical and Assignment operators	
3	To write program to implement increment & decrement operators and to find the greatest between two numbers using conditional operator.	
4	To evaluate an expression to study operator precedence and associativity and to write a program using casting a value.	
5	To use formatted scanf ( ) and printf( ) functions for different types of data.	
6	To find the roots of a quadratic equation. Find the greatest of three numbers using IF – ELSE and IF -ELSE IF statements.	
7	Write a program and run using **fo**r loop.	
8	Write a program and run using **while** loop.	
9	Write a program and run using **do-while** loop.	
10	Write a program and run using single dimensional **array.**	
11	Write a program and run using multi-dimensional **array**.	
12	Write a program and run using **Structure** and **Union**	
13	Write a program and run using **pointer**	
14	Write a program and run using user-defined function.	
15	Write a program and run using user-defined function, call-by value and Call by reference	
16	Write a program and run to open, create, edit, close the file	
Total Teaching Hrs. : (2 hrs. x 15 Weeks)		30
Assessment : **(**2hrs. x 2 Weeks)		04
Total: (2hrs. x 17 Weeks)		**34**

Course Outcomes (COs):

COs	***Students would be able to***
CO1	Execute a sample C program.
CO2	Execute a C program to solve a problem
CO3	Implement Programs with function, pointers and arrays, perform pointer arithmetic, and use the pre-processor
CO4	Design programs that perform operations using derived data types

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Note: Internship

I: Internship may be duration of 2- 4 weeks at Hospital/Diagnostic Centre/Industry.

1) 60% (Internal) will be assessed by the Institute, based on Internship Report, Assignment and Viva-Voce.

2) 40% marks (External), will be assessed during internship by the concern authority of the Institute/ hospital/ Industry etc. where students will go for their Internship based on performance, attendance, report etc.

Evaluation Scheme of Theory Courses:

Examination Scheme					
Course	Internal Assessment (40 Marks)			External Assessment (60 Marks)	Full Marks
	Mid Sem.Test	Quiz / Assignment	Attendance	End Semester Exam (Council)	
Theory	20	10	10	60	100
Pass Marks: Students have to obtain at least 40% marks (pass marks) in both Internal assessment and External separately.					

Evaluation Scheme of Sessional Courses:

Examination Scheme							
Course	Continuous Internal Assessment (60 Marks)					External Assessment (40 Marks)	
	Performance (20)	Assignment (30)			Attendance (10)	Assignment (On day of External sessional)	Viva-Voce (Before Board of Examiners with Lab Report)
		Assignment	Viva-Voce	Lab report			
Sessional	20	10	10	10	10	20	20
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both continuous assessment and end semester Assessment separately.							

Note: Course Outcomes may be fixed as per subject teacher of the Institute.