



DIPLOMA IN ENGINEERING AND TECHNOLOGY

1142

**DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY
SEMESTER PATTERN**

N-SCHEME

SYLLABUS

IMPLEMENTED FROM 2020-2021

CURRICULUM DEVELOPMENT CENTER,

DIRECTORATE OF TECHNICAL EDUCATION

CHENNAI – 600 025, TAMIL NADU

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

SYLLABUS COMMITTEE

Chair person

Tmt. G.LAXMI PRIYA, I.A.S.,

DIRECTOR,

DIRECTORATE OF TECHNICAL EDUCATION

CHENNAI- 600025

Co - ordinator

Tmt. V.THENMOZHI

Principal,

Government Polytechnic College

Karur-621 301

Convener

Tmt. V. VIJAYALAKSHMI

HOD / Instrumentation & Control Engineering,

Seshasayee Institute of Technology,

Trichy-10

Members

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Lecturer / Instrumentation & Control
Engineering,
Government Polytechnic College for
Women, Madurai.**

**Dr. J. B. Jeeva,
Associate Professor,
Department of Sensor and
Biomedical Technology,
School of Electronics Engineering,
Vellore Institute of Technology, Vellore.**

**Mrs. N. Soundarya,
Assistant Professor and Staff incharge,
Department of Medical Laboratory
Technology,
Holy Cross College of Medical Laboratory
Technology, Trichy.**

**Mrs. S. Suganthi Rani,
Lecturer/ Instrumentation & Control
Engineering,
Government Polytechnic College
for Women,
Bharathiar Road, Coimbatore.**

**Thiru. G. Mohamed Ashif,
Lecturer / Instrumentation & Control
Engineering,
Seshasayee Institute of Technology, Trichy**

**Thiru. N. Stalin,
Lab Technician, Government
Hospital, Musiri, Trichy.**

DIPLOMA COURSES IN ENGINEERING/TECHNOLOGY
(SEMESTER SYSTEM)
(Implemented from 2020 - 2021)
N – SCHEME
REGULATIONS*

**Applicable to the Diploma Courses other than Diploma in Hotel Management & Catering Technology.*

1. Description of the Course:

a. Full Time (3 years)

The Course for the Full Time Diploma in Engineering shall extend over a period of three academic years, consisting of 6 semesters* and the First Year is common to all Engineering Branches.

b. Sandwich (3½ years)

The Course for the Sandwich Diploma in Engineering shall extend over a period of three and half academic years, consisting of 7 semesters* and the First Year is common to all Engineering Branches. The subjects of three years full time diploma course being regrouped for academic convenience.

During 4th and/or during 7th semester the students undergo industrial training for six months/ one year. Industrial training examination will be conducted after completion of every 6 months of industrial training.

c. Part Time (4 years)

The course for the Part Time Diploma in Engineering shall extend over a period of 4 academic years containing of 8 semesters*, the subjects of 3 year full time diploma courses being regrouped for academic convenience.

*** Each Semester will have 16 weeks duration of study with 35 hrs. / Week for Regular Diploma Course and 18 hrs. / Week for Part-Time Diploma Course.**

The Curriculum for all the 6 Semesters of Diploma courses (Engineering & Special Diploma Courses viz. Textile Technology, Leather Technology, Printing Technology, Chemical Technology etc.) have been revised and revised curriculum is applicable for the candidates admitted from 2020 – 2021 academic year onwards.

2. Condition for Admission:

Condition for admission to the Diploma courses shall be required to have passed in The S.S.L.C Examination of the Board of Secondary Education, Tamil Nadu.

(Or)

The Anglo Indian High School Examination with eligibility for Higher Secondary Course in Tamil Nadu.

(Or)

The Matriculation Examination of Tamil Nadu.

(Or)

Any other Examinations recognized as equivalent to the above by the Board of Secondary Education, Tamil Nadu.

Note: In addition, at the time of admission the candidate will have to satisfy certain minimum requirements, which may be prescribed from time to time.

3. Admission to Second year (Lateral Entry):

A pass in HSC (academic) or (vocational) courses mentioned in the Higher Secondary Schools in Tamil Nadu affiliated to the Tamil Nadu Higher Secondary Board with eligibility for university Courses of study or equivalent examination & Should have studied the following subjects.

A pass in 2 Years ITI with appropriate Trade or Equivalent examination.

Sl. No	Courses	H.Sc Academic	H.Sc Vocational		Industrial Training Institutes Courses
		Subjects Studied	Subjects Studied		
			Related subjects	Vocational subjects	
1.	All the Regular and Sandwich Diploma Courses	Physics and Chemistry as compulsory along with Mathematics / Biology	Maths / Physics / Chemistry	Related Vocational Subjects Theory& Practical	2 years course to be passed with appropriate Trade
2.	Diploma Course in Modern Office Practice	English & Accountancy English & Elements of Economics English & Elements of Commerce	English & Accountancy, English & Elements of Economics, English & Management Principles & Techniques, English & Typewriting	Accountancy & Auditing, Banking, Business Management, Co-operative Management, International Trade, Marketing & Salesmanship, Insurance & Material Management, Office Secretaryship.	

- For the Diploma Courses related with Engineering/Technology, the related / equivalent subjects prescribed along with Practicals may also be taken for arriving the eligibility.
- Branch will be allotted according to merit through counseling by the respective Principal as per communal reservation.
- For admission to the Textile Technology, Leather Technology, Printing Technology, Chemical Technology and Modern Office Practice Diploma courses the candidates studied the related subjects will be given first preference.

- *Candidates who have studied Commerce Subjects are not eligible for Engineering Diploma Courses.*

4. Age Limit: **No Age limit.**

5. Medium of Instruction: English

6. Eligibility for the Award of Diploma:

No candidate shall be eligible for the Diploma unless he/she has undergone the prescribed course of study for a period of not less than 3 academic years in any institution affiliated to the State Board of Technical Education and Training, Tamil Nadu, when joined in First Year and two years if joined under Lateral Entry scheme in the second year and passed the prescribed examination.

The minimum and maximum period for completion of Diploma Courses are as given below:

Diploma Course	Minimum Period	Maximum Period
Full Time	3 Years	6 Years
Full Time (Lateral Entry)	2 Years	5 Years
Sandwich	3½ Years	6½ Years
Part Time	4 Years	7 Years

This will come into effect from N Scheme onwards i.e. from the academic year 2020-2021.

7. Subjects of Study and Curriculum outline:

The subjects of study shall be in accordance with the syllabus prescribed from time to time, both in theory and practical subjects.

The curriculum outline is given in Annexure – I.

8. Examinations:

Board Examinations in all subjects of all the semesters under the scheme of examinations will be conducted at the end of each semester.

The internal assessment marks for all the subjects will be awarded on the basis of continuous internal assessment earned during the semester concerned. For each subject 25 marks are allotted for internal assessment. Board Examinations are conducted for 100 marks and reduced to 75.

The total marks for result are $75 + 25 = 100$ Marks.

9. Continuous Internal Assessment:

A. For Theory Subjects:

The Internal Assessment marks for a total of 25 marks, which are to be distributed as follows:

i) Subject Attendance

5 Marks

(Award of marks for subject attendance to each subject Theory/Practical will be as per the range given below)

80%	-	83%	1 Mark
84%	-	87%	2 Marks
88%	-	91%	3 Marks
92%	-	95%	4 Marks
96%	-	100%	5 Marks

ii) Test

10 Marks

2 Tests each of 2 hours duration for a total of 50 marks are to be conducted. Average of the these two test marks will be taken and the marks to be reduced to: 05 Marks

The Test – III is to be the Model Examination covering all the five units and the marks obtained will be reduced to : 05 Marks

TEST	UNITS	WHEN TO CONDUCT	MARKS	DURATION
Test I	Unit – I & II	End of 6 th week	50	2 Hrs
Test II	Unit – III & IV	End of 12 th week	50	2 Hrs

Test III	Model Examination: Covering all the 5 Units. (Board Examinations-question paper-pattern).	End of 16 th week	100	3 Hrs
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From the Academic Year 2020 – 2021 onwards.

Question Paper Pattern for the Test - I and Test – II is as follows. The tests should be conducted by proper schedule. Retest marks should not be considered for internal assessment.

Without Choice:

Part A Type questions:	6 Questions × 1 mark	06 marks
Part B Type questions:	7 Questions × 2 marks	14 marks
Part C Type questions:	2 Questions × 15 marks	30 marks
Total		50 marks

iii) Assignment

5 Marks

For each subject Three Assignments are to be given each for 20 marks and the average marks scored should be reduced for 5 marks.

iv) Seminar Presentation

5 Marks

The students have to select the topics either from their subjects or general subjects which will help to improve their grasping capacity as well as their capacity to express the subject in hand. The students will be allowed to prepare the material for the given topic using the library hour and they will be permitted to present seminar (For First and Second Year, the students will be permitted to present the seminar as a group not exceeding six members and each member of the group should participate in the presentation. For the Third Year, the students should present the seminar individually.) The seminar presentation is mandatory for all theory subjects and carries 5 marks for each theory subject. The respective subject faculty may suggest topics to the students and will evaluate the submitted

materials and seminar presentation. (2 ½ marks for the material submitted in writing and 2 ½ marks for the seminar presentation). For each subject minimum of two seminars are to be given and the average marks scored should be reduced to 5 marks.

All Test Papers, Assignment Papers / Notebooks and the seminar presentation written material after getting the signature with date from the students must be kept in safe custody in the department for verification and audit. It should be preserved for one semester after publication of Board Exam results and produced to the flying squad and the inspection team at the time of inspection/verification.

B. For Practical Subjects:

The Internal Assessment mark for a total of 25 marks which are to be distributed as follows:-

a) Attendance : 5 Marks

(Award of marks same as theory subjects)

b) Procedure/ observation and tabulation/

Other Practical related Work : 10 Marks

c) Record writing : 10 Marks

TOTAL : 25 Marks

- *All the Experiments/Exercises indicated in the syllabus should be completed and the same to be given for final Board examinations.*
- The observation note book / manual should be maintained for 10 marks. The observation note book / manual with sketches, circuits, programme, reading and calculation written by the students manually depends upon the practical subject during practical classes should be evaluated properly during the practical class hours with date.
- The Record work for every completed exercise should be submitted in the subsequent practical classes and marks should be awarded for 10 marks for each exercise as per the above allocation.
- At the end of the Semester, the average marks of all the exercises should be calculated for 20 marks (including Observation and Record writing) and the marks

awarded for attendance is to be added to arrive at the internal assessment mark for Practical. (20+5=25 marks)

- Only regular students, appearing first time have to submit the duly signed bonafide record note book/file during the Practical Board Examinations.

All the marks awarded for Assignments, Tests, Seminar presentation and Attendance should be entered periodically in the Personal Theory Log Book of the staff, who is handling the theory subject.

The marks awarded for Observation, Record work and Attendance should be entered periodically in the Personal Practical Log Book of the staff, who is handling the practical subject.

10. Communication Skill Practical, Computer Application Practical and Physical Education:

The Communication Skill Practical and Computer Application Practical with more emphasis are being introduced in First Year. Much Stress is given to increase the Communication skill and ICT skill of students.

As per the recommendation of MHRD and under Fit India scheme, the Physical education is introduced to encourage students to remain healthy and fit by including physical activities and sports.

11. Project Work and Internship:

The students of all the Diploma Courses have to do a Project Work as part of the Curriculum and in partial fulfillment for the award of Diploma by the State Board of Technical Education and Training, Tamil Nadu. In order to encourage students to do worthwhile and innovative projects, every year prizes are awarded for the best three projects i.e. institution wise, region wise and state wise. **The Project work must be reviewed twice in the same semester. The project work is approved during the V semester by the properly constituted committee with guidelines.**

a) Internal assessment mark for Project Work & Internship:

Project Review I	...	10 marks
Project Review II	...	10 marks
Attendance	...	05 marks (Award of marks same as theory subject pattern)
Total	...	25 marks

Proper record should be maintained for the two Project Reviews and preserved for one semester after the publication of Board Exams results. It should be produced to the flying squad and the inspection team at the time of inspection/verification.

b) Allocation of Marks for Project Work & Internship in Board Examinations:

Demonstration/Presentation	25 marks
Report	25 marks
Viva Voce	30 marks
Internship Report	20 marks
Total	100* marks

*Examination will be conducted for 100 marks and will be converted to 75 marks.

c) Internship Report:

The internship training for a period of two weeks shall be undergone by every candidate at the end of IV / V semester during vacation. The certificate shall be produced along with the internship report for evaluation. The evaluation of internship training shall be done along with final year "Project Work & Internship" for 20 marks. The internship shall be undertaken in any industry / Government or Private certified agencies which are in social sector / Govt. Skill Centres / Institutions / Schemes.

A neatly prepared **PROJECT REPORT** as per the format has to be submitted by individual student during the **Project Work & Internship Board examination**.

12. Scheme of Examinations:

The Scheme of examinations for subjects is given in Annexure - II.

13. Criteria for Pass:

1. No candidate shall be eligible for the award of Diploma unless he/she has undergone the prescribed course of study successfully in an institution approved by AICTE and affiliated to the State Board of Technical Education & Training, Tamil Nadu and pass all the subjects prescribed in the curriculum.
2. A candidate shall be declared to have passed the examination in a subject if he/she secures not less than *40% in theory subjects and 50% in practical subjects* out of the total prescribed maximum marks including both the Internal Assessment and the Board Examinations marks put together, subject to the condition that he/she secures at least a minimum of *40 marks out of 100 marks in the Board Theory Examinations and a minimum of 50 marks out of 100 marks in the Board Practical Examinations*.

14. Classification of successful candidates:

Classification of candidates who will pass out the final examinations from April 2023 onwards (Joined first year in 2020 -2021) will be done as specified below.

First Class with Superlative Distinction:

A candidate will be declared to have passed in **First Class with Superlative Distinction** if he/she secures not less than 75% of the marks in all the subjects and passes all the semesters in the first appearance itself and passes all subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

First Class with Distinction:

A candidate will be declared to have passed in **First Class with Distinction** if he/she secures not less than 75% of the aggregate marks in all the semesters put together and passes all the semesters except the I and II semester in the first appearance itself and passes all subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

First Class:

A candidate will be declared to have passed in **First Class** if he/she secures not less than 60% of the aggregate marks in all the semesters put together and passes all the subjects within the stipulated period of study 2 / 3 / 3½ / 4 years [Full time(lateral entry)/Full Time/Sandwich/Part Time] without any break in study.

Second Class:

All other successful candidates will be declared to have passed in **Second Class**.

The above classifications are also applicable for the Sandwich / Part-Time students who pass out Final Examination from October 2023 /April 2024 onwards (both joined First Year in 2020 -2021)

15. Duration of a period in the Class Time Table:

The duration of each period of instruction is 1 hour and the total period of instruction hours excluding interval and lunch break in a day should be uniformly maintained as 7 hours corresponding to 7 periods of instruction (Theory & Practical).

ANNEXURE - I
CURRICULUM OUTLINE

III SEMESTER (FULLTIME)

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Tutorial	Practical	Total
1	4040310	Electronic Devices and Circuits*	5	-	-	5
2	4142320	Electrical Circuits and Machines	5	-	-	5
3	4142330	Fundamentals of MLT	5	-	-	5
4	4142340	Anatomy and Physiology	5			5
5	4040350	Electronic Devices and Circuits Practical*	-	-	4	4
6	4142360	Electrical Circuits and Machines Practical	-	-	4	4
7	4142370	Fundamentals of MLT Practical	-	-	4	4
Extra / Co-curricular activities		Physical Education			2	2
		Library			1	1
Total			20		15	35

*Common with ECE branch

IV SEMESTER (FULLTIME)

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Tutorial	Practical	Total
1	4142410	Analog and digital Electronics	5	-	-	5
2	4142420	Sensors and Signal conditioning circuits	5	-	-	5
3	4042430	Measurements and Instruments**	4	-	-	4
4	4142440	Analog and digital Electronics Practical	-	-	4	4
5	4142450	Sensors and Signal conditioning circuits Practical	-	-	4	4
6	4142460	Measurements and Instruments Practical	-	-	4	4
7	4142470	Clinical Pathology Practical			6	6
Extra / Co-curricular activities		Physical Education		-	2	2
		Library		-	1	1
Total			14		21	35

**Common with ICE

V SEMESTER (FULLTIME)

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Tutorial	Practical	Total
1	4142510	Basics of Bio-chemistry	5	-	-	5
2	4142520	Blood Banking Techniques	6	-	-	6
3		Elective Theory-I	5	-	-	5
4	4142540	Basics of Bio-chemistry Practical	-	-	4	4
5	4142550	Blood Banking Techniques Practical	-	-	4	4
6		Elective Practical-I	-	-	4	4
7	4142570	Entrepreneurship and startup	-	-	4	4
Extra / Co-curricular activities		Physical Education	-	-	2	2
		Library	-	-	1	1
Total			16		19	35

Elective Subjects

Any one of the following theory subject with corresponding Practical may be Selected as Elective-I

Elective Theory-I		Elective Practical- I	
4141531	Physiotherapy and operation Theatre Equipments [#]	4141533	Physiotherapy and operation Theatre Equipments Practical [#]
4142532	Microbiology	4142562	Microbiology Practical
4142533	Embedded system design with Arduino	4142563	Embedded system design with Arduino Practical

VI SEMESTER (FULLTIME)

Col. No.	Subject Code	Subject	Hours Per Week			
			Theory	Tutorial	Practical	Total
1	4142610	Radiological Equipments	5	-	-	5
2	4142620	Diagnostic and Therapeutic Equipments	5	-	-	5
3		Elective Theory-II	4	-	-	4
4	4142640	Diagnostic and Therapeutic Equipments Practical	-	-	6	6
5		Elective Practical-II	-	-	6	6
6	4142660	Project Work and Internship Report (Practical)	-	-	6	6
Extra / Co-curricular activities		Physical Education			2	2
		Library			1	1
Total			14		21	35

Elective Subjects

Any one of the following theory subject with corresponding Practical may be Selected as Elective-II

Elective Theory-II		Elective Practical-II	
4142631	Installation , maintenance and safety handling of Medical Equipment [#]	4142651	Installation, maintenance and safety handling of Medical Equipment Practical [#]
4142632	Medical Image Processing	4142652	Medical Image Processing Practical
4044633	Computer Hardware and Servicing [@]	4044653	Computer Hardware and Servicing Practical [@]

#Common with Medical Electronics

@Common with CSE

ANNEXURE II**SCHEME OF EXAMINATION****III SEMESTER (FULLTIME)**

SUBJECT CODE NO.	SUBJECT	EXAMINATION MARKS		TOTAL MARKS	MINIMUM FOR PASS	DURATION OF EXAM (HOURS)
		INTERNAL ASSESSMENT MARKS	BOARDEXAM MARKS (CONVERTED TO 75)			
4040310	Electronic Devices and Circuits*	25	100	100	40	3
4142320	Electrical Circuits and Machines	25	100	100	40	3
4142330	Fundamentals of MLT	25	100	100	40	3
4142340	Anatomy and Physiology	25	100	100	40	3
4040350	Electronic Devices and Circuits Practical*	25	100	100	50	3
4142360	Electrical Circuits and Machines Practical	25	100	100	50	3
4142370	Fundamentals of MLT Practical	25	100	100	50	3
Total		175	700	700	310	

IV SEMESTER (FULLTIME)

SUBJECT CODE NO.	SUBJECT	EXAMINATION MARKS		TOTAL MARKS	MINIMUM FOR PASS	DURATION OF EXAM (HOURS)
		INTERNAL ASSESSMENT MARKS	BOARD EXAM MARKS (CONVERTED TO 75)			
4142410	Analog and Digital Electronics	25	100	100	40	3
4142420	Sensors and Signal conditioning circuits	25	100	100	40	3
4042430	Measurements and Instruments**	25	100	100	40	3
4142440	Analog and Digital Electronics Practical	25	100	100	50	3
4142450	Sensors and Signal conditioning Circuits Practical	25	100	100	50	3
4142460	Measurements and Instruments Practical	25	100	100	50	3
4142470	Clinical Pathology Practical	25	100	100	50	3
Total		175	700	700	320	

V SEMESTER (FULLTIME)

SUBJECT CODE NO.	SUBJECT	EXAMINATION MARKS		TOTAL MARKS	MINIMUM FOR PASS	DURATION OF EXAM (HOURS)
		INTERNAL ASSESSMENT MARKS	BOARD EXAM MARKS (CONVERTED TO 75)			
4142510	Basics of Bio-chemistry	25	100	100	40	3
4142520	Blood Banking Techniques	25	100	100	40	3
	Elective Theory-I	25	100	100	40	3
4142540	Basics of Bio-chemistry Practical	25	100	100	50	3
4142550	Blood Banking Techniques Practical	25	100	100	50	3
	Elective Practical-I	25	100	100	50	3
4142570	Entrepreneurship and startups	25	100	100	50	3
Total		175	700	700	320	

Elective Subjects Any one of the following theory subject with corresponding Practical may be Selected as Elective-I

Elective Theory-I		Elective Practical- I	
4141531	Physiotherapy and operation Theatre Equipments [#]	4141533	Physiotherapy and operation Theatre Equipments Practical [#]
4142532	Microbiology	4142562	Microbiology Practical
4142533	Embedded system design with Audrino	4142563	Embedded system design with Audrino Practical

VI SEMESTER (FULLTIME)

SUBJECT CODE NO.	SUBJECT	EXAMINATION MARKS		TOTAL MARKS	MINIMUM FOR PASS	DURATION OF EXAM (HOURS)
		INTERNAL ASSESSMENT MARKS	BOARDEXAM MARKS (CONVERTED TO 75)			
4142610	Radiological Equipments	25	100	100	40	3
4142620	Diagnostic and Therapeutic Equipments	25	100	100	40	3
	Elective Theory-I	25	100	100	40	3
4142640	Diagnostic and Therapeutic Equipments Practical	25	100	100	50	3
	Elective Practical-I	25	100	100	50	3
4142660	Project Work and Internship Report (Practical)	25	100	100	50	3
Total		150	600	600	270	

Elective Subjects

Any one of the following theory subject with corresponding Practical may be Selected as Elective-II

Elective Theory-II		Elective Practical-II	
4142631	Installation , maintenance and safety handling of Medical Equipment [#]	4142651	Installation, maintenance and safety handling of Medical Equipment Practical [#]
4142632	Medical Image Processing	4142652	Medical Image Processing Practical
4044633	Computer Hardware and Servicing [@]	4044653	Computer Hardware and Servicing Practical [@]

DIPLOMA PROGRAMME IN MEDICAL LABORATORY TECHNOLOGY.

1. SALIENT FEATURES:

Name of the program	: Diploma Programme in Medical Laboratory Technology.
Duration of the program	: Three years (Six semesters)
Entry qualification	: Matriculation or equivalent as prescribed By State Board of Technical Education TamilNadu.
Intake	: 60
Pattern of the program	: Semester Pattern
Ratio between Theory and Practical Classes	: 50:50(approximate)
Internships	: Minimum2 internships have been incorporated in IV and V semesters(1+1) Of 'N' scheme A subject on Entrepreneurship and
Entrepreneurship and Startup	: Startup has been incorporated in V semester of 'N' scheme

2. Employment opportunities for Diploma Holders in Medical Laboratory Technology.

Graduates of the **DMLT** Course have various opportunities in both the private and public sectors. The following Employment opportunities are visualized indifferent **sectors** of employment for diploma holders in Medical Laboratory Technology.

1. Government Hospitals / Private hospitals / Primary Health centers / Private Nursing Homes / Private Diagnostic centers / Clinics / National Institute of communicable diseases
2. Medical Colleges / Dental colleges (clinical laboratories)
3. Medical research laboratories/Reference Laboratories/ R&D Bio-technology laboratories
4. Paramedical Institutes
5. Pharmaceutical Firms
6. Municipal Council
7. Self-Employment

Diploma Holders in Medical Laboratory Technology would typically be recruited as

- Medical Lab Technicians
- Technologists
- Lab information System Analyst
- HealthCare Administrator Hospital outreach assistant co-ordinator

3. Programme Outcomes

Upon the completion of the course student will be able to:

- Apply knowledge and technical skills associated with medical lab technology and servicing of the medical equipment.
- Perform routine clinical laboratory procedures within acceptable quality control parameters in hematology, chemistry, immune hematology, and microbiology.
- Demonstrate technical skills, social behavior, and professional awareness imperative upon a laboratory technician

III SEMESTER

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N-SCHEME

III SEMESTER

2020–2021 onwards

4040310 - Electronic Devices and Circuits

ANNEXURE-I

STATEBOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS

N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 1142 Diploma in Medical Laboratory Technology

Subject Code : 4040310

Semester : III

Subject Title : Electronic Devices and Circuits

TEACHING AND SCHEME OF EXAMINATION

No. of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Electronic Devices and Circuits	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Filters, Zener diode and Opto-electronic devices	14
II	Bipolar Junction Transistor, Field Effect Transistor and UJT	16
III	Feedback, Amplifiers and Oscillators	16
IV	Special Semiconducting Devices(SCR, DIAC AND TRIAC)	14
V	Wave shaping Circuits	13
Test & Model Exam		7
Total		80

RATIONALE:

Every Electronics Engineer should have sound knowledge about the components used in Electronics Industry. This is vital in R&D Department for chip level troubleshooting. To meet the industrial needs, diploma holders must be taught about the most fundamental subject, Electronic devices and Circuits. By studying this subject, they will be skilled in handling all types of electronic devices and able to apply the skill in electronics system.

OBJECTIVES:

On completion of the following units of syllabus contents, the students must be able to:

- Know the importance of Filters
- Know the construction, working principle and applications of Zener diode
- Know the construction, working principle and applications of Optoelectronic devices
- Know the biasing methods of Transistors and their applications
- Study the performance of special devices like UJT, FET
- Study the Concept of Feedback, different types of Negative feedback connections
- Know the Types of Transistor amplifiers, Transistor oscillators and their applications
- Study the performance of Special semiconducting devices like SCR, DIAC, and TRIAC
- Explain the concept of wave shaping circuits, Bistable Multivibrator and Schmitt trigger
- Study the working principle of clippers, clampers, Voltage Multipliers and their applications

DETAILED SYLLABUS

Contents: **Electronic Devices and Circuits**

Unit	Name of the Topics	Hours
I	FILTERS, ZENER DIODES AND OPTO-ELECTRONIC DEVICES	
	1.1: FILTERS Definition - Types - Capacitor filter - Inductor filter - L section filter – Pi section and RC filter - Comparison and Applications of Filters	5
	1.2: ZENER DIODE Construction, Working principle and Characteristics of Zener Diodes- Zener breakdown-Avalanche breakdown- Zener diode as a Voltage regulator.	5
	1.3: OPTO-ELECTRONIC DEVICES Definition - Types - Symbol, Working , Characteristics and Applications of LED, 7 Segment LED - Photo diode, Photo transistor and Opto- coupler	4
II	BIPOLAR JUNCTION TRANSISTOR (BJT), FIELD EFFECT TRANSISTOR (FET) AND UNI JUNCTION TRANSISTOR (UJT)	
	2.1: BIPOLAR JUNCTION TRANSISTOR Transistor biasing: Need for biasing - Types- Fixed bias, Collector to base bias and Self bias (Operation only ,No derivation of circuit elements and parameters)– Define: Stability factor - Operation of Common Emitter Transistor as an Amplifier and as a switch.	7
	2.2: FIELD EFFECT TRANSISTOR (FET) Construction – Working principle–Classification - Drain and Transfer Characteristics -Applications–Comparison between FET and BJT - FET amplifier (common source amplifier).	5
	2.3: UNIJUNCTION TRANSISTOR (UJT) Construction- Equivalent circuit-Operation-Characteristics-UJT as a relaxation oscillator	4
III	FEEDBACK , AMPLIFIERS AND OSCILLATORS	
	3.1: FEEDBACK Concept - effects of negative feedback-Types of negative feedback	6

	connections - Applications 3.2: AMPLIFIERS Transistor amplifiers - Types - RC coupled amplifier - Working and Frequency response characteristics –Working of Common Collector Amplifier(Emitter follower) 3.3 : OSCILLATORS Transistoroscillators–Conditionsforoscillation(Barkhausencriterion)- Classifications– Hartley Oscillator– Colpitts Oscillator – RC Phase shift oscillator	6 4
IV	SPECIAL SEMICONDUCTING DEVICES (SCR, DIAC AND TRIAC) 4.1:SCR (SILICON CONTROLLED RECTIFIER) Symbol – Layered Structure – Transistor analogy - Working–VI characteristics– Applications - Comparison between SCR and Transistor 4.2: DIAC (Diode for Alternating Current) Symbol – Layered structure - Working – VI characteristics- Applications 4.3: TRIAC (TRiode for Alternating Current) Symbol – Layered structure - Working – VI characteristics- Applications	5 5 4
V	WAVE SHAPING CIRCUITS 5.1: CLIPPERSAND CLAMPERS Construction and working of Positive, Negative and biased Clippers - Construction and working of Positive and Negative Clamper 5.2: Voltage Multipliers Construction and working of Voltage Doubler and Tripler. 5.3 :Multivibrator and Schmitt Trigger Construction – Working – Waveform of Astable and Monostable Multivibrator using Transistors and Schmitt Trigger using Transistors	5 3 5

Reference Books

1. Electronics Devices & Circuits by Salivahanan S,N. Suresh Kumar, A.Vallavaraj Tata McGraw Publication 3rdEdition 2016
2. Electronics Devices and circuit theory by Boyestad & Nashelsky, PHI , New Delhi 2009

3. Electronic Principles by Malvino,-Tata McGraw Hill Publication 2010.
4. Electronics Devices & Circuits by Jacob Millman and Halkias 3rd Edition 2010, Tata McGraw– Hill publication
5. Optical Fiber Communication by Gerd Keiser 5thEdition, Tata McGraw– Hill.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

III SEMESTER

2020–2021 onwards

4142320 - Electrical Circuits and Machines

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 1142 Diploma in Medical Laboratory Technology

Subject Code : 4142320

Semester : III

Subject Title : **Electrical Circuits and Machines**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16weeks

Subject	Instructions		Examination			
	Hours /Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Electrical Circuits and Machines	5	80	25	100*	100	3Hrs.

*Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	DC circuits	15
II	AC circuits	14
III	Resonance and 3 ϕ AC circuits	14
IV	DC generator& DC motor	15
V	AC machines	15
Test & Model Exam		7
Total		80

RATIONALE:

Basic Electrical knowledge is essential for Medical Laboratory Technology. Study of Electric Circuits and Machines forms the foundation of Electrical Engineering. It prepares the students to familiarize with basic concepts of electrical circuits and working of electrical machines used in industries.

OBJECTIVES:

- At the end of the course, the students will be able
- To understand current, EMF, power and energy.
- To apply Ohm's law and Kirchhoff's current and voltage laws to circuit problems.
- To simplify the circuits using series and parallel equivalents.
- To convert star to delta and delta to star connection.
- To solve problems using super position, thevenin's, Norton and maximum power transfer theorems.
- To develop knowledge on single phase A.C circuits.
- To develop knowledge on three phase A.C circuits.
- To understand the concept of series and parallel resonance.
- To know the dc generator principle, construction, types, characteristics and applications.
- To know the dc motor principle, construction, types, characteristics, Applications & starters.
- To know the principle, types and construction of transformer.
- To know the principle, types and construction of alternator.
- To know the principle, construction and applications of induction motors and special machines.

DETAILED SYLLABUS

Contents: **Electrical Circuits and Machines**

Unit	Name of the Topics	Hours
I	1.1 Concept of electrical quantities -Voltage-Current-Resistance - Power - Energy - Ohm's law - Resistances in series - resistances in parallel-Series parallel circuits-Kirchhoff's laws-Simple problems.	7
	1.2 Super position, Thevenin's and Maximum power transfer theorems - Statement and explanations - simple problems. Voltage to current and current to voltage conversion (Circuits).	8
II	AC fundamentals: AC fundamentals - AC waveform - Sinusoidal and non-sinusoidal - Period - Frequency - Cycle - Amplitude - Peak value - Average value - RMS value (effective value) - Form factor - Crest factor - Rectangular and Polar forms for complex number - Concept of vector diagram. AC through pure resistor, Inductor and Capacitor - Concept of Impedance - vector diagram. Capacitors in series and parallel - energy stored in a capacitor, Derivation - simple problems. Power in AC circuits - power factor - RL, RC and RLC series and parallel circuits - simple problems.	14
III	3.1 Resonance: Condition for resonance - series and parallel resonance - Resonance curve - selectivity - Q-factor and bandwidth, Applications of resonance - simple problems in resonance.	5
	3.2 3ϕ AC Circuits: Concept of 3 ϕ supply - Line and Phase voltage and current in star and delta connected circuits - 3 ϕ power - Measurement of 3 ϕ power by two watt meter method - simple problems - Advantages of 3 ϕ over 1 ϕ system.	9
IV	4.1 DC Generator: DC machines - Constructional details of DC Machines - DC generators - Principle - Types - EMF equation - Characteristics of shunt, series and compound generators.	8
	4.2 DC Motor: DC motor- Types - Motor action - Back EMF - Torque speed characteristics - Necessity of starters - Working of 3 point & 4 Point starters - Speed control of DC motor- Applications	7

V	5.1 Alternators: Ac machines - 3 ϕ Alternator - Construction and working - Relation between speed and frequency.	3
	5.2 Induction Motor: 3 ϕ induction motor – construction – Types – Principle of operation - Methods of starting of 3 ϕ Induction motor - Slip. 1 ϕ induction motor - Principle of operation -Capacitor start Motors -Applications.	5
	5.3 Transformer: Transformer - Ideal Transformer - Principle of working - Constructional details – EMF equation – Turns ratio – Core loss – Copper loss – Efficiency – Regulation – SC and OC tests – Simple problems - All day efficiency. Auto transformer - Construction and working – Applications	7

Reference Books

1. “B.L.Theraja” A text book of Electrical Technology-Vol. I&II S. Chand & Co.”
2. “Arumugam & Premkumar” “CircuitTheory” “Khanna Publishers”
3. “Nagoor kani” “Circuit Theory” “RBA Publications”
4. “M.M.Louis” “Elements of Electrical Engineering” “Khanna Publishers”

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

III SEMESTER

2020 – 2021 onwards

414233 - FUNDAMENTALS OF MLT

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020 – 2021 onwards)

Course Name : 4142 - Diploma in Medical Laboratory Technology

Subject Code : 4142330

Semester : III

Subject Title : **Fundamentals of MLT**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Fundamentals of MLT	5	80	25	100*	100	3Hrs.

*Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Organization of Laboratory	15
II	Sterilization and Disinfection and First aid techniques	15
III	Solutions, Reagents and Dyes Preparation	15
IV	Basic Principles of Sample Collection	14
V	Quality control and Quality assurance	14
Test & Model Exam		7
Total		80

RATIONALE:

Fundamentals of MLT are an important branch of subject needed for the DMLT course. It covers all the basic knowledge about the clinical laboratory and role of technician in clinical diagnosis. This subject cover all fundamentals needed for designing clinical laboratory and enable the student to become an entrepreneur as well as a technician in clinical diagnosis.

OBJECTIVES:

On completion of the Units mentioned above, the students would be able to

- Explain the organization of basic design of a clinical laboratory
- Understand the different are sand departments of clinical laboratory.
- Understand the code of conduct of medical laboratory personnel.
- Explain the different processes of sterilization and disinfection.
- Understand the importance of sterilization and disinfection.
- Analyze the different causes of accidents in the laboratory.
- Explain the Importance of safety regulations and first aid measures.
- Understand the role of different types of solutions and explains its role in Clinical diagnosis.
- Understand various types of sample collection techniques and its processing.
- Explains about importance of quality assurance in the clinical laboratory and Describes about the management of quality control in the laboratory.
- Explain about record maintenance in the laboratory and waste management.

DETAILED SYLLABUS

Contents: **Fundamentals of MLT**

Unit	Name of the Topics	Hours
I	Organization of Laboratory Laboratory management and its place in patient's care and service —code of conduct of medical laboratory personnel — medical ethics and habits of scientific minds— basic design of laboratory— set up of standardized clinical laboratory and functional components of the laboratory.	15
II	Sterilization and Disinfection and First aid techniques Process of sterilization and disinfection – Physical, chemical, mechanical and radiation methods of sterilization—Decontamination. Safety regulations in the laboratory — accidents in the laboratory — awareness on handling acids, alkalis, organic solvents, corrosive, carcinogenic and inflammable chemicals, infected materials, pathogenic microbes and first aid measures for the accidents –list of materials in the Laboratory first aid kit.	15
III	Solutions, Reagents and Dyes Preparation Measurements - Mass, length, area, volume, SI units, temperature and other conversion factors. Preparation of solutions and reagents— stock solution, working solution, standard solution, normal solution, percent solution, molar solution, isotonic, hypotonic and hypertonic solution, saturated, unsaturated solutions. Basic knowledge of dyes— preparation of various stains, storage, stability and uses	15
IV	Basic Principles of Sample Collection Method of Collection, Preservation, storage, stability and transportation of various clinical specimens – Labeling and rejection of specimen – appropriate collection technique — Patient and site preparation — processing of clinical specimens.	14

V	Quality control and Quality assurance Maintenance of record manual – SOP (standard operation procedure) - Methods of writing and releasing diagnostic reports – Proper disposal laboratory waste by applying Biomedical waste rules of India–Internal and external Quality control of the laboratory and Quality of assurance.	14
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Reference Books

1. Kanai L.Mukherjee -Text book of Medical laboratoryTechnologyVol1,2&3.
2. Ramnik Sood–Hand book of Medical laboratory technology.
3. Praful B.Godkar–Text book of Med. Lab. Technology.
4. V.H.Talib– Practical Textbook of Laboratory Medicine.5.N.C.Jain&Saakshi-
5. First aid and emergency care revised edition 2012.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

III SEMESTER

2020–2021 onwards

4142340 - Anatomy and Physiology

ANNEXURE-I

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142340

Semester : III

Subject Title : **Anatomy and Physiology**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Anatomy and Physiology	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Skeletal system	14
II	Digestive system	15
III	Respiratory system	15
IV	Circulatory system	15
V	Excretory system	14
Test & Model Exam		7
Total		80

RATIONALE:

Anatomy and physiology provides information about structure, location and organization of different parts of the body while physiology is the study of functions of the body parts. Without the knowledge of internal body, the health professionals cannot evaluate, diagnose the illness. Students will learn the structure and function of each body system and how they maintain homeostasis

OBJECTIVES:

At the conclusion of the Units mentioned above, the students would be able to

- Identify the major components of skeletal system and describe their function.
- Describe the major types of bones and joints.
- Differentiate the bones of axial skeleton and appendicular skeleton.
- Describe the overall structure, functions and components of digestive system.
- Explain the mechanism of digestion, absorption and assimilation.
- Explain the role of digestive juices in the digestion and how they are produced.
- Locate and identify the structures that make up upper and lower respiratory tracts.
- Describe the structure of lungs and alveoli and explain about mechanism of breathing
- Differentiate internal and external respiration.
- Identify the major components of circulatory system and describe their functions.
- Elaborate the exchange of gases between lungs and blood stream.
- Explain about cardiac cycle and maintenance of blood pressure.
- Describe the anatomical difference between male and female urinary system.
- Explain about the mechanism of urine formation and storage,
- Explain how micturition is controlled by the nervous system.

DETAILED SYLLABUS

Contents: **Anatomy and Physiology**

Unit	Name of the Topics	Hours
I	Skeletal system Basic structure of human body-classification of bones- Axial and appendicular skeleton - the skull, bones of face, sternum, ribs, vertebral column, skeleton of limbs and girdles - classification of joints-joints of skeleton, characters of joints, abnormalities of skeletal system.	14
II	Digestive system Digestive system of human alimentary canal, digestive glands, the duct System of liver, gallbladder and pancreas, process of Digestion and absorption of protein, carbohydrate and fat.	15
III	Respiratory system Structure of respiratory organs, mechanism of breathing, cellular respiration, gaseous transport, artificial respiration.	15
IV	Circulatory system Structure of circulatory system - structure of heart, blood vessels-types of circulation - double circulation - cardiac cycle - regulation of cardiac activity - Electrocardiogram (ECG) - disorders of circulatory system.	15
V	Excretory system Human urinary system-kidney, ureter, bladder, urethra-formation of urine-functions of tubule, mechanism of urine formation and micturition - Disorders of excretory system.	14

Reference Books

1. Ross and Wilson–Anatomy and physiology in health and illness12th Edition
2. Indu Khurana and Arushi–Text book of anatomy and physiology or health professionals
3. Vidya Ratan–Hand book of human physiology
4. Guyton and Hall-textbook of medicalphysiology2nd Edition.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

III SEMESTER

2020–2021 onwards

4040350 Electronic Devices and Circuits Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4040350

Semester : III

Subject Title : **Electronic Devices and Circuits Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Electronic Devices and Circuits Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Every Electronics Engineer should have sound knowledge about the components used in Electronics Industry. This is vital in R&D Department for chip level troubleshooting. To meet the industrial needs, diploma holders must be taught about the most fundamental subject, Electronic devices and Circuits Practical. By doing practical experience in this, they will be skilled in handling all types of electronic circuits and able to apply the skill in electronic systems.

OBJECTIVES:

On completion of the following experiments, the students must be able to

- Know the Color Checking of Active and Passive Component
- Find out the Unknown Resistance value of a Resistor using Colour Coding
- Find out the Unknown Capacitance value of a Capacitor using Colour Coding
- Find out the Unknown Inductance value of an Inductor using Colour Coding.

- Understand the concept, working principle and applications of PN Junction diode
- Understand the concept, working principle and applications of Zener diode
- Understand the concept, working principle and applications of BJT and FET
- Understand the concept, working principle and applications of UJT
- Understand the concept, working principle and applications of SCR
- Understand the concept, working principle and applications of DIAC and TRIAC
- Understand the concept, working principle and applications of Clippers and Clampers
- Understand the concept, working principle and applications of various types of Negative feedback amplifiers
- Understand the concept, working principle and applications of Astable Multivibrator

DETAILED SYLLABUS

Contents: **Electronic Devices and Circuits Practical**

Exercise

Note: At least 5 experiments should be done using Soldering board / Bread board

1. Construct a circuit to test the forward and reverse bias characteristics of a PN Junction Silicon diode. Find the value of its cut-in voltage
2. Construct a circuit to test the forward and reverse bias characteristics of a Zener diode. Find the value of its reverse breakdown voltage
3. Construct a Full wave (center tapped) rectifier and test its input and output waveforms with and without Capacitor filter. Find its maximum voltage.
4. Construct a Full wave (Bridge) rectifier and test its input and output waveforms with and without Capacitor filter. Find its maximum voltage.
5. Construct a Common Emitter Transistor circuit and test its input and output characteristic curves.
6. Construct a Common Source Field Effect Transistor circuit and test its drain and transfer characteristic curves.
7. Construct a circuit to test the Turning on and Turning off characteristics of SCR and find out the forward break over voltage, the value of Latching and Holding currents.

8. Construct a circuit to test the bidirectional characteristics of DIAC and plot its switching characteristics.
9. Construct a circuit to test the bidirectional characteristics of TRIAC and plot its switching characteristics.
10. Construct a Common emitter amplifier circuit and test its frequency response characteristics with and without Current series feedback introduced in it.
11. Construct a circuit to test the switching characteristics of Astable Multivibrator
12. Construct a circuit to test the negative resistance Characteristics of UJT.

BOARD EXAMINATION

DETAILED ALLOCATION OF MARKS

CIRCUIT DIAGRAM	: 25
CONNECTION	: 25
EXECUTION & HANDLING OF EQUIPMENT	: 25
OUTPUT / RESULT	: 15
VIVA – VOCE	: 10
TOTAL	: 100

LIST OF EQUIPMENTS

S.NO	Name of the Equipments	Range	Required Nos.
1.	DC Regulated power supply	0-30V,1A	10
2.	High Voltage Power Supply	0-250V,1A	2
3.	Signal Generator	1MHz	4
4.	Dual trace CRO	20MHz / 30MHz	5
5.	Digital Multi meter	-	10
6.	DC Voltmeter (Analog/Digital)	Different Ranges	15
7.	DC Ammeter (Analog/Digital)	Different Ranges	15

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

III SEMESTER

2020–2021 onwards

4142360 Electrical Circuits and Machines Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142360

Semester : III

Subject Title : **Electrical Circuits and Machines Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Electrical Circuits and Machines Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

The fundamental practical knowledge about AC and DC circuit is essential for all diploma holders. The working principle for DC generator and transformer is further understood by conducting load test.

OBJECTIVES:

Basic Electrical knowledge is essential for Medical Laboratory Technology. Study of Electric Circuits and Machines forms the foundation of Electrical Engineering. It prepares the students to familiarize with basic concepts of electrical circuits and working of electrical machines used in industries.

DETAILED SYLLABUS

Contents: **Electrical Circuits and Machines Practical**

Exercise

1. Verification of Ohm's law by constructing a circuit.
2. Verification of superposition theorem
3. Verification of Thevinin's theorem
4. Verification of maximum power transfer theorem
5. Verification of Kirchoff's law
6. Series Resonance
7. Measurement of power and power factor of single phase load (Fluorescent lamp).
8. Calibration of Energy meter.
9. Open Circuit Characteristics of DC shunt generator
10. Speed control of DC shunt motor
11. Predetermination of efficiency and regulation by open circuit and short circuit tests on single phase transformer.
12. Measurement of three phase power by two wattmeter method

DETAILED ALLOCATION OF MARKS

SL.NO	DESCRIPTION	MARKS
1	Circuit Diagram	30
2	Connections	30
3	Reading & Graph	25
4	Result	05
5	Viva	10
6	TOTAL	100

LIST OF EQUIPMENTS

1. Power supplies
2. Resistors
3. Multi meters
4. Fluorescent Lamp
5. Energy Meter
6. Wattmeter
7. DC Shunt Generator
8. DC Shunt Motor
9. Single Phase Transformer
- 10.AC Motor

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

III SEMESTER

2020–2021 onwards

4142370 - Fundamental of MLT Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142370

Semester : III

Subject Title : **Fundamental of MLT Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Fundamental of MLT Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Fundamentals of MLT are an important branch of subject needed for the DMLT course. It needs a practical knowledge about the formation of clinical laboratory. The students obtain practical exposure about first aid measures to be followed for reducing laboratory accidents, preparation of various solutions use in the laboratory and different sterilization methods to be followed in clinical laboratory

OBJECTIVES:

- To understand the technique of first aid to be given during emergency period.
- To get practice about the preparation of solutions
- To get knowledge about the preparation of stains

- To practice about the how sterilize materials in the laboratory before and after usage.

DETAILED SYLLABUS

Contents: **Fundamental of MLT Practical**

LIST OF EXPERIMENTS

1. Construction of Basic design of Laboratory–outline drawing
2. First aid technique for accidents in laboratory caused by chemicals
3. First aid technique for electrical shock
4. First aid measures for wound and injury caused by broken glass wares
5. Preparation of solution–Saturated, unsaturated and poly unsaturated solution
6. Preparation of solution–Stock solution, working and standard solution
7. Preparation of solution–Normality, molarity and Percent solution
8. Preparation of solution–Isotonic, hypertonic and hypotonic salt solution
9. Preparation of stains–Romano sky stains
10. Sterilization techniques–model preparation

SCHEME OF EVALUATION		
No.	Allocation	Marks
1	Methodology	30
2	Presentation	30
3	Tabulation & Calculation	25
3	Result	10
4	Viva Voce	05
Total		100

Equipments Required:

S.No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1.	Autoclave	1
2.	Hot air oven	1
3.	First aid kit	1
4.	Weighing balance(Digital)	1
5.	Chemicals like NaCl, NaOH, HCl, KOH, H ₂ SO ₄	1
6.	Test tubes	50
7.	Test tube rack	25
8.	Beakers	10
9.	Conical flask	10
10.	Volumetric Pipettes(1ml,2ml,5ml,10ml)	10
11.	Measuring cylinder	5
12.	Other glass wares	

IV SEMESTER

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

IV SEMESTER

2020–2021 onwards

4142410 Analog and Digital Electronics

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142410

Semester : IV

Subject Title : **Analog and Digital Electronics**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Analog and Digital Electronics	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Linear IC s: Op-amp. Timer and their applications	15
II	Boolean Algebra and reduction technique	15
III	Combinational Logic circuits	15
IV	Sequential Logic circuits	14
V	D/A, A/D and Memory	14
Test & Model Exam		7
Total		80

RATIONALE:

Digital electronics replaces the analog circuits in many fields. Using digital circuits is easier. Diploma holders must have knowledge about the fundamental laws used in digital electronics and the working principle of digital circuits. Operational amplifiers find application in timer circuits. This subject deals with both analog and digital electronic circuits.

OBJECTIVES:

- Explain the characteristics and applications of operational amplifier.
- Learn the concepts of astable and Mono stable Multivibrator using 555.
- Recognize the different number systems such as binary, BCD, Octal, Hexa decimal
- Familiarize the Truth Table and symbol of Logic gates
- Learn the operation of Adders and subtractor
- distinguish between combinational Logic and Sequential Logic
- Familiarize the reduction technique using Karnaugh map(2 variable to 4variable)
- Familiarize the concept of multiplexer, De-multiplexer, encoder and decoder
- Explain various Flip flops ,registers and counters
- Study the different types of A/D and D/A converters

ANALOG AND DIGITAL ELECTRONICS

DETAILED SYLLABUS

Unit	Name of the Topic	Hours
I	1.1 Linear ICs: Op-amps, Timers and their applications: Operational amplifier – Ideal Op-Amp – Block diagram and characteristics – Op-amp parameters – CMRR – Slew rate – Applications of op-amp – Inverting amplifier – Virtual ground Summing amplifier – Non inverting amplifier – Voltage follower – Comparator – Zero crossing detector – Differential Amplifier – Instrumentation Amplifier – Integrator – Differentiator – V to I converter – I to V converter, Op-Amp Specifications.	9
	1.2. 555 Timer – Functional Block diagram – Astable, Monostable and Schmitt Trigger – Sequence timer, 555 timer can be used as PWM.	6
II	Boolean Algebra and Reduction technique: Numbers systems – Decimal – Binary – Octal – Hexadecimal – BCD – Conversion from one number system to other – Boolean Algebra – Basic laws and Demorgan's Theorems – Logic gates – OR – AND – NOT – NOR – NAND – EX-OR Symbols, Truth table and Boolean expression – Realization of gates using universal gates NAND, and NOR – Boolean expression for outputs – Simplification of Boolean expression using Karnaugh map (upto 4 variable) – Problems using 2, 3, and 4 variables – Constructing logic circuits for the Boolean expressions.	15
III	Combinational Logic Circuits: Arithmetic circuits – Binary addition – Binary Subtraction – 1's complement and 2's complement – Signed binary numbers – Design, Construction and working of Half adder – Full adder – Half subtractor – Full subtractor – Parity Generator and checker – Digital comparator – Arithmetic Logic Unit – Decoder – 3 to 8 decoder – BCD to seven segment decoder – Encoder – Multiplexer – Demultiplexer – Digital Logic families – TTL – CMOS – LS series – Fanin – Fanout – Propagation delay – Noise immunity for the above families.	15

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N-SCHEME

IV SEMESTER

2020–2021 onwards

4142420 Sensors and Signal Conditioning Circuits

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142420

Semester : IV

Subject Title : **Sensors and Signal Conditioning Circuits**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Sensors and Signal Conditioning Circuits	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Bio-electric signals ,electrodes and clinical measurement	15
II	Bio-medical recorders	15
III	Therapeutic instruments	14
IV	Biotelemetry and patient safety	14
V	Modern imaging techniques	15
Test & Model Exam		7
Total		80

RATIONALE:

Most of the Bio medical Equipments are designed with Electronic circuits to process the signal sensed by sensors or electrodes. Lab technician should be well-known with the sensors and bio electrodes. The signals picked up by sensors and electrodes need various processing to further use it. Hence signal conditioning circuitry using operational amplifiers are included in this subject. This subject to enable the students to learn the basic principles of different sensors and Electrodes and signal processing circuits

OBJECTIVES:

After learning this subject the student twill be able to understand the about

- Construction and working of various types of Displacement sensors
- Construction and working of various types of Proximity sensors
- Construction and working of various types of Motion sensors
- Construction and working of Force sensors
- Construction and working of various types of flow sensors
- Construction and working of various types of pressures sensors
- Construction and working of various types of level sensors
- Construction and working of various types of temperature sensors
- Construction and working of various types of light sensors
- The generation of Bio-potential and its measurement using various electrodes.
- Operational amplifiers and its specification, characteristics
- Open loop and closed loop application circuits using operational amplifiers
- Various signal processing circuits like amplifiers
- ECG amplifier circuit construction and working
- Lowpass,Highpass,Bandpass,NotchfiltercircuitsusingOperationalamplifier
- Schmitt trigger, Digital to analog and analog to digital converters

DETAILED SYLLABUS

Contents: Sensors and Signal Conditioning Circuits

Unit	Name of the Topics	Hours
I	<u>SENSORS & TRANSDUCERS-I</u> Sensor-Transducer-specifications-Displacement sensors – Potentiometer, strain gauged element, Capacitive element, LVDT- Proximity sensors–Eddy current proximity sensor, Inductive proximity sensor, proximity switches, Hall effect sensor-Velocity and motion sensors–Incremental encoder, Tacho generator –Piezoelectric sensors- Force sensor-strain gauge Load cell	15
II	<u>SENSORS&TRANSDUCERS-II</u> Fluid pressure sensors-Diaphragm pressure gauge, capsules, Bellows, piezoelectric sensor-Liquid Flow sensor–orifice plate, turbine meter, venturi - Liquid Level sensor-Float, Differential pressure sensor - Temperature sensor - Bimetallic strips –Resistance temperature detectors–Thermistor-Thermo-diodes and transistors-Thermocouples – Light sensors –Photodiodes •Photo resistors	15
III	<u>Bio-Electrodes and Bio-sensors:</u> Origin of Bio-Electric signal–Bio potential - Resting and Action potential - Recording Electrodes- types of Electrodes- Micro- skin and Needle electrodes - Silver-Silver chloride electrodes–ECG Electrodes–EEG Electrodes–EMG Electrodes–Electrical conductivity of Electrode jellies and creams–Transducers for body temperature measurement–Photoelectric transducer–Biosensors-Smart sensors	14
IV	<u>Operational Amplifiers:</u> Operational Amplifier— Block diagram of operational amplifier— characteristics of ideal operational amplifier-practical operational amplifier- operational amplifier parameters-input offset voltage, offset Current-output offset voltage and current-CMRR-Slew rate-Symbol- Input output characteristics- pin details of IC741-JFET Operational Amplifiers –LF155 and TL082.	14

V	<u>Signal conditioning circuits using Op-Amp:</u> comparator – Zero crossing detector - Derivation and characteristics of Inverting Amplifier-summing amplifier-Non-inverting Amplifier-voltage follower – Differential Amplifier – Instrumentation amplifier – ECG amplifier Adder–subtractor-Integrator–Differentiator-Voltage to current converter-Current to voltage converter- low pass filter-High pass filter Band pass filter –Notch filter- Non-inverting Schmitt trigger-Inverting Schmitt trigger- Digital to analog converter	15
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Text Book:

1. Hand book of Bio-Medical instrumentation- Third Edition, Dr.R.S.Khandpur, McGraw Hill Education (India)Private Limited
2. Dr.M.Arumugam–Biomedical Instrumentation, Anuradha publications, Chennai.
3. Linear Integrated Circuits, Second Edition, D.Roy Choudhury, New age international publishers

Reference Books

1. Leslie Cromwell–Fredj. Wibell, Erich A.P Feither–Biomedical Instrumentation and measurements, II Edition.
2. Medical Electronics- Kumaradoss
3. Introduction to Medical Electronics. B.R.Klin
4. Introduction to Biomedical Instrumentation Mandeep Singh Printice HallIndia2010

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N-SCHEME

IV SEMESTER

2020–2021 onwards

4042430 Measurements and Instruments

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4042430

Semester : IV

Subject Title : **Measurements and Instruments**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Measurements and Instruments	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	MEASURING INSTRUMENTS	12
II	BRIDGES AND OSCILLOSCOPE	12
III	TEST INSTRUMENTS	11
IV	DIGITAL INSTRUMENTS-I	11
V	DIGITAL INSTRUMENTS-II	11
Test & Model Exam		7
Total		64

RATIONALE:

Instrumentation and Control Engineers plays a major role in process industries. The students of MEDICAL LABORATORY TECHNOLOGY branch need a brief idea about the basic concepts of Measuring instruments and test instruments, which can be helpful to them to conduct various measurements. This subject covers the basic needs of measurements and measuring instruments and it makes the students to understand the importance of measuring instruments in industries.

OBJECTIVES:

On completion of the Units mentioned above, the students would be able to

- Explain the construction and working of indicating instruments for measurement of D.C and A.C voltage, current Power & Energy.
- Understand the working and applications of Multimeter for Ω , V, A measurement.
- Explain range extension methods for Ammeters and Voltmeters.
- Understand the resistance measurement with voltmeter and Ammeter
- Understand the resistance measurement with ohm meter
- Understand the dynamometer type wattmeter, single phase energy meter and DC potentiometer
- Understand the dynamometer type wattmeter, single phase energy meter and DC potentiometer
- Explain the construction and working and practical application of WB Bridge for Resistance measurement.
- Explain the construction and working of AC Bridges & measurement of L and C using three bridges.
- Explain the construction and working of AC Bridges & measurement of frequency using Wien bridge.
- Explain the construction, working and applications of CRO.
- Explain the voltage probe and current probe with active and passive components.
- Explain the working and application of Power Supply as a test instrument.

- Understand the use of Audio signal generator, Frequency generator, and Megger for testing of electronic/electrical circuits.
- Explain the working and use of CT's and PT's
- Understand and write the working of recorders.
- Compare Digital Vs Analog Instruments.
- Explain the working of different types of DVM.
- Explain the block diagram and circuit diagram of DFM.
- Use Digital Multimeter.
- Explain the working of EC and Digital Panel meter using LCD.

DETAILED SYLLABUS

Contents: **Measurements and Instruments**

Unit	Name of the Topics	Hours
I	MEASURING INSTRUMENTS Construction , working and Equations of Permanent magnet and Moving coil instrument , Attraction and Repulsion type Moving iron instrument- Electrostatic Instrument-Electro dynamic instrument-Ballistic Galvanometer - Ammeter –Extending the range –Multi range ammeter, Voltmeter-Extending the range-Multi range voltmeter–Resistance measurement with voltmeter and ammeter-Construction and working of Ohm meter - rectifier type ac volt meter dynamo meter type wattmeter - 1 ϕ induction type energy meter, DC potentiometer-Kelvin varley Potential divider	12
II	BRIDGES AND OSCILLOSCOPE DC Bridge -Construction, working, derivation of balance equation and application of measurement of resistance by Wheatstone bridge –AC Bridge — Balance equation of AC bridge in Ratio form and Product form, measurement of unknown lossy inductor using standard variable inductor, Maxwell's Bridge — Hay's bridge- Measurement of unknown capacitance by Schering bridge —measurement of frequency using Wien bridge. Block diagram of oscilloscope–construction and working of CRT–horizontal deflection and vertical deflection– time base generator – CRO probes–voltage–current–active–passive probes-applications of CRO.	12
III	TEST INSTRUMENTS Block diagram, working and applications of DC power supply–fixed and variable — Megger – working and applications .Instrument transformer –Current Transformer(C) and Potential Transformer (PT) – Recorders-Diagram and working of Strip chart recorders–XY recorder–ultraviolet recorder-Analog Tape recorder and Digital tape recorder	11

IV	DIGITAL INSTRUMENTS-I Digital Vs Analog instruments –inverting and non-inverting Schmitt trigger circuit -Digital Frequency Meter –Block diagram- circuit diagram for frequency measurement– Period measurement- Digital tachometer — digital panel meter using LCD—Digital storage oscilloscope, mixed Storage oscilloscope.	11
V	DIGITAL INSTRUMENTS-II Digital volt meter- Linear ramp type voltmeter – Dual slope voltmeter- Digital ramp type voltmeter–successive approximation type voltmeter- Digital Multi meter– auto ranging – auto zeroing – auto polarity Function generator to generate triangular and pulse and sinusoidal wave- Block Diagram – Circuit diagram.	11

Text Books

1. A course in Electrical and electronic measurements and instrumentation– A.K.SAWHENY, DHANPAT RAI & sons. 1986. (Page Nos.292-329,585-599,605,1171-1173,785-814,865-867,390-412,1303-1315,1295,825,1372)
2. Electronic Instrumentation and Measurements : David A. Bell

REFERENCE BOOKS:

1. Modern electronics Instrumentation and measurement techniques– ALBERTD.HELFRICK
2. Electrical and Electronics measurements and instrumentation–UMESH SINHA, SATYAPRAKASHAN, Tech India publication 1992.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

IV SEMESTER

2020–2021 onwards

4142440 Analog and Digital Electronics Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142440

Semester : IV

Subject Title : **Analog and Digital Electronics Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Analog and Digital Electronics Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Medical lab technology students play a major role in diagnosis of the diseases and providing the best care and treatment available for it. The students of medical lab technology branch need a brief idea about the basic concepts of analog and digital circuits which can be helpful to them to learn about conditioning of bio signals. The lab is well equipped with analog and digital electronic components, so students can fabricate their own circuit for processing the signals further. The lab also comprises of Analog and digital trainer kits so as to facilitate verification of the results obtained through the fabricated circuits.

OBJECTIVES:

On completion of all the experiments mentioned below, the students would be able to

- Construct and verify the applications of operational amplifier
- Test the characteristics of IC 555 timer
- Obtain the output of IC voltage regulators
- Learn the construction of instrumentation amplifier
- Realize the V to I and I to V converters
- Familiarize the truth table of Logic gates
- Realize the logic circuit of Boolean expression
- Distinguish the operation of adder and subtractor
- Verify the truth table of multiplexer, Demultiplexer, encoder and Decoder.
- Learn the operation of shift register and counters.
- Study the operation of A/D and D/A converters.

DETAILED SYLLABUS

Contents: **Analog and Digital Electronics Practical**

List of Experiments:

1. Construct and test inverting amplifier and Non-inverting amplifier with D.C gain 10 and observe output voltages for the given positive and negative DC input voltages and draw the voltage transfer characteristics.
2. Construct the practical test Integrator and differentiator using operational amplifier with DC gain and corner frequency. Observe the input and output wave forms and frequency response.
3. Construct Astable multi-vibrator using IC 555 timer and observe the output waveform verify using CRO.
4. Experimentally obtain the output of IC voltage regulator power supplies using IC 7805 and 7912.
5. Experimentally verify the Truth table of OR, AND, NOT, NOR, NAND AND XOR gate using 7432, 7408, 7404, 7402 and 7486.
6. Experimentally verify the universal property of NAND and NOR gates.
7. Design, Construct and test Half adder and Full adder using gates.
8. Design, Construct and test Half Subtractor and full Subtractor using discrete IC's.
9. Experimentally verify the truth table of D,T and JK flip-flops
10. Construct and test 4 bit ripple counter using Flip-flop and observe the counting sequence using LEDs.
11. Construct and verify R-2R ladder Digital to Analog converter using operational amplifier.
12. Construct and verify A/D converter using ADC 0808 IC.

SCHEME OF VALUATION		
NO.	Allocation	Marks
1.	Circuit diagram and Truth table	30
2.	Connection and procedure	30
3.	Tabulation and Graph	25
4.	Result	10
5.	Viva Voce	5
Total		100

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N – SCHEME

IV SEMESTER

2020–2021 onwards

4142450 Sensors and Signal Conditioning Circuits Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142450

Semester : IV

Subject Title : **Sensors and Signal Conditioning Circuits Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Sensors and Signal Conditioning Circuits Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Instrumentation and Control Engineers plays a major role in process industries. The students of MEDICAL LABORATORY TECHNOLOGY branch need practical knowledge to measure various parameters such as Temperature, pressure, Flow, etc. This subject gives practical exposure to the students about measurement of process variables of instrumentation industries.

OBJECTIVES:

- To understand the extension of the range of meters
- To get practice to measure voltage, current and frequency using CRO
- To get practice to measure Flow, Viscosity
- To get practice to measure resistance, capacitance using Bridges
- To understand the characteristics of DPT experimentally

DETAILED SYLLABUS

Contents: **Sensors and Signal Conditioning Circuits Practical Exercise**

1. Conduct experiment to measure the displacement using potentiometer.
2. Conduct experiment to measure the displacement using LVDT
3. Conduct experiment to measure the force using strain gauge load cell
4. Conduct experiment to measure the temperature using Thermistor
5. Conduct experiment to measure the temperature using RTD
6. Conduct experiment to measure light intensity using LDR
7. Conduct experiment to measure the body temperature
8. Construct inverting and Non-inverting amplifier using operational amplifier and experimentally obtain the input output characteristics.
9. Construct the instrumentation amplifier circuit and test it
10. Construct V to I and I to V converter circuit using operational amplifier
11. Construct Low pass , High pass and Notch filter using operational amplifier and test it
12. Construct R- 2R digital to analog converter circuit using operational amplifier and test it

SCHEME OF EVALUATION		
No.	Allocation	Marks
1	Circuit diagram	30
2	Connection & Procedure	30
3	Tabulation & graph	25
3	Result	10
4	Viva Voce	05
Total		100

Equipments Required:

S.No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1.	Potentiometer	4
2.	LVDT	2
3.	Strain gauge Load cell	2
4.	Thermistor, RTD, LDR	2
5.	Analog IC trainer board with bread board and power supply	4
6.	IC741, Resistors,	50
7.	Digital Multimeter	5
8.	Cathode ray oscilloscope	4
9.	Audio Function generator	4
10	Connecting wires	

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N-SCHEME

IV SEMESTER

2020–2021 onwards

4142460 Measurements and Instruments Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : Diploma in Medical Laboratory Technology
 Subject Code : 4142460
 Semester : IV
 Subject Title : **Measurements and Instruments Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Measurements and Instruments Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

The students of Medical Lab Technology branch need practical knowledge to measure various parameters such as Temperature, pressure, Flow, etc. and they need practice to handle the measuring instrument. This subject gives practical exposure to the students about measurement of various parameters.

OBJECTIVES:

- To understand the extension of the range of meters
- To get practice to measure voltage, current and frequency using CRO
- To get practice to measure Flow, Viscosity
- To get practice to measure resistance, capacitance using Bridges
- To understand the characteristics of DPT experimentally

DETAILED SYLLABUS

Contents: **Measurements and Instruments Practical Exercise**

1. Conduct experiment to extend the range of Ammeter
2. Conduct experiment to extend the range of Voltmeter
3. Conduct experiment to measure resistance using Ammeter and voltmeter
4. Conduct experiment to measure the unknown resistance using Wheatstone bridge
5. Conduct experiment to measure the unknown Inductance using Maxwell's bridge
6. Conduct experiment to measure the unknown capacitance using Schering bridge
7. Conduct experiment to measure unknown frequency using Lissajous patterns in CRO
8. Conduct experiment using Digital storage oscilloscope to observe waveform and store the waveform
9. Conduct experiment to measure voltage and current using Digital panel meter
10. Conduct experiment to measure voltage, current, resistance using Digital multimeter.

SCHEME OF EVALUATION		
No.	Allocation	Marks
1	Circuit diagram	30
2	Connection & Procedure	30
3	Tabulation & graph	25
3	Result	10
4	Viva Voce	05
Total		100

S.No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1.	IC Trainer With Power Supply Facility	10
2.	Cathode Ray Oscilloscope	2
3.	Audio Oscillator	2
4.	Ammeter	5
5.	Voltmeter	5
6.	Whetstone Bridge KIT	2
7.	Maxwell's Bridge KIT	2
8.	Schering Bridge KIT	2
9.	Digital Panel Meter	3
10	Digital Multimeter	5
11	Bread Board	5
12	Connecting Wires	

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

II YEAR

N-SCHEME

IV SEMESTER

2020–2021 onwards

4142470 Clinical Pathology Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142470

Semester : IV

Subject Title : **Clinical Pathology Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Clinical Pathology Practical	6	96	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Clinical pathology practical supports the diagnosis of diseases using laboratory testing of blood, body fluids, tissues and their microscopic evaluation. It involves physical, chemical, microbiological and microscopic examination of all the body fluids. After completion of this practical the students can understand the importance of clinical diagnosis of body fluids and their influence in the treatment process.

OBJECTIVES:

- To understand the sample collection for urine analysis and other body fluid analysis
- To get practice about the clinical analysis of urine, stool, CSF, sputum and semen.
- To get knowledge about the clinical importance of variation in the body fluids

DETAILED SYLLABUS

Contents: Clinical Pathology Practical Exercise

LIST OF EXPERIMENTS

1. Physical examination of urine – colour, volume, appearance, pH, specific gravity
2. Test for sugar in urine–Benedict's test
3. Test for a albumin in urine–heat test and precipitation test
4. Test for bile salt in urine–hay's sulphur test
5. Test for bile pigment in urine–Fouchet's test
6. Occult blood in urine–benzidine test
7. Test for urobiliogenin urine–Ehrlichaldehyde test
8. Test for ketone bodies in urine–Rothera's test
9. Microscopic examination of urine
10. Urine pregnancy test
11. Microscopic examination Sputum
12. AFB staining of Sputum
13. Semen analysis–Sperm count, spermmotility test and spermmorphology analysis

SCHEME OF EVALUATION		
No.	Allocation	Marks
1	Methodology	30
2	Presentation	30
3	Tabulation & Calculation	25
3	Result	10
4	Viva Voce	05
Total		100

Equipments Required:

S.No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1.	Urino meter	10
2.	pH papers	50
3.	Spirit lamp	10
4.	Test tube holder	25
5.	Pasteur pipette	10
6.	Test tubes	50
7.	Test tube rack	25
8.	Beakers	10
9.	Conical flask	10
10.	Volumetric Pipettes(1ml,2ml,5ml,10ml)	10
11.	Measuring cylinder	5
12.	Other glass wares	
13.	Chemicals	
14.	Pregnancy kit	

V SEMESTER

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

V SEMESTER

2020–2021 onwards

4142510 Basics of Bio-Chemistry

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142510

Semester : V

Subject Title : **Basics of Bio-Chemistry**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Basics of Bio-Chemistry	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Water and Electrolytes	14
II	Carbohydrates	15
III	Proteins and Amino acids	15
IV	Lipids and Lipoproteins	15
V	Vitamins and Minerals	14
Test & Model Exam		7
Total		80

RATIONALE:

Biochemistry is the branch of science deals with the study of chemical processes within the cell. Basics of biochemistry focuses on understanding the chemical basis which allows biological molecules to give rise to processes that occur within living cells and between cells. Students will understand the biological processing of proteins, carbohydrates, lipids, vitamins and minerals

OBJECTIVES:

.At the conclusion of the Units mentioned above, the students would be able to

- Understand the Importance of water in their life
- Describe the composition of electrolytes in the body fluids.
- Elaborate the classification of carbohydrates.
- Understand the metabolism of carbohydrates and explain the mechanism of glycolysis, TCA cycle, Electron transport system.
- Analyses the metabolic defects caused by impaired carbohydrate metabolism.
- Explain the hormonal regulation of glucose metabolism and differentiates IDM and NIDM.
- Describe the importance of protein in the growth and explain the various classifications of protein
- Understand the metabolic pathways of protein metabolism.
- Analyse the clinical importance of protein and identifies the disorders of protein deficiency.
- Explain the various classifications of amino acids and analyze the metabolic disorders of amino acid deficiency.
- Understand the classification of lipids and explains the mechanism of fat metabolism.
- Describe the classification of vitamins and elaborates role of minerals in day today life.

DETAILED SYLLABUS

Contents: **Basics of Bio-Chemistry**

Unit	Name of the Topics	Hours
I	Water and Electrolytes Water — water balance — distribution of water in body — water intake (Exogenous and Endogenous)– water output (Urine, Skin, Lungs, Faces). Electrolyte – composition of electrolyte in the body fluids (Extracellular and Intracellular fluids)–Regulation of Electrolyte balance (Aldosterone, ADH & Renin-angiotensin).	14
II	Carbohydrates Carbohydrates – definition, classifications of Carbohydrates – major pathways of carbohydrate metabolism–Glycolysis, glycogenesis, glycogenolysis, gluconeogenesis, TCA cycle, electron transport system – Regulation of blood glucose level- abnormalities of glucose metabolism- determination of blood glucose level – clinical significance- hypoglycemia and hyperglycemia complications. Effect of insulin–Role of hormone in blood glucose homeostasis-IDDm,NIDDm.	15
III	Proteins and Amino acids Proteins- Definition- simple, conjugated and derived proteins – Nutritional classification of Protein-metabolism of protein–components of Plasma proteins- functions of albumin and globulin – abnormalities of Protein digestion–urea cycle –bio synthesis of Creatine–clinical importance of creatine and creatinine. Amino acids – classification of amino acids – Essential and Non-essential amino acids- amino acids derivatives of proteins - Metabolic fate of amino acids–(glycogenic, Ketogenic and Glycogenic – ketogenic amino acids)– –clinical features of Phenylketonuria, albinism, Proteinuria, Micro albuminuria, Parkinson's disease.	15

IV	Lipids and Lipoproteins Lipids—Classification of lipids-emulsification of lipids—functions of lipids — Saturated and unsaturated fatty acids — Essential fatty acids — metabolism of fatty acids. Lipoproteins-functions of glycolipids, phospholipids — clinical significance of LDL, HDL, VLDL — clinical significance of Hyperlipidemia and hypolipidemia – Lipid profile test – Estimation of Serum total cholesterol, HDL cholesterol, total Cholesterol /HDL cholesterol ratio, serum triglycerides.	15
V	Vitamins and Minerals Vitamins- classification of vitamins– fat soluble and water soluble vitamins – dietary requirements – biochemical functions of vitamins-Deficiency syndromes. Minerals-Biochemical function of minerals–dietary requirements–diseases related to minerals — Hypocalcemia, rickets, osteoporosis, Addison's disease (Cushing's syndrome), Wilson's disease.	14

Reference Books

1. Kanai L. Mukherjee-Text book of Medical laboratory Technology Vol 1, 2 & 3.
2. U. Satyanarayana and U. Chakrapani–Biochemistry–third Edition 2009
3. Prem Prakash Gupta–Text book of Biochemistry with biomedical significance- 2nd edition
4. R.C. Gupta and S. Bhargava-Practical Bio chemistry - 5th Edition

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VSEMESTER

2020–2021 onwards

4042520 Blood Banking Techniques

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142520

Semester : V

Subject Title : **Blood Banking Techniques**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Blood Banking Techniques	6	65	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Blood bank management	12
II	Inheritance of Blood group system	11
III	Preparation of anticoagulant and Storage of blood	12
IV	Blood transfusion	12
V	Compatibility Testing	11
Test & Model Exam		7
Total		65

RATIONALE:

Blood banking technique involves typing of blood group, blood collection, pre transfusion testing, testing of infectious diseases transmitted by transfusion. Blood banking is the process in the lab to make sure that donate blood and blood products are safe before the use of transfusion. So on completion of this course the student can aware of the importance of blood donation in saving many lives

OBJECTIVES:

At the conclusion of the Units mentioned above, the students would be able to

- Describe the maintenance record and documentation blood bank
- Understand the principles of immune haemato logical reactions and explain the mechanism of antigen-antibody reactions.
- Understand the inheritance of blood group system and identifies the various techniques of blood grouping and Rh typing.
- Understand the purpose of various anticoagulants used in the blood bank and explains the physical and biochemical changes in the stored blood
- Analyse the pre transfusion processes and explain the selection and rejection of donors.
- Elaborate the separation of blood components from the donated blood. Understand the importance of pre transfusion testing and explain the compatibility testing

DETAILED SYLLABUS

Contents: **Blood Banking Techniques**

Unit	Name of the Topics	Hours
I	Blood bank management Reception and recording of specimen— cataloging and indexing-maintenance of records-bio safety and infection control in blood bank—Medico legal – aspects – Quality control in blood bank. Principles of Immunohematology – antigen and antibody reactions.	12
II	Inheritance of Blood group system Discovery of Human blood group system-blood group antigens and antibodies—ABO & H antigens – Rh blood group system-testing for A ₁ and A ₂ subgroups-Technique of Blood grouping and Rh typing Sources of error in grouping and Rh typing.	11
III	Preparation of anticoagulant and Storage of blood Preparation and uses of –Acid citrate dextrose (ACD), Citrate phosphate Dextrose (CPD-A, CPD-A1, CPD-A2), heparin, ethylene diamine tetraacetic acid (EDTA), Optimal additive solution(OAS), Storage and transportation of blood-physical and biochemical changes in stored blood and blood components.	12
IV	Blood transfusion Collection of blood-Pre transfusion test-Donor selection—screening of donor-Criteria for selection and rejection of donor—post donation care—Processing of Blood—separation of blood components—blood transfusion technique.	12
V	Compatibility Testing Clinical significance of Compatibility testing—Major cross Matching, Minor cross matching, LISS(Low ionic strength solution) method, Coomb's Test or Antihuman globulin test—Direct and indirect methods	11

Reference Books

1. Kanai L. Mukherjee-Text book of Medical laboratory Technology Vol1,2&3.
2. V.H. Talib - Practical Textbook of Laboratory Medicine.
3. A.B. Dutta – Blood bank and Transfusion.
4. H.B. Williams- Laboratory manual of Serology, Immunology and Blood banking
5. Dacee-Haematology and Blood banking

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VSEMESTER

2020–2021 onwards

**4041531 Physiotherapy and Operation Theatre Equipment's
(Elective Theory-I)**

ANNEXURE-I

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
Subject Code : 4141531
Semester : V
Subject Title : **Physiotherapy and Operation Theatre Equipment's**
(Elective Theory-I)

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Physiotherapy and Operation Theatre Equipment's	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Introduction to Physiotherapy	15
II	Ultrasonic Therapy Unit	14
III	Electrotherapy	14
IV	Operation Theatre Equipment	15
V	Autoclaves	15
Test & Model Exam		7
Total		80

RATIONALE:

This subject includes an exposure to equipment used in electrotherapy, Physiotherapy and operation theatre of a hospital. Physiotherapy and electrotherapy job opportunities are available in assembly, Production, Sales, Repair and Maintenance of Electro physiotherapy and O.T Equipment.

OBJECTIVES:

Students will be able to know

- Introduction to Physiotherapy
- Ultrasonic Therapy
- Electrotherapy
- Operation Theatre Equipment
- Autoclaves

DETAILED SYLLABUS

Contents: **Physiotherapy and Operation Theatre Equipment's (Elective Theory-I)**

Unit	Name of the Topics	Hours
I	INTRODUCTION TO PHYSIOTHERAPY 1.1 INTRODUCTION TO PHYSIOTHERAPY Introduction to physiotherapy, Principle of high frequency heat therapy, advantages of high frequency thermo-therapy over the common therapy. Dipole molecules of the body and their orientation under the influence of an electric field. Diathermy technique and production of heat within the body. Frequency used in shortwave diathermy unit and its advantages.	7
	1.2 DIATHERMY Short Wave (SW) Diathermy- circuit description – automatic tuning of SW diathermy automatic tuning, Application and troubleshooting techniques of SW therapy. Dia-pulse therapy - Micro Wave (MW) Diathermy - Production of microwaves, schematic diagram of a microwave diathermy unit and its description, the delay circuit, the magnetron circuit and safety circuit, specifications.	8

II	ULTRASONIC THERAPY UNIT 2.1 ULTRASONIC THERAPY UNIT Use of ultrasonic's for therapeutic purposes, ultrasonic generators, circuit description, Dosage control, specifications.	7
	2.2 ELECTRO DIAGNOSTIC/THERAPEUTIC APPARATUS Electro diagnosis, intensity-time curve, type of waveforms required for electro diagnosis.	7
III	ELECTROTHERAPY 3.1 ELECTROTHERAPY Principle, waveforms used in electrotherapy, galvanic current, faradic current, surging current. Types of apparatus, functional blocks diagram description, advantages of constant current therapy, specifications	7
	3.2 STIMULATORS Transcutaneous Electrical Nerve Stimulator (TENS) introduction, pain relief through electrical stimulation, different stimulators like spinal cord stimulator, magnetic stimulator, Bladder stimulator, cerebella stimulator.	7
IV	OPERATION THEATRE EQUIPMENT Operation theater lights, Basic diagram, Circuit connections, CCTV, repair and maintenance, Types of surgical procedures, Depth-of-anesthesia monitor, patient warmers, blood and fluid warmers, Operating tables. Cold light source, basic principle, applications and components.	15
V	AUTOCLAVES Basic layout, circuit diagram, connections for inlet and outlet, components of auto claves, application and usage, operating principle.	15

Reference Books

1. "R.Thurston" "Ultrasonic Instruments & Devices – I", Allan Pierce, Volume Editor Emmanuel Papadakis, 1998
2. "Shyam Devias Ganvir & Nithin Suhas Nikhade & Amit Viniyak Nagrale" "Electrotherapy", 2019.
3. "Albert M cook & Webster J G" "Trerapeutic Medical Devices", Prentice Hall INC., New Jersey 1982.
4. "Fein Berg B.N" "Applied Clinical Engineering", Prentice Hall INC., Newjersey 1986.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VSEMESTER

2020–2021 onwards

4142532 Microbiology (Elective Theory–I)

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142532

Semester : V

Subject Title : **Microbiology (Elective Theory-I)**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Microbiology	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	General Microbiology	15
II	Specimen preparation	15
III	Culture Media and Culture Techniques	15
IV	Staining techniques and Microscopic observation	14
V	Morphology and Pathogenesis of Microbes	14
Test & Model Exam		7
Total		80

RATIONALE:

Microbiology is study of microorganisms and it focuses on the structure, function and classification of microbes and the diagnosis of diseases caused by the microbes and their clinical importance. The aim of microbiology course is to introduce basic principles and application relevance of clinical diseases for students. The content of the course include many etiological agents responsible for global diseases. The course will provide the conceptual basis for understanding pathogenic microbes and address the fundamental mechanism of their pathogenicity

OBJECTIVES:

At the conclusion of the Units mentioned above, the students would be able to

- Understand the scope of microbiology and the classification of microbiology
- Explain the general characteristics of microbes
- Understand the method of sample collection and transport of specimen.
- Describe the process of sterilization and disinfection methods.
- Explain the methodology of culture of microorganism sand types of culture techniques and understand the importance of antimicrobial sensitivity testing
- Describethedifferentstainingtechniquesinvolvedinidentificationofmicrobes.
- Elaborates the morphological identification of microbes and their role in the pathogenesis of diseases

DETAILED SYLLABUS

Contents: **Microbiology (Elective Theory-I)**

Unit	Name of the Topics	Hours
I	General Microbiology History and Scope of Microbiology, Prokaryotic and Eukaryotic Microorganisms. Classification of Microorganisms.-Morphology and General Characteristics of Bacteria Fungus, Algae &Virus	15
II	Specimen preparation Method of collection of specimen – transport of specimen & Precaution –CBTM, VR, Stuart's, Pike's transport medium and their uses in transportation of specimen; Sterilization – physical, chemical, mechanical, radiation, filtration Methods and disinfections – halogens, aldehydes, dyes, others	15
III	Culture Media and Culture Techniques Nutritional requirements of Microorganisms - growth cycle, Factors in flouncing microbial growth. Culture media - classification of media - Preparation, uses, precaution and storage of routine laboratory media - culture techniques – Aerobic culture – liquid, stab culture, slant culture, streak culture , colony characters after growth–anaerobic culture–Candle jar technique – Preservation of Microbe in artificial media–Antimicrobialsusceptibilitytesting–ModifiedKirby-Bauemethod	15
IV	Staining techniques and Microscopic observation Commonly used stains – simple staining, differential staining – Gram's staining, Zileh-Neelsen staining (Hot and Cold), Albert staining, Negative staining–India ink preparation–visualization of the morphology and reaction to the chemical present in the stain.	14
V	Morphology and Pathogenesis of Microbes Colonial, microscopical morphology and pathogenesis of microbes: Bacteria – Staphylococcus, Streptococcus, Pneumoniae, E.coli, Enterococcus, Bacillus, Clostridiumtetani, Klebsiella, Proteus, Salmonella, Shigella, Pseudomonas, Mycobacterium tuberculosis, Corynebacterium.	14

Reference Books

1. Anantha narayanan R & Panicker CKJ- Text book of Microbiology. Orient Longmans.7th39ed.2006.
2. Dubey RC and Maheswari DK.A text book of Microbiology. SChand,2007.
3. Manual of Microbiology tools and techniques. Kanika Sharma. Ane's student edition.2007.
4. KanaiL. Mukherjee-Text book of Medical laboratoryTechnologyVol1,2&3.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

V SEMESTER

2020–2021 onwards

**4142533 EMBEDDED SYSTEM DESIGN WITH ARDUINO
(Elective Theory–I)**

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142533
 Semester : V
 Subject Title : **EMBEDDED SYSTEM DESIGN WITH ARDUINO**
 (Elective Theory-I)

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Embedded System Design with Arduino	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Introduction to Embedded system	16
II	ARDUINO Hardware	15
III	ARDUINO software and Library functions	15
IV	ARDUINO interface with devices ,sensors, & Actuators	13
V	Embedded application development with ARDUINO	14
Test & Model Exam		7
Total		80

RATIONALE:

Embedded system is inevitable in today's Industrial applications. Arduino is an open source based prototyping platform used to sense and control physical devices. The purpose of this subject is to become familiar with ARDUINO based embedded system design methods both in hardware and software

OBJECTIVES:

After learning this subject the student will be able to understand

- What is embedded system
- Classification and characteristics and applications of embedded system
- Different types of ARDUINO BOARDS and its descriptions
- Embedded C programming
- Structure of ARDUINO sketch
- ARDUINO built in library functions
- Interface with input and output devices like, switches, LED's
- Interface different kinds of sensors with ARDUINO board
- Interface with Actuators like stepper motor, DC motor, and servomotor
- To build applications like digital ohm meter, digital thermometer
- To build applications like digital lux meters, and distance measuring meter
- To build applications with wireless communication interface like Bluetooth
- To build applications to measure humidity
- To build application to interface with internet

DETAILED SYLLABUS

Contents: Embedded System Design with Arduino (Elective Theory-I)

Unit	Name of the Topics	Hours
I	INTRODUCTION TO EMBEDDED SYTEMS Definition of Embedded Systems-Embedded System vs General Computing Systems - Embedded Systems Classification (Small Scale, Medium Scale and Sophisticated) – Major Application Areas – Purpose of Embedded Systems-Characteristics and Quality Attributes of Embedded Systems.	16
II	ARDUINO HARDWARE Arduino – Advantages – Arduino History – Arduino family: Arduino Uno, Arduino Mega and Arduino Nano – Arduino uno Board descriptions – Arduino Mega Board descriptions – Arduino Due Board description – Arduino Board installation-Digital and Analog Peripherals– Arduino Mega Ports–Pins–Communication Models–Communication Interface	15
III	ARDUINOS OF TWARE & LIBRARY FUNCTIONS: Embedded C – Difference between C and Embedded C – Data types-constant-Variables-Variable scope (local, global)-Operators for Arduino –Arithmetic, logical, Boolean, bitwise, compound–control Statements–if- if else- if else if else –switch case –While – Do while –for loop-infinite loop – Function declaration –Time manipulation functions-declaring array - Arduino Function Libraries: pin Mode() function-digital Read(), digital Write()function- analog Read function()-analog Reference() function-Familiarizing with Arduino IDE–Sketch designing for Arduino	15
IV	ARDUINO INTERFACE WITH DEVICES, SENSORS and ACTUATORS 4.1.Hardware and Arduino sketch for Devices: Arduino Hardware and sketch for- Blinking LED, Brightness control of LED ,Reading analog voltage, Reading analog voltage and displaying in LED Bar graph, Interfacing seven segment Display-Interfacing 16X2 LCD display, Interfacing relay sand buzzer with switches 4.2.Hardware and Arduino sketch for sensors:	5

	Arduino Hardware and Sketch for – temperature sensor LM35, Humidity sensor DHT22, IR motion sensor PIR – ultrasonic sensor HC-SR04- Light sensor LDR 4.3.Hardware and Arduino sketch for Actuators: Arduino hardware and sketch for DC Motor-Servomotor–Stepper Motor	4 4
V	EMBEDDED APPLICATION DEVELOPMENT WITH ARDUINO Arduino Hardware and sketch for - measuring unknown resistance, to measure temperature, to measure light intensity, to measure distance in cm – to measure angle using potentiometer – to measure humidity – to communicate with android phone through Bluetooth – to use wifi and local area network—to send data through Internet - switches and LED control using I²C protocol	14

TEXT / REFERENCE BOOKS:

1. Introduction to Embedded Systems(2ndEdition)by KVShibu, McGraw Hill India
2. Embedded Systems Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill Publishing
3. Arduino Based Embedded Systems Interfacing, Simulation and Lab View GUI by RajeshSingh, AnitaGehlot, Bhupendra Singh, Sushaban Choudhury, CRCPress
4. Sams Teach Your self Arduino Programming in24 Hours by Richard Blum
5. Arduino for Dummies by John Nussey
6. Arduino Cookbook (3rd edition) by Michael Margolis, Brian Jepson and Nicholas Robert Weldin, O' Reilly
7. Arduino Made Simple with Interactive Projects by Ashwin Pajankar, BPB Publications
8. <https://arduino.cc>
9. <https://www.tutorialspoint.com/arduino/>

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VSEMESTER

2020–2021 onwards

4142540 Basics of Bio-Chemistry Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142540

Semester : V

Subject Title : **Basics of Bio-Chemistry Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Basics of Bio-Chemistry Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Basics of biochemistry involve the study of biomolecules and their metabolic reactions within the cells. So the students need the knowledge of vb practical exposure to biochemical analysis of biologically important molecules which enable them to analyze the variation in the biomolecules and their effects in diseased state

OBJECTIVES:

- To get practice about preparation of sample for biochemical analysis.
- To get practice about the estimation of biologically important molecules.
- To know the impact of variation in the level of biomolecules.
- To understand the clinical importance of biochemical analysis and their clinical significance in the diagnosis of disease.

DETAILED SYLLABUS

Contents: **Basics of Bio-Chemistry Practical**

LIST OF EXPERIMENTS

1. Collection of blood and Preparation of Serum and Plasma.
2. Estimation of True glucose - Glucose oxidase (GOD) method
3. Estimation of Total Protein-Biuret method
4. Estimation of Blood Urea - Diacetyl monoxime - Thiosemicarbazide (DAM-TSC) method
5. Estimation of Total Cholesterol-Modified Zak method and Sacket Method
6. Estimation of Triglycerides-Enzymatic method
7. Estimation of HDL/LDL cholesterol
8. Estimation of serum creatinine - Alkaline picrate method
9. Estimation of serum Bilirubin-Malloy & Evelyn method

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

IIIYEAR

N – SCHEME

VSEMESTER

2020–2021 onwards

4142550 Blood Banking Techniques Practical

ANNEXURE-I

STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS

N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : Diploma in Medical Laboratory Technology

Subject Code : 4142550

Semester : V

Subject Title : **Blood Banking Techniques Practical**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Blood Banking Techniques Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Blood banking techniques is most important in the field of blood bank and transfusion medicine. Blood banking techniques involve collection of donate blood, storage and typing of blood for transfusion and testing of infectious diseases. Students can practice about basic blood banking techniques through this subject and get fundamental knowledge

OBJECTIVES:

- To understand the technique of blood collection.
- To get practice about the Blood grouping techniques
- To get knowledge about the Compatibility testing
- To practice about preparation of anticoagulants

DETAILED SYLLABUS

Contents: **Blood Banking Techniques Practical**

List of Experiments

1. ABO blood grouping–Slide method and tube method
2. Rh typing–Slide method and Tube method
3. Testing for A1 and A2 subgroups
4. Cross matching - Major cross matching
5. Cross matching – Minor cross matching
6. Compatibility testing – Coomb's test – Direct method
7. Compatibility testing – Coomb's test – Indirect method
8. Preparation of Anticoagulants.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

V SEMESTER

2020–2021 onwards

**4141534 Physiotherapy and Operation Theatre Equipment's Practical
(Elective Practical-I)**

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4141534
 Semester : V
 Subject Title : **Physiotherapy and Operation Theatre Equipment's
 Practical (Elective Practical-I)**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours / Week	Hours / Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Physiotherapy and Operation Theatre Equipments Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

This subject includes an exposure to equipment used in electrotherapy, Physiotherapy and operation theatre of a hospital. Physiotherapy and electrotherapy job opportunities are available in assembly, Production, Sales, Repair and Maintenance of Electro physiotherapy and O.T Equipment.

OBJECTIVES:

Students will able to know

- Introduction to Physiotherapy
- Ultrasonic Therapy
- How to operate OT Machines

- How to operate Diathermy Unit
- How to operate Autoclaves
- How to operate Ambient Light Measurement
- How to operate Temperature Measurement

DETAILED SYLLABUS

Contents: Physiotherapy and Operation Theatre Equipments Practical
(Elective Practical-I)

LIST OF EXPERIMENTS

1. Operation and use of electro physiotherapy machines (Demonstration).
2. Electrical Safety Precautions while using physiotherapy and OT machines (Demonstration).
3. Circuit testing-cold tests live tests precautions
4. Measurement of voltage levels at various test points, wave form tests (where applicable) in good working machines like shortwave diathermy unit and ultrasonic therapy unit.
5. Troubleshooting of shortwave diathermy and ultrasonic therapy unit.
6. Measurement of ambient light and temperature in OT.
7. Sterilization of surgical instruments using Autoclave.
8. Study of Laparoscopic surgical procedures.
9. Visit to any Government or Private hospitals and submit a report.
10. Recording of various physiological parameters using patient monitoring system.
11. Measurement of flow rate using Syringe pump and Infusion pump
12. Measurement of heart rate using biotelemetry
13. Study of Pacemaker.

DETAILED ALLOCATION OF MARKS

S. No	Allocation	Marks
1	Circuit Diagram	25
2	Procedure & Connection	25
3	Execution & Handling of Equipments	25
4	Output / Result	20
5	Viva Voce	5
Total		100

LIST OF EQUIPMENTS

S. NO	NAME OF THE EQUIPMENTS	QUANTITY
1	Electro Physiotherapy Machines	1
2	OT Machines	1
3	Diathermy Unit	2
4	Ultrasonic Therapy Unit	2
5	Autoclave	1
6	Ambient Light Measurement KIT	1
7	Temperature Measurement KIT	1

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

V SEMESTER

2020–2021 onwards

4142562 Microbiology Practical (Elective Practical–I)

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142562
 Semester : V
 Subject Title : **Microbiology Practical (Elective Practical-I)**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Microbiology Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Diagnostic microbiology involves the identification of pathogenic microbes that causes disease and distinguishes from normal flora and from environmental organisms. The microbiology laboratory is essential for the diagnosis and treatment of infectious diseases. After the completion of this practical, it will provide opportunity to the students to develop diagnostic skills in microbiology, practical application and interpretation of laboratory tests for the diagnosis of infectious diseases

OBJECTIVES:

- To understand the culture techniques of various microbes like bacteria, fungi and virus
- To get practice about staining techniques of identification of microbes
- To get knowledge about the antibiotic sensitivity testing and analyzing suitable antibiotics for the treatment process.
- To practice about the how sterilize materials in the laboratory before and after usage.

DETAILED SYLLABUS

Contents: **Microbiology Practical (Elective Practical –I)**

LIST OF EXPERIMENTS

1. Cultivation of bacteria-Preparation of Media and Inoculation of Bacteria
2. Identification of colonial morphology – colony growth pattern
3. Microscopic morphology:
 - (i) Simple staining–Methylene blue staining
 - (ii) Grams Staining
 - (iii) Ziehl - Neelsen staining
4. Motility of bacteria-Hanging drop preparation
5. Antimicrobial susceptibility testing–Modified Kirby-Bauer method

SCHEME OF EVALUATION		
No.	Allocation	Marks
1	Methodology	30
2	Presentation	30
3	Tabulation & Calculation	25
3	Result	10
4	Viva Voce	05
Total		100

Equipments Required:

S.No	NAME OF THE EQUIPMENT	QUANTITY REQUIRED
1.	Auto clave	1
2.	Hot air oven	1
3.	Microscope	10
4.	Weighing balance(Digital)	1
5.	Media for Culture	
6.	Test tubes	50
7.	Test tube rack	25
8.	Beakers	10
9.	Conical flask	10
10.	Petridishes	50
11.	Measuring cylinder	5
12.	Incubator	1
13.	Staining Rack	1
14.	Spreader rod	2
15.	Glass rod	10
16.	Glass slides	100
17.	All the stains	
18.	Colony counter	1
19.	Slide box	2

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

V SEMESTER

2020–2021 onwards

**4042653 EMBEDDED SYSTEM DESIGN WITH ARDUINO PRACTICAL
(Elective Practical-I)**

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142653
 Semester : V
 Subject Title : **EMBEDDED SYSTEM DESIGN WITH ARDUINO PRACTICAL**
 (Elective Practical-I)

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Embedded System Design with Arduino Practical	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

The Arduino platform has become quite popular with people just starting out with electronics. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs- light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. Arduino is one of those Embedded System Devices (called a san Embedded Development Board), which got very famous in the maker's community due to its free and open source nature. Instrumentation Engineers must be familiar with embedded system development.

OBJECTIVES:

After learning this subject student will be able to

- Familiar with ARDUINO board, ARDUINO IDE and ARDUINO sketch
- To interface ARDUINO board with LCD
- Design digital ohmmeter to measure unknown resistance.
- Design digital thermometer to measure unknown temperature
- Design digital Lux meter to measure light intensity.
- Design embedded system to measure distance
- Design embedded system to measure humidity.
- Design embedded system to measure humidity
- Design embedded system to measure angular measurement
- Design embedded system to control stepper motor and servomotor
- Design embedded system to use I²C protocol and SPI protocol
- Design embedded system to communicate with Android phone through bluetooth
- Design embedded system to communicate with WIFI and local area network
- Design embedded system to communicate with Internet

DETAILED SYLLABUS

Contents: Embedded System Design with ARDUINO Practical
(Elective Practical-I)

List of Experiments:

1. Familiarization of ARDUINO board, ARDUINO IDE and ARDUINO sketch.
Develop C program to blink LED in the ARDUINO board.
2. Construct a circuit to interface 16X 2 LCD to ARDUINO hardware. Write a C program to display your name in the LCD.
3. Construct circuit using ARDUINO hardware and develop C program to measure unknown resistance and test it
4. Construct circuit using ARDUINO hardware and develop C program to measure temperature using LM35 temperature sensor and test it
5. Construct circuit using ARDUINO hardware and develop C program to measure light intensity using LDR and test it
6. Construct circuit using ARDUINO hardware and develop C program to measure distance using ultrasonic distance sensor and test it
7. Construct circuit using ARDUINO hardware and develop C program to measure angular displacement using potentiometer sensor and test it
8. Construct circuit using ARDUINO hardware and develop C program to measure humidity using Humidity sensor and test it
9. Construct circuit using ARDUINO hardware and develop C program to control speed, step and direction of Bipolar stepper motor
10. Construct circuit using ARDUINO hardware and develop C program to control Servo motor for angular positioning
11. Construct circuit using ARDUINO hardware and develop C program to interface switches and LED using I²C protocol

12. Develop C program to Send data from one Arduino board to another arduino board through SPI protocol (switch in one arduino and LED in another arduino)
13. Construct circuit using ARDUINO hardware and develop C program to communicate with Android phone through Bluetooth shield
14. Construct circuit using Arduino hardware and develop C program to use WIFI and Local area network
15. Construct circuit using Arduino hardware and develop c program to send data through Internet

EQUIPEMENT REQUIRED:

S. No	Name of the Equipments	Required No's
	Software required:-	
1	ARDUINO IDE - Open source software	1no
	Hardware required:-	
1	ARDUINO/ESP8266 Development Kit With switches, sensors, LCD, LED's, POT, LDR, etc.,	10 no's
2	Connecting wires	

Hardware requirement mentioned here is meant for a batch of 30 students only

SCHEME OF VALUATION

Circuit diagram	20 Marks
C program	40 Marks
Execution / Debugging	25 Marks
Result	10 Marks
Viva-voce	5 Marks
TOTAL	100 MARKS

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

V SEMESTER

2020–2021 onwards

ENTREPRENEURSHIP AND STARTUPS

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic Year 2020-2021 onwards)

Course Name : All Branches of Diploma in Engineering and
 Technology and Special Programmes.

Subject Code : 4142570

Semester : V

Subject Title : ENTREPRENEURSHIP AND STARTUPS

TEACHING AND SCHEME OF EXAMINATION

No of Weeks per Semester: 16 Weeks

Subject	Instruction		Examination			
	Hours/ Week	Hours/Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Entrepreneurship and Startups	4	64	25	75	100	3Hours

Topics and Allocation of Hours

UNIT	Topic	Hours
1	Entrepreneurship - Introduction and Process	10
2	Business Idea and Banking	10
3	Startups, E-cell and Success Stories	10
4	Pricing and Cost Analysis	10
5	Business Plan Preparation	10
Revision, Field visit and Preparation of case study report		14
Total		64

RATIONALE:

Development of a diploma curriculum is a dynamic process responsive to the society and reflecting the needs and aspiration of its learners. Fast changing society deserves changes in educational curriculum particularly to establish relevance to emerging socio-economic environments; to ensure equity of opportunity and participation and finally promoting concern for excellence. In this context the course on entrepreneurship and startups aims at instilling and stimulating human urge for excellence by realizing individual potential for generating and putting to use the inputs, relevant to social prosperity and thereby ensure good means of living for every individual, provides jobs and develop Indian economy.

OBJECTIVES:

At the end of the study of 5th semester the students will be able to

- To excite the students about entrepreneurship
- Acquiring Entrepreneurial spirit and resourcefulness
- Understanding the concept and process of entrepreneurship
- Acquiring entrepreneurial quality, competency and motivation
- Learning the process and skills of creation and management of entrepreneurial venture
- Familiarization with various uses of human resource for earning dignified means of living
- Know its contribution in and role in the growth and development of individual and the nation
- Understand the formation of E-cell
- Survey and analyze the market to understand customer needs
- Understand the importance of generation of ideas and product selection
- Learn the preparation of project feasibility report
- Understand the importance of sales and turnover
- Familiarization of various financial and non financial schemes
- Aware the concept of incubation and starts ups

DETAILED SYLLABUS

Contents: ENTREPRENEURSHIP AND STARTUPS

Unit	Name of the Topics	Hours
I	Entrepreneurship – Introduction and Process • Concept, Functions and Importance • Myths about Entrepreneurship • Pros and Cons of Entrepreneurship • Process of Entrepreneurship • Benefits of Entrepreneur • Competencies and characteristics • Ethical Entrepreneurship • Entrepreneurial Values and Attitudes • Motivation • Creativity • Innovation • Entrepreneurs - as problem solvers • Mindset of an employee and an entrepreneur • Business Failure – causes and remedies • Role of Networking in entrepreneurship	10 Hrs
II	Business Idea and Banking • Types of Business: Manufacturing, Trading and Services. • Stakeholders: sellers, vendors, consumers and competitors • E- commerce Business Models • Types of Resources - Human, Capital and Entrepreneurial tools and resources • Selection, utilization of human resources and professionals, etc. • Goals of Business; Goal Setting • Patent, copyright and Intellectual property rights • Negotiations - Importance and methods • Customer Relations and Vendor Management	10 Hrs

	• Size and capital based classification of business enterprises • Various sources of Information • Role of financial institutions • Role of Government policy • Entrepreneurial support systems • Incentive schemes for state government • Incentive schemes for Central Governments	
III	Startups, E-cell and Success Stories • Concept of Incubation centre's • Visit and report of DIC , financial institutions and other relevance institutions • Success stories of Indian and global business legends • Field Visit to MSME's • Study visit to Incubation centers and start ups • Learn to earn • Startup and its stages • Role of Technology – E-commerce and Social Media • Role of E-Cell • E-Cell to Entrepreneurship	10 Hrs
IV	PRICING AND COST ANALYSIS • Calculation of Unit of Sale, Unit Price and Unit Cost • Types of Costs - Variable and Fixed, Operational Costs • Break Even Analysis • Understand the meaning and concept of the term Cash Inflow and Cash Outflow • Prepare a Cash Flow Projection • Pricing and Factors affecting pricing • Understand the importance and preparation of Income Statement • Launch Strategies after pricing and proof of concept • Branding - Business name, logo, tag line	10 Hrs

	● Promotion strategy	
V	BUSINESS PLAN PREPARATION ● Generation of Ideas, ● Business Ideas vs. Business Opportunities ● Selecting the Right Opportunity ● Product selection ● New product development and analysis ● Feasibility Study Report – Technical analysis, financial analysis and commercial analysis ● Market Research - Concept, Importance and Process ● Marketing and Sales strategy ● Digital marketing ● Social Entrepreneurship ● Risk Taking-Concept ● Types of business risks	10 Hrs

REFERENCEBOOKS:

1. Dr. G.K. Varshney, Fundamentals of Entrepreneurship, Sahitya Bhawan Publications,Agra-282002
2. Dr. G.K. Varshney, Business Regulatory Framework , Sahitya Bhawan Publications,Agra-282002
3. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Entrepreneurship , McGraw Hill(India)PrivateLimited,Noida-201301
4. M.Scarborough, R.Cornwell, Essentials of Entrepreneurship and small businessmanagement,PearsonEducationIndia,Noida-201301
5. Charantimath Poornima M. Entrepreneurship Development and Small BusinessEnterprises,PearsonEducation,Noida-201301
6. Trott, Innovation Management and New Product Development, Pearson Education,Noida-201301

7. MN Arora, A Text book of Cost and Management Accounting, Vikas Publishing House Pvt. Ltd., New Delhi-110044
8. Prasanna Chandra, Financial Management, Tata McGraw Hill education private limited, New Delhi
9. I.V. Trivedi, Renu Jatana, Indian Banking System, RB SA Publishers, Rajasthan
10. Simon Daniel, HOW TO START A BUSINESS IN INDIA, BUUKS, Chennai-600018
11. Ramani Sarada, The Business Plan Write-Up Simplified - A practitioners guide to writing the Business Plan, Notion Press Media Pvt. Ltd., Chennai 600095.

Board Examination – Evaluation Pattern

Internal Mark Allocation

Assignment(Theory portion)*	- 10
Seminar Presentation	- 10
Attendance	- 5
Total	- 25

Note: *Two assignments should be submitted. The same must be evaluated and converted to 10 marks.

Guide lines for assignment:

First assignment - Unit I

Second assignment - Unit II

Guidelines for Seminar Presentation - Unit III

Each assignment should have five three marks questions and two five marks questions.

BOARD EXAMINATION

Note

1. The students should be taught all units and proper exposure and field visit also arranged. All the portions should be completed before examinations.
2. The students should maintain theory assignment and seminar presentation. The assignment and seminar presentation should be submitted during the Board Practical Examinations.
3. The question paper consists of theory and practical portions. All

students should write the answers for theory questions (40 Marks) and practical portions (60Marks) should be completed for Board Examinations.

4. All exercises should be given in the question paper and students are allowed to select by lot. If required the dimensions of the exercises may be varied for every batch. No fixed time allotted for each portion and students have liberty to do the examination for 3Hrs
5. For Written Examination: theory question and answer: 45Marks
Ten questions will be asked for 3marks each. Five questions from each unit 1& 2. (10X3=30).
Three questions will be asked for 5 marks each. One question from each unit 1,2 & 3.(3X5=15)
6. For Practical Examination: The business plan / Feasibility report or Report on Unit 4 & 5 should be submitted during the board practical examinations. The same have to be evaluated for the report submission (40marks).

DETAILED ALLOCATION OF MARKS

Sl. No	Description	Marks
Part A	Written Examination - Theory Question and answer (10 questions x3marks:30marks) & (3 questions x5 marks:15marks)	45
Part B	Practical Examination - Submission on Business Plan/Feasibility Report or Report on Unit 4 & 5	40
Part C	Viva voce	15
	Total	100

VI SEMESTER

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VI SEMESTER

2020–2021 onwards

4142610 Radiological Equipments

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142610

Semester : VI

Subject Title : Radiological Equipments

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Radiological Equipments	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	.X-Ray	14
II	Tomography and computer Tomography	15
III	Fluoroscopy	14
IV	MRI and Mammography	15
V	Radiation Therapy and Radiation safety	15
Test & Model Exam		7
Total		80

RATIONALE:

Radiology plays a huge role in disease management by giving physicians more options, tools, and techniques for detection and treatment. Every DMLT engineer is in need of knowledge and skill about various diagnostic equipments which plays vital role in medical field. This subject provides the basics, construction and working of X-Ray, MRI, CT scan, fluoroscopy and radiological safety

OBJECTIVES:

.The student should be made to

- Understand the generation of X-ray and its uses in imaging
- Learn different types of radio diagnostic instruments and techniques
- Describe the principle of Computed Tomography.
- Know the techniques used for visualizing various sections of the body.
- Learn the principles of different radio diagnostic equipment in Imaging
- Learn radiation therapy methodologies and the safety.

DETAILED SYLLABUS

Contents: Radiological Equipments

Unit	Name of the Topics	Hours
I	<u>X-Ray</u> Introduction - Electromagnetic spectrum - properties of electromagnetic waves, Types of rays - Quantum effects existing for Electromagnetic waves-units to measure radioactivity, Types of X-Ray radiations, X-ray , Block diagram of X-ray Tube, Block diagram of X-ray Machine, applications of X-Ray	14
II	<u>Tomography and computer Tomography</u> Tomography: Basic principle - Theory of tomography - multi section radiography-Tomography equipment - subtraction, Dodging. Computed Tomography: Basic principle - Mathematical basis of image construction [back projection reconstruction] -Block diagram of a Computer Tomography(CT) scanner-Spiral CT,3D Imaging and its application	6 9
III	<u>Fluoroscopy:</u> Fluoroscopic Equipment- Direct fluoroscopy-Fluoroscopic screen-Fluoroscopic image- factors affecting fluoroscopic image-Difference between radiography and fluoroscopy ,Angiography-concepts and types	14
IV	<u>MRI and Mammography</u> MRI: Fundamentals of Magnetic resonance-Interaction of Nuclei with static magnetic field and Radio frequency wave-rotation and precession-Induction of magnetic resonance signals, MRI parameters-spin density,Spin lattice relaxation time t_1, Spin-spin relaxation time t_2, blockdiagram of a MRI system and its applications Mammography: Basic principles-equipment details-heel effect-compression paddle-and its advantages-viewing conditions-Magnification mammography and digital mammography	9 6

V	<u>Radiation Therapy and Radiation safety</u> Radiation Therapy-linear accelerator, Tele gamma medicine, SRS-SRT,- recent techniques in radiation therapy- 3DCRT-IMRT-IGRT and Cyber knife- radiation measuring instruments-Dosimeter, film badges, Thermo Luminescent dosimeters - electronic dosimeter- Radiation protection in medicine-radiation protection principles	15
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TEXT BOOKS:

1. Steve Webb, the Physics of Medical Imaging, Adam Hilger, Philadelphia, 1988 (Units I, II, III&IV).
2. R. Hendee and Russell Ritenour "Medical Imaging Physics", Fourth Edition William, Wiley-Liss,2002.

REFERENCE BOOKS:

1. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine"- Third edition Springer,2006.
2. B.H. Brown, PV Law ford, R H Small wood , D R Hose, D C Barber, "Medical physics and biomedical Engineering", - CRC Press, 1999.
3. Myer Kutz, "Standard handbook of Biomedical Engineering and design", McGraw Hill, 2003.
4. P.Ragunathan, "Magnetic Resonance Imaging and Spectroscopy in Medicine

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VI SEMESTER

2020–2021 onwards

4142620 - Diagnostic and Therapeutic Equipments

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142620

Semester : VI

Subject Title : Diagnostic and Therapeutic Equipments

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Diagnostic and Therapeutic Equipments	5	80	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Physiological & clinical measurements	15
II	Bio-medical recorder	14
III	Therapeutic instruments	15
IV	Electrotherapy equipment and therapeutic lasers	14
V	Respiratory aids and special equipments	15
Test & Model Exam		7
Total		80

RATIONALE:

Bio medical engineering education is in the growing stage. But every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of various medical equipments. This course to enable the students to learn the basic principles of different bio medical instruments viz clinical measurement, Bio-medical recorders, therapeutic instruments, Biotelemetry and Modern imaging techniques instruments.

OBJECTIVES:

To impart knowledge on

1. Principle of various bio potential recordings equipment.
2. Working of equipment used for physiological parameters.
3. Diagnostic and therapeutic procedures
4. Pulmonary analyzers and aid equipments and their functions on respiratory system
5. Instruments dealing with kidney and bones, sensory measurements and special equipments

DETAILED SYLLABUS

Contents: **Diagnostic and Therapeutic Equipments**

Unit	Name of the Topics	Hours
I	Physio logical & clinical measurements: Components of man instrument system – Bio-potential and their generation—resting&action potential—propagation of action potential. Electrodes-Micro- Skin, Surface –Needle electrodes. Measurement of blood pressure (direct & indirect) - instantaneous flow (Electromagnetic blood flow meter, Ultrasonic blood flow meter).— blood PH. Measurement of Respiration rate — Lung Volume — Heart rate—Temperature (Body temperature & Skin Temperature).	15
II	Bio–medical recorder: Electrocardiography (ECG),- Lead system –ECG Electrodes – ECG Amplifiers –ECG recording –analysis of ECG curves. Nervous system-EEG recorder -10-20 lead System-EEG wave types – Clinical use of EEG— brain Tumor. Electromyography (EMG) - EMG Waves—Measurement of conduction velocity – electroretinography (ERG). Phonocardiography Audiometer – Types – Basic Audio meter. Bekesy Audiometer	14
III	Therapeutic instruments: Cardiac pacemaker- Classification –External pacemaker-Implantable pacemaker-Programmable pacemaker (only concepts).—power source of implantable pacemaker (Hg batteries, Nuclear Batteries, Lithium cells).Cardiac Defibrillators-Types –AC-DC defibrillators. Heart lung Machine –Oxygenators–Blood pumps-Peristolic pump-Heart valves- problems of artificial heart valves.Dialysis-Hemodialysis–peritoneal dialysis.	15

IV	Electro therapy equipment and therapeutic lasers: High frequency heat therapy, Principle, Short wave diathermy, Micro wave diathermy, Ultrasonic therapy, Lithotripsy, Therapeutic IR radiation, Therapeutic UV Lamps. Basic principles of Biomedical LASERS: Application of lasers in medicine, CO ₂ laser, He-Ne laser, Nd-YAG and Ruby laser.	14
V	Respiratory aids and special equipments: Ventilator-Need, Types, Intermittent positive pressure, breathing apparatus operating sequence, electronic IPPB unit with monitoring for all respiratory parameters, Humidifier, Nebulizer, Aspirator. Laparoscopy - Cryogenic Equipment - Automated drug delivery system – Components of drug infusion system – Implantable infusion systems, BMD Measurements – SXA – DXA – Quantitative ultrasound bone densitometer	15

Reference Books

1. "Jacobson and Webster" "Medicine and clinical Engineering", Prentice-Hall.
2. "Kumaradoss" "Medical Electronics" Cambridge University-2nd edition Press-2003"
3. "B.R. Klin" "Introduction to Medical Electronics" "Mcgraw hill international edition, 3rd edition, 1989"
4. "Mandeep Singh" "Introduction to Biomedical Instrumentation" "PHI Learning Pvt. Ltd, 2nd edition 2010"

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VI SEMESTER

2020–2021 onwards

**4142631 Installation, Maintenance and Safety Handling of Medical
Equipments (Elective Theory–II)**

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142631
 Semester : VI
 Subject Title : Installation, Maintenance and Safety Handling of Medical Equipment **(Elective Theory-II)**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Installation, Maintenance and Safety Handling of Medical Equipment	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Installation of medical equipment	12
II	Maintenance and servicing of medical equipment	11
III	Stabilizers, Inverters and power supplies	11
IV	Safety aspects	11
V	Servicing of medical equipment	12
Test & Model Exam		7
Total		64

RATIONALE:

Every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of various medical equipment's. This course to enable the students to learn the basic principles of different biomedical instruments and how to install, maintain and servicing of the instruments.

OBJECTIVES:

- To understand the scope of healthcare services
- To familiarize the medical device working standards, maintenance procedures
- To know the need of biomedical engineers in research and development
- Learn the troubleshooting of medical equipment.
- Apply the tools in design, testing and developing medical equipment
- To learn about the importance of patient safety and various methods of accident prevention

DETAILED SYLLABUS

Contents: Installation, Maintenance and Safety Handling of Medical Equipment
(Elective Theory-II)

Unit	Name of the Topics	Hours
I	INSTALLATION OF MEDICAL EQUIPMENT Selection of proper site for the installation of small equipment available in institute, availability of electrical connections (sockets/switches) of proper ratings, minimal use of loose wiring. Non conducting (electrical) Lab tables for equipment installation. Space for handling of equipment. Design and Fabrication of an electronic circuit, equipment, nature of Faults, troubleshooting (fault location, fault-finding) aids. Trouble-shooting techniques, procedure, component tests, Ground systems, systematic troubleshooting checks. Temperature sensitive intermittent problems, corrective action preventive maintenance, service and maintenance laboratory, professional qualities and work habits	12
II	MAINTENANCE AND SERVICING OF MEDICAL EQUIPMENT ECG machine – EEG Machine - X-Ray Machine – Colorimeter – Auto analyzer – Electro surgical unit – Incubator – Bed Side Monitor - Defibrillator	11
III	STABILIZERS, INVERTERS AND POWER SUPPLIES Use and installation of stabilizers, generators in Hospital, Nursing Home, in laboratory of the institute, their ratings. Time delays of CVT, SMPS, UPS- UPS: various type, Basic principles, block diagrams of online, and off-line, systems. - Inverters: Selection of Inverter, load calculation, voltage and ampere ratings - Use and installation of above kind of equipment	11
IV	SERVICING OF MEDICAL EQUIPMENT Use and operation of equipment, understanding of probable effects, Operation of the equipment, cold tests –visual and by use of test instruments (generally multi-meter), finding loose, broken/burnout parts and components, electrical wire, fuse etc. Live tests - testing of power leads, fuses, and power supply circuit testing (voltage measurements) tests at different points in a machine. Finding faults in a machine and its repairs.	11

V	SAFETY ASPECTS Introduction - Radiation safety instrumentation - Physiological effects due to 50 Hz current passage - Micro-shock and macro-shock hazards of medical instruments - Electrical accidents in hospitals –Devices to protect against electrical hazards – Hospital architecture, hospital regulation, inspections of equipment, emergency power system, Oxygen safety, safety in the operating room, hazards of gases, pressure chambers, preventive maintenance	12
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REFERENCE BOOKS

1. Introduction to Biomedical Equipment Technology by Carr and Brown, Regents and Prentice Hall of India, New Delhi 2002
2. Principles of Bio-medical Instrumentation and Measurements by Leslie Cromwell, Fred J Weibell, Erich A Pfeiffer Prentice Hall of India, New Delhi I Edition 2000
3. Principles of Biomedical Instrumentation and Measurements by Richard and Aston by MERRIL an Imprint of Macmillan Publishers Co New York. 1990
4. Modern Electronic Equipment Troubleshooting, Repair and Maintenance by RS Khandpur, Tata Mc Graw Hill Publishing House, New Delhi 1999
5. Hospitals Planning, Design and Management, by GD Kunders, S Gopinath and A Katakam, Tata Mc Graw Hill, Publishing House, New Delhi 2013

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VI SEMESTER

2020–2021 onwards

4142632 Medical Image Processing (Elective Theory–II)

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4142632

Semester : VI

Subject Title : Medical Image Processing (**Elective Theory-II**)

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Medical Image Processing	4	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Image processing fundamentals	11
II	Medical Image Enhancement	12
III	Modeling image degradation	11
IV	Medical Image Analysis and Classification	12
V	Image Compression	11
Test & Model Exam		7
Total		64

RATIONALE:

1. Comprehend image sampling and DFT
2. Process the given images to enhance the min spatial and frequency domains
3. Restore degraded images using frequency domain filters such as adaptive and Wiener filters
4. Extract features from a given image by segmentation and classify them
5. Develop algorithms for image compression
6. Register images from different modalities for better visualization and diagnosis
7. Develop algorithms for specific applications

OBJECTIVES:

1. To discuss digital image fundamentals and image enhancement techniques
2. To discover the principles filtering techniques in spatial domain and frequency domain for enhancement and restoration
3. To identify the segmentation techniques for feature extraction from images and classification

DETAILED SYLLABUS

Contents: Medical Image Processing (Elective Theory-II)

Unit	Name of the Topics	Hours
I	Image processing fundamentals Modulating transfer function of visual system, Digitizing an image, medical image formats, image quality and information content –his to gram, entropy, Fourier Transform and spectral contents, Signal-to-Noise-Ratio	11
II	Medical Image Enhancement Digital subtraction angiography, image averaging, gray scale transforms, Histogram transformation, Contrast enhancement, Low pass and high pass filtering in spatial and frequency domain, application to xray images and ultra sound images	12
III	Modeling image degradation Inverse filtering, Wiener filtering, motion de blurring, blinded blurring.	11
IV	Medical Image Analysis and Classification Image segmentation —pixel based, edge based, and region based, morphological operations. Representation of shapes and contours, shape factors, statistical analysis of texture. Feature extraction and image classification - statistical, rule based and neural network approaches, application to microscopic, CT and MRI images	12
V	Image Compression Lossy Vs lossless compression, distortion measures and fidelity criteria, Direct source coding, transform coding, predictive coding, Image coding and compression standards, application to medical images	11

Reference Books

1. Rafael C. Gonzales, Richard E.Woods, "Digital Image Processing", 2016, 3rd edition, Pearson Education, Noida

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VI SEMESTER

2020–2021 onwards

4044633 Computer Hardware and Servicing (Elective Theory–II)

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology

Subject Code : 4044633

Semester : VI

Subject Title : Computer Hardware and Servicing (**Elective Theory-II**)

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Computer Hardware and Servicing	6	64	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

Topics and Allocation of Hours

UNIT	Topic	Hrs.
I	Mother Board Components	11
II	Memory & I/O Devices	12
III	Display, Power Supply & Bios	12
IV	Desktop, Laptop, Mobile and Tablet PC	12
V	Future Hardware Systems	10
Test & Model Exam		7
Total		64

RATIONALE:

Computers do much working in medical labs. As computers play a major role in hospital information system, data analysis in medicine, medical imaging, computing, a medical lab technology student should be able to install and maintain keyboard, printer, mouse, monitor, etc. along with the computer system. The students will get to know how various peripherals communicate with central processing unit of the computer system and pattern their respective operations. They should also know about the hardware and software installations in computer and Laptop. This subject provides the required background knowledge of installation, maintenance and testing of peripherals with Computers and Laptops.

OBJECTIVES:

On completion of the following units of syllabus contents, the students must be able to

- Know the evolution of Personal Computer from PC through Corei and Laptop.
- Know and explain the major components that make up the system unit.
- Know the data process and store the minmeaninful information.
- Explain about the principle of operations of Keyboard, Mouse and Displays.
- Understand the components of media system.
- Know the Basics, working principle, specification and modern technology of different types of drives.
- KnowthespecificationofI/OPortsofallI/OdeviceslikeSerial,Parallel,USB—Gameport,BluetoothandIPConnectors
- Know the operation, working principle and troubleshooting of devices like Dotmatrix, Ink-jet, Laser, Thermal, MFP Printers.
- Know the aspects related to Power Supply.
- Understand & troubleshoot the common problems in the computer system and the peripherals
- Know and explain the major components & troubleshooting of Laptop.
- Understand the basic components and tools used in servicing of Mobile phones.
- Know to install the software required for mobile phones and to maintain it.
- Understand the basics of Non Volatile Memory(NVM), Remote Direct Memory Access (RDMA)and Embedding hardware.

DETAILED SYLLABUS

Contents: Computer Hardware and Networking (Elective Theory-II)

UNIT- I MOTHER BOARD COMPONENTS		11 HOURS
1.1	Motherboard components: Process or sockets / slots —Memory sockets — Chipsets — Cache— BIOS — Clock generator — RTC — Super I/O Controller—Power connector—Battery—Keyboard/Mouse Connectors—Jumpers—Ports and Headers—Pin Connectors-Motherboard Form factor-Hardware, Software and Firmware.	3
1.2	Computer Peripheral devices: Internal and External devices	2
1.3	Processors: Introduction—Core2Duo processor, Quad core processor, Core i3, i5, i7series, AMDAIO series, Xeon Processor.	2
1.4	Chipsets: Chipset basics-North/South Bridge architecture and Hub architecture.	2
1.5	Bus Standards: Overview and features of PCI, AGP, USB, & Processor Bus.	2
UNIT-II MEMORY AND I/O DEVICES		12 HOURS
2.1	Primary and Secondary Memory: Introduction. Main Memory — Types —Organization, Access time, Cycle time, and Memory errors and Error detection Techniques. Hard Disk: Introduction —Construction—WorkingPrinciple—FileSystems—FormattingandTroubleshooting.	2
2.2	Removable Storage and Special Devices: DVD-ROM — Recordable DVD Rewritable DVD. Blu-ray: Introduction-Blu-ray Disc Para meters-Recording and Playback Principles. Special drives: External drives, Memory stick, USB flash drive, Solid state drive. Data Recovery tools -DOS, and Third party tools.	3
2.3	Keyboard and Mouse: Keyboard: Interfacing and Signals (USB, Wireless), Types of keys, Keyboard Matrix, Key bouncing, Types of keyboard (Simple, Mechanical).Mouse: Optical mouse operation— Optical mouse cleaning—Troubleshooting flow chart for a mouse.	2
2.4	Printers and Scanners: Printer: Introduction Types of printers — Dot Matrix, Inkjet, Laser, Thermal, MFP printer (Multi-Function Printer) – Operation and Troubleshooting. Scanner: Introduction, Scanner mechanism, Working principle—Types of Scanners (Barcode,	3

	Handheld, Flatbed) — Preventive maintenance, and Troubleshooting tools.	
2.5	Special I/O Devices: Track ball, Touch pad, Pointing stick, Joystick, Light pen, Graphic tablet, Camera, Bar-code reader, RFID reader	2
UNIT-III DISPLAY, POWER SUPPLY AND BIOS		12 HOURS
3.1	Displays and Graphic Cards: Displays: LCD Principles — Plasma Displays -TFT Displays – LED Displays. Graphic Cards: Video capture card – Troubleshoot display and graphics card problems	3
3.2	SMPS: Block diagram Basic Principles and Operations O/P Voltage — Cable color code — Connectors and Power Good — Common Failures (No circuit diagram to be discussed)	3
3.3	Bios: Bios functions—Cold and Warm booting —BIOS error codes — BIOS interrupts — BIOS advanced setup. Upgrading BIOS, Flash BIOS-setup. Identification of different BIOS (AMI,AWARD BIOS).	4
3.4	POST: Error, Beep Codes, Error messages, Post — Faults related to Hardware.	2
UNIT-IV DESKTOP, LAPTOP, MOBILE AND TABLET PC		12 HOURS
4.1	Upgrading of Systems: Hardware up-gradation. Updating of System &Application software: Device Driver - OS Update and Firewall Security —Control panel-Installed devices and properties—Install procedure, Roll back or Uninstall procedure, Tests of various device driver software.	2
4.2	Installation and Troubleshooting: Formatting, Partitioning and Installation of OS —Trouble Shooting Laptop and Desktop computer problems - .Antivirus and Application Software Installation — Backup and Restore procedure –Recovery software	2
4.3	Networking:Peer-to-PeerandClient/ServerNetwork,Ethernet,WI-Fi,Bluetooth,MobileNetworking,WiredandwirelessNetworking-Understanding Wireless Network protocols- 802.11a, 802.11b,802.11g,802.11n,802.11ac	2

4.4	Laptop: Difference between laptop and desktop- Types of laptop — working principles—Configuring laptops and power settings - Upgrade RAM, Hard disk, Replacing battery-Configuration of camera, mic, WLAN, Bluetooth, Touch pad Laptop and Keyboard.	2
4.5	Mobile phone: Basics of mobile communication, Battery- antenna-earpiece- Microphone - Speaker- Buzzer -LCD- keyboard. Basic circuit board components — Names and functions of different ICs used in mobile phones. Installation & Troubleshooting: Mobile servicing kit, Assembling and disassembling of different types of mobile phones – Installation of OS – Fault finding & troubleshooting	2
4.6	Introduction to Tablet PC: Digitizers Versus Touch-Screen Displays, Merits and Demerits. Comparisons: Laptops, Desktops, Pocket PC, Other PDAs, Other Pen-Based Computers, Differences in Hardware. Windows XP Tablet PC Edition Configuration : Basic Interface Settings, Screen Settings, Display Properties, Other Settings and Options	2

UNIT–V FUTURE HARDWARE SYSTEMS

10 HOURS

5.1	Moore's law, Calculating the Hardware Growth using Moore's Law, Introduction to Non Volatile Memory Technology,- Architecture of NVM Technology – Advantages and Scope of NVM Technology	2
5.2	Emerging Non Volatile Memory Technologies (Concepts only)- Magnetic Random Access Memory(MRAM),Spin Transfer Torque Random Access Memory(STT-RAM)-Ferro electric Random Access Memory (Fe RAM), Phase Change Memory(PCM)and Resistive Random-Access Memory (RRAM).	3
5.3	Introduction to Advanced Network technologies : Remote Direct Memory Access(RDMA)-Working Principle of RDMA—Limitations and Challenges in RDMA technology	2
5.4	Embedded Systems-Basic concepts-Embedded Board and the Von Neumann Model-Basic Electronics of Embedded devices-AC Circuits, DC Circuits and Active Devices-Power supply-Scope, Control and Probes –Advantages and Applications of Embedded devices.	3

Reference Books

S.No	Title	Author	Publisher	Year of Publishing /Edition
1	Computer Installation and Servicing	D.Bala subramanian	Tata Mc-Graw Hill, New Delhi	Second Edition 2010
2	Trouble shooting, Maintaining and Repairing PCs	Stephen J.Bigelow	TMH, New Delhi	Fifth Edition
3	PC Hardware in a nut shell	Robert Bruce Thompson.	O'Reilly Media	Third Indian Reprint 2008.
4	The Laptop Repair Work book : An Introduction to Trouble shooting and Repairing Laptop Computers	Morris Rosenthal	Foner books	First Edition 2008
5	The Cell Phone Hand book	P.J. Stetz and Peneloe Stetz	Find Tech Ltd	Second Edition
6	Advanced Mobile Repairing	Pandit Sanjib	BPB Publication, New Delhi	First Edition 2010
7	Absolute Beginner's Guide to Tablet PCs	Craig F. Mathews	Tool Kits, Inc.	First Edition 2004
8	Embedded Hardware: Know It All	Ganssle J, Noergaard T, Eady F, Edwards L, Katz DJ, Gentile R, Arnold K, Hyder K, Perrin B	Newnes	1 st Edition (2007)

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

VI SEMESTER

2020–2021 onwards

**4142640 Diagnostic and Therapeutic Equipments
Practical**

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142640
 Semester : VI
 Subject Title : Diagnostic and Therapeutic Equipments Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Diagnostic and Therapeutic Equipments Practical	6	96	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Bio medical engineering education is in the growing stage. But every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of various medical equipments. This course to enable the students to learn the basic principles of different biomedical instruments viz clinical measurement, Bio-medical recorders, Therapeutic instruments, Biotelemetry and Modern imaging techniques instruments

OBJECTIVES:

To provide hands on training on Measurement of physiological parameters, biochemical parameters measurement and bio signal analysis.

DETAILED SYLLABUS

Contents: Diagnostic and Therapeutic Equipments Practical Exercise

1. Design and analysis of biological pre amplifiers
2. Recording of ECG signal and analysis
3. Recording of EMG-Signal
4. Recording of EEG-Signal
5. Recording of various physio logical parameters using patient monitoring system and telemetry units.
6. Measurement of pH and conductivity.
7. Measurement and recording of peripheral blood flow
8. Measurement of visually evoked potential.
9. Study of characteristics of optical I solation amplifier
10. Galvanicsk in resistance(GSR)measurement

DETAILED ALLOCATION OF MARKS

SL.NO	DESCRIPTION	MARKS
1.	Circuit Diagram	30
2.	Connections	30
3.	Reading& Graph	25
4.	Result	05
5.	Viva	10
6.	TOTAL	100

LISTOFEQUIPMENTS

- Multi parameter patient monitoring system: 1 No.
- EEG recorder with accessories forevokedstudies:1 No.
- ECG recorder: 1 No.
- EMG recorder: 1 No.
- pH meter,conductivitymeter:1 No.
- Bloodflowmeasurementsystemusingultrasoundtransducer:1 No.

- GSR measurement setup.: 1 No.
- Function Generators
- DSOs
- Regulated Power supplies
- Breadboards
- IC741

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N-SCHEME

VI SEMESTER

2020–2021 onwards

**4142651 Installation, Maintenance and Safety Handling of Medical
Equipment Practical
(Elective Practical–II)**

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142651
 Semester : VI
 Subject Title : **Installation, Maintenance and Safety Handling of Medical Equipment Practical (Elective Practical–II)**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Installation, Maintenance and Safety Handling of Medical Equipment Practical	6	96	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

Every year, there is a tremendous increase in the use of modern medical equipment in the hospital and health care industry therefore it is necessary for every student to understand the functioning of various medical equipment's. This course to enable the students to learn the basic principles of different bio medical instruments and how to install, maintain and servicing of the instruments.

OBJECTIVES:

- To understand the scope of health care services
- To familiarize the medical device working standards, maintenance procedures
- To know the need of biomedical engineers in research and development
- Learn the troubleshooting of medical equipment.
- Apply the tools in design, testing and developing medical equipment

DETAILED SYLLABUS

Contents: Installation, Maintenance and Safety Handling of Medical Equipment Practical
(Elective Practical-II)

LIST OF EXPERIMENTS

1. Testing of electrical installation in the institute from electrical power meter output to the electrical output points (sockets), safety devices and their proper installations, loose connection. Earthing preparation and installation of proper earthing and its extension to electrical points.
2. Installation of small medical equipment in laboratories of the institute, precautions to be taken.
3. Study of large medical equipment in hospital/nursing home (Special emphasis to x-ray machines)
4. Installation of stabilizers, inverters, generators in laboratory of the institute nursing home / hospital.
5. Maintenance schedule for different equipment and their records in a hospital.
6. Servicing of small medical machines / equipment in Laboratory.
7. Operating And Maintenance Of the electrical centrifuge machine.
8. Assembling, Disassembling and Maintenance of microtome machine
9. Precautionary measures and uses of microscope while its operation.
10. Operate the machine and familiarize with its external control of the machine.
11. To find out the concentration of Na^+ , K^+ and Ca^+ of given blood sample.

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

VI SEMESTER

2020–2021 onwards

4142652 Medical Image Processing Practical (Elective Practical–II)

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2021 -2022 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142652
 Semester : VI
 Subject Title : Medical Image Processing Practical **(Elective Practical-II)**

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Medical Image Processing Practical	6	96	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

The students of medical Lab technology are essential people in hospital and medical industry. They are trained to attend to the faults in medical devices and instruments including imaging instruments. Medical Imaging is a vital part of medical diagnosis. It is necessary for the students to understand the concepts of medical image processing. This subject covers the basics of image processing that is necessary for detection and classification.

OBJECTIVES:

1. To discuss digital image fundamentals and image enhancement techniques
2. To discover the principles filtering techniques in spatial domain and frequency domain for enhancement and restoration
3. To identify the segmentation techniques for feature extraction from images and classification.

DETAILED SYLLABUS

Contents: **Medical Image Processing Practical (Elective Practical–II)**

LIST OF EXPERIMENTS

S. NO	Medical Image Processing Practical	No. of hours
1	List of Experiments (Indicative) Read the given x-ray image using MATLAB software and perform contrast enhancement.	3
2	Read the given x-ray image using MATLAB software to remove the noise using spatial low pass filters. Compare the performance of filters.	3
3	Read the CT image of the given lungs image, perform intensity Enhancement, and extract the nodules in the lungs using MATLAB software.	3
4	Restore the given blurred image using Wiener filter	3
5	Perform segmentation of the given image using (i) single and Multi-threshold. Compare the outputs	3
6	Perform morphological operations on the given image and Perform background subtraction	3
7	Segment the tumor from the given MRI image using MATLAB software and determine its area and perimeter	3
8	Process the given endoscopic images and extract the tumor Detected using MATLAB software.	3
9	Extract the blood vessels from the given retinal image using MATLAB software.	3
10	Classify the given images using simple neural network classification	3
11	Compress the given image using Huffman code	3
12	Perform jpeg compression on the given image. Calculate the compression ratio	3

Equipment Required:

1.PC

2.MATLab software

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

VI SEMESTER

2020–2021 onwards

**4052640 Computer Hardware and Servicing Practical
(Elective Practical II)**

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4052640
 Semester : VI
 Subject Title : Computer Hardware and Servicing Practical
(Elective Practical-II)

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester:16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours /Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Computer Hardware and Networking Practical	6	96	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

RATIONALE:

The course aims at making the students familiar with various parts of computers and laptops and how to assemble them along with the different types of peripherals desired. In addition, the course will provide necessary knowledge and skills to the students in computer and laptop software installation and maintenance and also make them to diagnose the software faults. It also gives the knowledge and competency to diagnose the problems in computer hardware, note book, tablet and peripherals for systematic repair and maintenance of them.

OBJECTIVES:

On completion of the following exercises, the students must be able to

- Know the various indicators, switches and connectors used in Computers.
- Familiarize the layout of SMPS, motherboard and various Disk Drives.
- Configure Bios setup options.
- Install various Secondary storage devices with memory partition and formatting.
- Know the various types of Printer installation and to handle the troubleshooting ability.
- Assemble PC system and checking the working condition.
- Installation of Dual OS in a system.
- Identify the problems in Computer systems, Software installation and rectification
- Assembling and disassembling of Laptop to identify the parts and to install OS and configure it.
- Enable to perform different cabling in a network.
- Configure Internet connection and use utilities to debug the network issues.
- Configure router for any topology
- Install various packets sniffing tools in Linux
- Wireless file transfer
- Router Configuration in block website/ MAC addresses

DETAILED SYLLABUS

Contents: **Computer Hardware and Networking Practical**
(Elective Practical–II)

LAB EXERCISES

1	Identification of system layout (Study Exercise) a) Front panel indicators & switches and front side & rear side connectors. b) Familiarize the computer system Layout: Marking positions of SMPS, Motherboard, HDD, DVD and add on cards. c) Configure bios setup program and troubleshoot the typical problems using BIOS utility.
2	HARD DISK a) Install Hard Disk. b) Configure CMOS-Setup. c) Partition and Format Hard Disk. d) Identify Master / Slave / IDE Devices. e) Practice with Scan disk, Disk cleanup, Disk De-fragmentation, Virus Detecting and Rectifying Software.
3	a) Install and Configure a DVD Writer & Blu-ray Disc Writer. b) Recording a Blank DVD & Blu-ray Disc.
4	Printer Installation and Servicing a) Install and configure Dot matrix printer and Laser printer. b) Troubleshoot the above printers
5	Install and configure Scanner, Web cam, and Bio-metric device with system and trouble-shoot the problems
6	Assemble a system with add-on cards and check the working condition of the system and install IOS.
7	Do the following cabling works in a network a) Cable Crimping b) Standard Cabling c) Cross Cabling d) I/O Connector Crimping e) Testing the Crimped cable using a Cable tester

8	a) Configure Host IP, Subnet Mask and Default Gateway in a system in LAN (TCP / IP Configuration). b) Configure Internet connection and use IPCONFIG, PING / Tracert and Net stat utilities to Debug the Network issues.
9	a) Install and configure Network Devices: HUB, Switch and Routers b) Install and Configure Wired and transfer files between systems
10	a) Transfer files between systems in LAN using FTP Configuration. b) Install a Printer in LAN and share it in the network.
11	Installation of Dual OS in a system.
12	Installation and configuration of DHCP Server in Linux.
13	Installation of various open source packets sniffing tools and inspects packets in Linux.
14	Transfer files between desktop computers using Wi-Fi adapter using different OS
15	Configure Router to block websites using IP Address
16	Configure Router to block terminals using MAC filtering

Note:

The Students must and should install software. After the demonstration, the same should be uninstalled.

Each batch has to learn to install and use the tools.

SCHEME OF VALUATION

Procedure Writing – One Question	25Marks
Executing Exercise	30Marks
Result	10Marks
Demonstration of mini project	5Marks
VIVA-VOCE	5Marks
TOTAL	75Marks

REQUIREMENTS

Hardware Requirements:	
Desktop Systems	30Nos
Hard disk drive	06Nos
DVD, Blu-ray Drive	06Nos
Blank DVD, Blu-ray Disc	20Nos
Head Cleaning CD	05Nos
Dot matrix Printer	02Nos
Laser Printer	02Nos
Web Cam, Scanner, Finger print scanner	03Nos
Network Requirements:	
Crimping Tool	06Nos
Screwdriver set	06Nos
Network Cables	30Mtrs
Modem	02Nos
Hub	01No
Router	01No
Switch	02Nos
Software Requirements:	
Windows/Linux OS,DVD and Blu-ray Burning S/W.	

DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

III YEAR

N – SCHEME

VI SEMESTER

2020–2021 onwards

4142660 Project Work and Internship Report Practical

ANNEXURE-I
STATE BOARD OF TECHNICAL EDUCATION & TRAINING, TAMILNADU
DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY SYLLABUS
N-SCHEME

(Implemented from the Academic year 2020-2021 onwards)

Course Name : 4142 Diploma in Medical Laboratory Technology
 Subject Code : 4142660
 Semester : VI
 Subject Title : Project Work and Internship Report Practical

TEACHING AND SCHEME OF EXAMINATION

No of weeks per semester: 16 weeks

Subject	Instructions		Examination			
	Hours /Week	Hours/ Semester	Marks			Duration
			Internal Assessment	Board Examinations	Total	
Project Work and Internship Report Practical	6	96	25	100*	100	3Hrs.

* Examinations will be conducted for 100 marks and it will be reduced to 75 marks.

OBJECTIVES:

- Implement the theoretical and practical knowledge gained through the curriculum into an application suitable for a real practical working environment preferably in an industrial environment
- Get exposure on industrial environment and its work ethics.
- Learn and understand the gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key dates, asynchronous document sharing and discussions, as well as to prepare collaborative edition of the final project report.

INTERNAL ASSESSMENT:

The internal assessment should be calculated based on the review of the progress of the work done by the student periodically as follows.

Detail of assessment	Period of	Max. Marks
First Review	6 th week	10
Second Review	12 th week	10
Attendance	Entire semester	5
Total		25

EVALUATION FOR BOARD EXAMINATION

Details of Mark allocation	Max Marks
Demonstration / Presentation	25
Report	25
Viva-Voce	30
Internship Report	20
Total	100