THE ASSAM ROYAL GLOBAL UNIVERSITY

ROYAL SCHOOL OF MEDICAL AND ALLIED SCIENCES (RSMAS)

DEPARTMENT OF MEDICAL LABORATORY TECHNOLOGY (MLT)

COURSE STRUCTURE AND SYLLABUS FOR B.SC. IN MLT (Four Year Under-Graduate Program)

W.E.F

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(Based on National Education Policy 2020)

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Preamble

The National Education Policy (NEP) 2020 conceives a new vision for India's higher education system. It recognizes that higher education plays an extremely important role in promoting equity, human as well as societal well-being and in developing India as envisioned in its Constitution. It is desired that higher education will significantly contribute towards sustainable livelihoods and economic development of the nation as India moves towards becoming a knowledge economy and society.

If we focus on the 21st century requirements, the higher education framework of the nation must aim to develop good, thoughtful, well-rounded, and creative individuals and must enable an individual to study one or more specialized areas of interest at a deep level, and also develop character, ethical and Constitutional values, intellectual curiosity, scientific temper, creativity, spirit of service, and twenty-first-century capabilities across a range of disciplines including sciences, social sciences, arts, humanities, languages, as well as professional, technical, and vocational subjects.

Towards the attainment of holistic and multidisciplinary education, the flexible curricula of the University will include credit-based courses, projects in the areas of community engagement and service, environmental education, and value-based education. As part of holistic education, students will also be provided with opportunities for internships with local industries, businesses, artists, crafts persons, and so on, as well as research internships with faculty and researchers at the University, so that students may actively engage with the practical aspects of their learning and thereby improve their employability.

The undergraduate curriculums are diverse and have varied subjects to be covered to meet the needs of the programs. As per the recommendations from the UGC, introduction of courses related to Indian Knowledge System (IKS) is being incorporated in the curriculum structure which encompasses all of the systematized disciplines of Knowledge which were developed to a high degree of sophistication in India from ancient times and all of the traditions and practices that the various communities of India—including the tribal communities—have evolved, refined and preserved over generations, like for example Vedic Mathematics, Vedangas, Indian Astronomy, Fine Arts, Metallurgy, etc.

At RGU, we are committed that at the societal level, higher education will enable each student to develop themselves to be an enlightened, socially conscious, knowledgeable, and skilled citizen who can find and implement robust solutions to its own problems.

1. Introduction

The National Education Policy (NEP) 2020 clearly indicates that higher education plays an extremely important role in promoting human as well as societal well-being in India. As envisioned in the 21st-century requirements, quality higher education must aim to develop good, thoughtful, well-rounded, and creative individuals. According to the new education policy, assessments of educational approaches in undergraduate education will integrate the humanities and arts with Science, Technology, Engineering and Mathematics (STEM) that will lead to positive learning outcomes. This will lead to develop creativity and innovation, critical thinking and higher-order thinking capacities, problem-solving abilities, teamwork, communication skills, more in-depth learning, and mastery of curricula across fields, increases in social and moral awareness, etc., besides general engagement and enjoyment of learning. and more in-depth learning.

The NEP highlights that the following fundamental principles that have a direct bearing on the curricula would guide the education system at large, viz.

i. Recognizing, identifying, and fostering the unique capabilities of each student to promote her/his holistic development.
ii. Flexibility, so that learners can select their learning trajectories and programmes, and thereby choose their own paths in life according to their talents and interests.
iii. Multidisciplinary and holistic education across the sciences, social sciences, arts, humanities, and sports for a multidisciplinary world.
iv. Emphasis on conceptual understanding rather than rote learning, critical thinking to encourage logical decision-making and innovation; ethics and human & constitutional values, and life skills such as communication, teamwork, leadership, and resilience.
v. Extensive use of technology in teaching and learning, removing language barriers, increasing access for Divyang students, and educational planning and management.
vi. Respect for diversity and respect for the local context in all curricula, pedagogy, and policy. Equity and inclusion as the cornerstone of all educational decisions to ensure that all students can thrive in the education system and the institutional environment are responsive to differences to ensure that high-quality education is available for all. Rootedness and pride in India, and its rich, diverse, ancient, and modern culture, languages, knowledge systems, and traditions.

2. Approach towards Curriculum Planning:

2.1. Credits in Indian Context:

2.1.1. Choice Based Credit System (CBCS) by UGC

Under the CBCS system, the requirement for awarding a degree or diploma or certificate is prescribed in terms of the number of credits to be earned by the students. This framework is being implemented in several universities across States in India. The main highlights of CBCS are as below:

• The CBCS provides flexibility in designing curriculum and assigning credits based on the course content and learning hours.

• The CBCS provides for a system wherein students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning.

• CBCS also provides opportunity for vertical mobility to students from a bachelor's degree programme to masters and research degree programmes.

2.2. Definitions:

2.2.1. Academic Credit

An academic credit is a unit by which a course is weighted. It is fixed by the number of hours of instructions offered per week. As per the National Credit Framework.

1 Credit = 30 NOTIONAL CREDIT HOURS (NCH)

Yearly Learning Hours = 1200 Notional Hours (@40 Credits x 30 NCH)

30 Notional Credit Hours		
Lecture/Tutorial	**Practicum**	**Experiential Learning**
1 Credit = 15 -22 Lecture Hours	10-15 Practicum Hours	0-8 Experiential Learning Hours

2.2.2. Course of Study:

Course of study indicates pursuance of study in Graphic Design. The Graphic Design course shall offer Major Courses (Core), Minor Courses, Skill Enhancement Courses (SEC), Value Added Courses (VAC), Ability Enhancement Compulsory Courses (AECCs) and Interdisciplinary courses.

2.2.3. Disciplinary Major:

The major would provide the opportunity for a student to pursue in-depth study of a particular subject in Graphic Design. Students may be allowed to change major within the broad discipline at the end of the second semester by giving her/him sufficient time to explore interdisciplinary courses during the first year. Advanced-level disciplinary/interdisciplinary courses, a course in research methodology, and a project/dissertation will be conducted in the seventh semester. The final semester will be devoted to seminar presentation, preparation, and submission of project report/dissertation. The project work/dissertation will be on a topic in the disciplinary programme of study or an interdisciplinary topic.

2.2.4. Disciplinary/interdisciplinary minors:

Students will have the option to choose courses from disciplinary/interdisciplinary minors and skill-based courses. Students who take a sufficient number of courses in a discipline or an interdisciplinary area of study other than the chosen major will qualify for a minor in that discipline or in the chosen interdisciplinary area of study. A student may declare the choice of the minor at the end of the second semester, after exploring various courses.

2.2.5. Courses from Other Disciplines (Interdisciplinary):

All UG students are required to undergo 3 introductory-level courses relating to any of the broad disciplines given below. These courses are intended to broaden the intellectual experience and form part of liberal arts and science education. Students are not allowed to choose or repeat courses already undergone at the higher secondary level (12th class) in the proposed major and minor stream under this category.

i. Natural and Physical Sciences: Students can choose basic courses from disciplines such as Natural Science, for example, Biology, Botany, Zoology, Biotechnology, Biochemistry, Chemistry, Physics, Biophysics, Astronomy and Astrophysics, Earth and Environmental Sciences, etc.

ii. Mathematics, Statistics, and Computer Applications: Courses under this category will facilitate the students to use and apply tools and techniques in their major and minor disciplines. The course may include training in programming software like Python among others and applications software like STATA, SPSS, Tally, etc. Basic courses under this category will be helpful for science and social science in data analysis and the application of quantitative tools.

iii. Library, Information, and Media Sciences: Courses from this category will help the students to understand the recent developments in information and media science (journalism, mass media, and communication)

iv. Commerce and Management: Courses include business management, accountancy, finance, financial institutions, fintech, etc.,

v. Humanities and Social Sciences: The courses relating to Social Sciences, for example, Anthropology, Communication and Media, Economics, History, Linguistics, Political Science, Psychology, Social Work, Sociology, etc. will enable students to understand the individuals and their social behavior, society, and nation. Students be introduced to survey methodology and available large-scale databases for India. The courses under humanities include, for example, Archaeology, History, Comparative Literature, Arts & Creative expressions, Creative Writing and Literature, language(s), Philosophy, etc., and interdisciplinary courses relating to humanities. The list of Courses can include interdisciplinary subjects such as Cognitive Science, Environmental Science, Gender Studies, Global Environment & Health, International Relations, Political Economy and Development, Sustainable Development, Women's, and Gender Studies, etc. will be useful to understand society.

2.2.6. Ability Enhancement Courses (AEC): Modern Indian Language (MIL) & English language focused on language and communication skills. Students are required to achieve competency in a Modern Indian Language (MIL) and in the English language with special emphasis on language and communication skills. The courses aim at enabling the students to acquire and demonstrate the core linguistic skills, including critical reading and expository and academic writing skills, that help students articulate their arguments and present their thinking clearly and coherently and recognize the importance of language as a mediator of knowledge and identity. They would also enable students to acquaint themselves with the cultural and intellectual heritage of the chosen MIL and English language, as well as to provide a reflective understanding of the structure and complexity of the language/literature related to both the MIL and English language. The courses will also emphasize the development and enhancement of skills such as communication, and the ability to participate/conduct discussion and debate.

2.2.7. Skill Enhancement Course (SEC): These courses are aimed at imparting practical skills, hands-on training, soft skills, etc., to enhance the employability of students and

should be related to Major Discipline. They will aim at providing hands-on training, competencies, proficiency, and skill to students. SEC course will be a basket course to provide skill-based instruction. For example, SEC of English Discipline may include Public Speaking, Translation & Editing and Content writing.

2.2.8. Value-Added Courses (VAC):

i. Understanding India: The course aims at enabling the students to acquire and demonstrate the knowledge and understanding of contemporary India with its historical perspective, the basic framework of the goals and policies of national development, and the constitutional obligations with special emphasis on constitutional values and fundamental rights and duties. The course would also focus on developing an understanding among student-teachers of the Indian knowledge systems, the Indian education system, and the roles and obligations of teachers to the nation in general and to the school/community/society. The course will attempt to deepen knowledge about and understanding of India's freedom struggle and of the values and ideals that it represented to develop an appreciation of the contributions made by people of all sections and regions of the country, and help learners understand and cherish the values enshrined in the Indian Constitution and to prepare them for their roles and responsibilities as effective citizens of a democratic society.

ii. Environmental science/education: The course seeks to equip students with the ability to apply the acquired knowledge, skills, attitudes, and values required to take appropriate actions for mitigating the effects of environmental degradation, climate change, and pollution, effective waste management, conservation of biological diversity, management of biological resources, forest and wildlife conservation, and sustainable development and living. The course will also deepen the knowledge and understanding of India's environment in its totality, its interactive processes, and its effects on the future quality of people's lives.

iii. Digital and technological solutions: Courses in cutting-edge areas that are fast gaining prominences, such as Artificial Intelligence (AI), 3-D machining, big data analysis, machine learning, drone technologies, and Deep learning with important applications to health, environment, and sustainable living that will be woven into undergraduate education for enhancing the employability of the youth.

iv. Health & Wellness, Yoga education, sports, and fitness: Course components relating to health and wellness seek to promote an optimal state of physical, emotional, intellectual,

social, spiritual, and environmental well-being of a person. Sports and fitness activities will be organized outside the regular institutional working hours. Yoga education would focus on preparing the students physically and mentally for the integration of their physical, mental, and spiritual faculties, and equipping them with basic knowledge about one's personality, maintaining self-discipline and self-control, to learn to handle oneself well in all life situations. The focus of sports and fitness components of the courses will be on the improvement of physical fitness including the improvement of various components of physical and skills-related fitness like strength, speed, coordination, endurance, and flexibility; acquisition of sports skills including motor skills as well as basic movement skills relevant to a particular sport; improvement of tactical abilities; and improvement of mental abilities.

2.2.9. Summer Internship /Apprenticeship:

The intention is induction into actual work situations**.** All students must undergo internships / Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other HEIs/research institutions during the ***summer term***. Students should take up opportunities for internships with local industry, business organizations, health and allied areas, local governments (such as panchayats, municipalities), Parliament or elected representatives, media organizations, artists, crafts persons, and a wide variety of organizations so that students may actively engage with the practical side of their learning and, as a by-product, further improve their employability. Students who wish to exit after the first two semesters will undergo a 4-credit work-based learning/internship during the summer term to get a UG Certificate.

2.2.9.1. Community engagement and service: The curricular component of 'community engagement and service' seeks to expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity or part of a major or minor course depending upon the major discipline.

2.2.9.2. Field-based learning/minor project: The field-based learning/minor project will attempt to provide opportunities for students to understand the different socio-economic contexts. It will aim at giving students exposure to development-related issues in rural and urban settings. It will provide opportunities for students to observe situations in rural and urban contexts, and to observe and study actual field situations regarding issues related to

socioeconomic development. Students will be given opportunities to gain a first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process. They would have the opportunity to gain an understanding of the complex socio-economic problems in the community, and innovative practices required to generate solutions to the identified problems. This may be a summer term project or part of a major or minor course depending on the subject of study.

2.2.10. Indian Knowledge System:

In view of the importance accorded in the NEP 2020 to rooting our curricula and pedagogy in the Indian context all the students who are enrolled in the four-year UG programmes should be encouraged to take an adequate number of courses in IKS so that the ***total credits of the courses taken in IKS amount to at least five per cent of the total mandated credits*** *(i.e. min. 8 credits for a 4 yr. UGP)***.** The students may be encouraged to take these courses, preferably *during the first four semesters of the UG programme*. At least half of these mandated credits should be in courses in disciplines which are part of IKS and are related to the major field of specialization that the student is pursuing in the UG programme. They will be included as a part of the total mandated credits that the student is expected to take in the major field of specialization. The rest of the mandated credits in IKS can be included as a part of the mandated Multidisciplinary courses that are to be taken by every student. All the students should take a Foundational Course in Indian Knowledge System, which is designed to present an overall introduction to all the streams of IKS relevant to the UG programme. The foundational IKS course should be broad-based and cover introductory material on all aspects.

Wherever possible, the students may be encouraged to choose a suitable topic related to IKS for their project work in the 7/8th semesters of the UG programme.

2.2.11. Experiential Learning:

One of the most unique, practical & beneficial features of the National Credit Framework is assignment of credits/credit points/ weightage to the experiential learning including relevant experience and professional levels acquired/ proficiency/ professional levels of a learner/student. Experiential learning is of two types:

a. Experiential learning as part of the curricular structure of academic or vocational program. E.g., projects/OJT/internship/industrial attachments etc. This could be either within the Program- internship/ summer project undertaken relevant to the program being

studied or as a part time employment (not relevant to the program being studied- up to certain NSQF level only). In case where experiential learning is a part of the curricular structure the credits would be calculated and assigned as per basic principles of NCrF i.e., 40 credits for 1200 hours of notional learning.

b. Experiential learning as active employment (both wage and self) post completion of an academic or vocational program. This means that the experience attained by a person after undergoing a particular educational program shall be considered for assignment of credits. This could be either Full or Part time employment after undertaking an academic/ Vocation program.

In cases where experiential learning is as a part of employment the learner would earn credits as weightage. The maximum credit points earned in this case shall be double of the credit points earned with respect to the qualification/ course completed. The credit earned and assigned by virtue of relevant experience would enable learners to progress in their career through the work hours put in during a job/employment.

2.3. Distribution of Credits:

'Credit' is recognition that a learner has completed a prior course of learning, corresponding to a qualification at a given level. For each such prior qualification, the student would have put in a certain volume of institutional or workplace learning, and the more complex a qualification, the greater the volume of learning that would have gone into it. Credits quantify learning outcomes that are subject achieving the prescribed learning outcomes to valid, reliable methods of assessment.

The ***credit points*** will give the learners, employers, and institutions a mechanism for describing and comparing the learning outcomes achieved. The credit points can be calculated as credits attained multiplied with the credit level.

The workload relating to a course is measured in terms of credit hours. A credit is a unit by which the coursework is measured. It determines the number of hours of instruction required per week over the duration of a semester (minimum 15 weeks).

Each course may have only a lecture component or a lecture and tutorial component or a lecture and practicum component or a lecture, tutorial, and practicum component, or only practicum component.

A course can have a combination of ***lecture credits, tutorial credits, practicum credits and experiential learning credits.***

The following types of courses/activities constitute the programmes of study. Each of them

will require a specific number of hours of teaching/guidance and laboratory/studio/workshop activities, field-based learning/projects, internships, and community engagement and service.

- **Lecture courses:** Courses involving lectures relating to a field or discipline by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.
- **Tutorial courses:** Courses involving problem-solving and discussions relating to a field or discipline under the guidance of qualified personnel in a field of learning, work/vocation, or professional practice. Should also refer to the Remedial Classes, flip classrooms and focus on both Slow and Fast Learners of the class according to their merit.
- **Practicum or Laboratory work:** A course requiring students to participate in a project or practical or lab activity that applies previously learned/studied principles/theory related to the chosen field of learning, work/vocation, or professional practice under the supervision of an expert or qualified individual in the field of learning, work/vocation or professional practice.
- **Seminar:** A course requiring students to participate in structured discussion/conversation or debate focused on assigned tasks/readings, current or historical events, or shared experiences guided or led by an expert or qualified personnel in a field of learning, work/vocation, or professional practice.
- **Internship:** A course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity. A key aspect of the internship is induction into actual work situations. Internships involve working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in on-site experiential learning.
- **Studio activities:** Studio activities involve the engagement of students in creative or artistic activities. Every student is engaged in performing a creative activity to obtain a specific outcome. Studio-based activities involve visual- or aesthetic-focused experiential work.
- **Field practice/projects:** Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity.

- **Community engagement and service:** Courses requiring students to participate in field-based learning/projects generally under the supervision of an expert of the given external entity. The curricular component of 'community engagement and service' will involve activities that would expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems.

2.4. Levels of Courses

2.4.1 NHEQF levels:

The NHEQF levels represent a series of sequential stages expressed in terms of a range of learning outcomes against which typical qualifications are positioned/located. NHEQF level 4.5 represents learning outcomes appropriate to the first year (first two semesters) of the undergraduate programme of study, while Level 8 represents learning outcomes appropriate to the doctoral-level programme of study.

Table: 4: NHEQF Levels

NHEQF level	Examples of higher education qualifications located within each level	Credit Requirements
Level 4.5	Undergraduate Certificate. Programme duration: First year (first two semesters) of the undergraduate programme, followed by an exit 4-credit skills-enhancement course(s).	40
Level 5	Undergraduate Diploma. Programme duration: First two years (first four semesters) of the undergraduate programme, followed by an exit 4-credit skills-enhancement course(s) lasting two months.	80
Level 5.5	Bachelor's Degree. Programme duration: First three years (Six semesters) of the four-year undergraduate programme.	120
Level 6	Bachelor's Degree (Honours/ Honours with Research). Programme duration: Four years (eight semesters).	160
Level 6	Post-Graduate Diploma. Programme duration: One year (two semesters) for those who exit after successful completion of the first year (two semesters) of the 2-year master's programme	160
Level 6.5	Master's degree. Programme duration: Two years (four semesters) after obtaining a 3- year Bachelor's degree (e.g. B.A., B.Sc., B.Com. etc.).	80
Level 6.5	Master's degree. Programme duration: One year (two semesters) after obtaining a 4 -year Bachelor's degree (Honours/ Honours with Research) (e.g. B.A., B.Sc., B.Com. etc.).	40
Level 7	Master's degree. (e.g., M.E./M.Tech. etc.) Programme duration: Two years (four semesters) after obtaining a 4-year Bachelor's degree. (e.g., B.E./B.Tech. etc.)	80
Level 8	Doctoral Degree	Credits for course work,

NHEQF level	Examples of higher education qualifications located within each level	Credit Requirements
		Thesis, and published work

2.5. Course Code based on Learning Outcomes:

Courses are coded based on the learning outcomes, level of difficulty, and academic rigor. The coding structure is as follows:

i. 0-99: ***Pre-requisite courses*** required to undertake an introductory course which will be a pass or fail course with no credits. It will replace the existing informal way of offering bridge courses that are conducted in some of the colleges/ universities.

ii. 100-199: ***Foundation or introductory courses*** that are intended for students to gain an understanding and basic knowledge about the subjects and help decide the subject or discipline of interest. These courses may also be prerequisites for courses in the major subject. These courses generally would focus on foundational theories, concepts, perspectives, principles, methods, and procedures of critical thinking in order to provide a broad basis for taking up more advanced courses.

iii. 200-299: ***Intermediate-level courses*** including subject-specific courses intended to meet the credit requirements for minor or major areas of learning. These courses can be part of a major and can be pre-requisite courses for advanced-level major courses.

iv. 300-399: ***Higher-level courses*** which are required for majoring in a disciplinary/interdisciplinary area of study for the award of a degree.

v. 400-499: Advanced courses which would include lecture courses with practicum, seminar-based course, term papers, research methodology, advanced laboratory experiments/software training, research projects, hands-on-training, internship/apprenticeship projects at the undergraduate level or First year post-graduate theoretical and practical courses.

vi. 500-599: ***Courses at first-year PG degree level*** for a 2-year post-graduate degree programme

vii. 600-699: ***Courses for second year of 2-year PG*** or 1-year post-graduate degree programme

viii. 700 -799 & above: Courses limited to doctoral students.

3. Award of Degree in Medical Laboratory Technology

The structure and duration of undergraduate programmes of study offered by the University as per NEP 2020 include:

3.1. Undergraduate programmes of either 3 or 4-year duration with Single Major, with multiple entry and exit options, with appropriate certifications:

3.1.1. UG Certificate: Students who opt to exit after completion of the first year and have secured 40 credits will be awarded a UG certificate if, in addition, they complete one vocational course of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.

3.1.2. UG Diploma: Students who opt to exit after completion of the second year and have secured 80 credits will be awarded the UG diploma if, in addition, they complete one vocational course of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.

3.1.3. 3-year UG Degree: Students who will undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 120 credits and satisfying the minimum credit requirement.

3.1.4. 4-year UG Degree (Honours): A four-year UG Honours degree in the major discipline will be awarded to those who complete a four-year degree programme with 160 credits and have satisfied the credit requirements as given in table 2 in Section 5.

3.1.5. 4-year UG Degree (Honours with Research): Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a Faculty Member of the University. The research project/dissertation will be in the major discipline. The students who secure 160 credits, including 12 credits from a research project/dissertation, will be awarded UG Degree (Honours with Research).

(Note: ***UG Degree Programmes with Single Major:*** A student must secure a minimum of 50% credits from the major discipline for the 3-year/4-year UG degree to be awarded a single major. For example, in a 3-year UG programme, if the total number of credits to be earned is 120, a student of Mathematics with a minimum of 60 credits will be awarded a B.Sc. in Mathematics with a single major. Similarly, in a 4-year UG programme, if the total number of credits to be earned is 160, a student of Chemistry with a minimum of 80 credits will be awarded a B.Sc. (Hons./Hon. With Research) in Chemistry in a 4-year UG

programme with single major. Also, the **4-year Bachelor's degree programme with Single Major** is considered as the preferred option since it would allow the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per the choices of the student.)

Table: 5: Award of Degree and Credit Structure with ME-ME

Award	**Year**	**Credits to earn**	**Additional Credits**	**Re-entry allowed within (yrs)**	**Years to Complete**
UG Certificate	1	40	4	3	7
UG Diploma	2	80	4	3	7
3-year UG Degree (Major)	3	120	x	X	x
4-year UG Degree (Honours)	4	160	x	X	x
4-year UG Degree (Honors with Research):	4	160	Students who secure cumulative 75% marks and above in the first six semesters		

4. Learning Outcomes

4.1 The Graduate Attributes

As per the NHEQF, each student on completion of a programme of study must possess and demonstrate the expected ***Graduate Attributes*** acquired through one or more modes of learning, including direct in-person or face-to-face instruction, online learning, and hybrid/blended modes. The graduate attributes indicate the quality and features or characteristics of the graduate of a programme of study, including learning outcomes relating to the disciplinary area(s) relating to the chosen field(s) of learning and generic learning outcomes that are expected to be acquired by a graduate on completion of the programme(s) of study.

The graduate profile/attributes include,

- capabilities that help widen the current knowledge base and skills,
- gain and apply new knowledge and skills,

- undertake future studies independently, perform well in a chosen career, and
- play a constructive role as a responsible citizen in society.

The graduate profile/attributes are acquired incrementally through development of cognitive levels and describe a set of competencies that are transferable beyond the study of a particular subject/disciplinary area and programme contexts in which they have been developed.

Graduate attributes include,

- ***learning outcomes that are specific to disciplinary areas*** relating to the chosen field(s) of learning within broad multidisciplinary/interdisciplinary/ transdisciplinary contexts.
- ***generic learning outcomes*** that graduate of all programmes of study should acquire and demonstrate.

Table: 6: The Learning Outcomes Descriptors and Graduate Attributes

Sl.no.	**Graduate Attribute**	**The Learning Outcomes Descriptors** ***(The graduates should be able to demonstrate the capability to:)***
GA1	Disciplinary Knowledge	acquire knowledge and coherent understanding of the chosen disciplinary/interdisciplinary areas of study.
GA 2	Complex problem solving	solve different kinds of problems in familiar and non-familiar contexts and apply the learning to real-life situations.
GA 3	Analytical & Critical thinking	apply analytical thought including the analysis and evaluation of policies, and practices. Able to identify relevant assumptions or implications. Identify logical flaws and holes in the arguments of others. Analyse and synthesize data from a variety of sources and draw valid conclusions and support them with evidence and examples.
GA 4	Creativity	create, perform, or think in different and diverse ways about the same objects or scenarios and deal with problems and situations that do not have simple solutions. Think 'out of the box' and generate solutions to complex problems in unfamiliar contexts by adopting innovative, imaginative, lateral thinking, interpersonal skills, and emotional intelligence.
GA 5	Communication Skills	listen carefully, read texts and research papers analytically, and present complex information in a clear and concise manner to different groups/audiences. Express thoughts and ideas effectively in writing and orally and communicate with others using appropriate media.
GA 6	Research-related skills	develop a keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions. Should acquire the ability to problematize, synthesize

Sl.no.	Graduate Attribute	The Learning Outcomes Descriptors *(The graduates should be able to demonstrate the capability to:)*
		and articulate issues and design research proposals, define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships. Should develop the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work.
GA 7	Collaboration	work effectively and respectfully with diverse teams in the interests of a common cause and work efficiently as a member of a team.
GA 8	Leadership readiness/qualities	plan the tasks of a team or an organization and setting direction by formulating an inspiring vision and building a team that can help achieve the vision.
GA 9	Digital and technological skills	use ICT in a variety of learning and work situations. Access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.
GA 10	Environmental awareness and action	mitigate the effects of environmental degradation, climate change, and pollution. Should develop the technique of effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living.

4.2. Program Learning Outcomes

The outcomes described through learning outcome descriptors are attained by students through learning acquired on the completion of a programme of study relating to the chosen fields of learning, work/vocation, or an area of professional practice. The term 'programme' refers to the entire scheme of study followed by learners leading to a qualification. Individual programmes of study will have defined learning outcomes that must be attained for the award of a specific certificate/diploma/degree.

The programme learning outcomes focusses on knowledge and skills that prepare students for further study, employment, and responsible citizenship.

Table: 7: The Programme Learning Outcome Descriptors

Sl.no.	Programme Learning Outcome	The Programme Learning Outcomes Descriptors *The graduates will acquire the following:*
PLO 1	Knowledge of Medical Laboratory	• The student will be able to identify the pathogen, types of and its impact on the medical health sciences.

Sl.no.	Programme Learning Outcome	The Programme Learning Outcomes Descriptors *The graduates will acquire the following:*
	Technology	• The students will be able to understand and outline the laboratory technology and diagnostic lab • Students will be able to understand the role of microbiology, biochemistry, pathology, blood banking and molecular tools in MLT. • Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Medical Laboratory Technology.
PLO 2	Develop the ability to solve complex problems	An increased understanding of fundamental concepts and their applications of scientific principles is expected at the end of this course. Students will become critical thinkers and acquire problem solving capabilities.
PLO 3	Develop Critical and analytical thinking skills	The students to develop critical thinking skills and apply them to medical and laboratory terminology concepts and other health care topics related to laboratory medicine. An introductory course for students to develop critical thinking skills and apply them to medical and laboratory terminology concepts and other health care topics related to laboratory medicine.
PLO 4	Develop and Demonstrate Creativity	A student will be able to demonstrate, perform, or think in different and diverse ways by using tools and techniques. The students will be able to deal with problems and situations that do not have simple solutions. They will be able to think 'out of the box' and generate solutions to complex problems in unfamiliar contexts by adopting innovative, imaginative, lateral thinking, interpersonal skills and emotional intelligence
PLO 5	Develop effective Communication Skills	The students will develop the ability to listen carefully, read texts and research papers analytically, and present complex information in a clear and concise manner to different groups/audiences through various means of communication. A student will be able to express thoughts and ideas effectively in writing, through experiments and also orally and communicate with others using appropriate technologies.

Sl.no.	Programme Learning Outcome	The Programme Learning Outcomes Descriptors *The graduates will acquire the following:*
PLO 6	Develop Research-related Skills	A student will develop a keen sense of observation, inquiry, and capability for asking relevant/ appropriate questions. Should acquire the ability to problematize, synthesize and articulate issues and design research proposals, define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypothesis using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships. Students will develop the ability to acquire the understanding of basic research ethics and skills in practicing/doing ethics in the field/ in personal research work.
PLO 7	Develop the ability to Collaborate and execute teamwork	Capable to work effectively and respectfully with diverse teams in the classroom and in the field, in the interests of a common cause and work efficiently as a member of a team.
PLO 8	Develop Leadership Qualities	Students will learn team workmanship in order to serve efficiently institutions, industry and society. Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.
PLO 9	Develop technological and Digital skills	Students will acquire digital skills and integrate the fundamental concepts with modern tools.
PLO 10	Develop the ability to Identify & address the Environmental Issues	A student will identify the effects of environmental degradation, climate change, and pollution. They will develop the technique and illustrate awareness on effective waste management, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living by producing different Information Education and Communication (IEC) materials.

4.3. Programme specific Learning Outcomes (PSOs):

PSO1. A student completing the course can understand different specializations of medical laboratory technology such as definitions related to medical laboratory technology, an introductory concept about clinical microbiology, histopathology, blood banking, clinical pathology, molecular biology and analyzing biological samples such as tissue and bodily fluids

PSO2. Ability to critically analyze various report interpretations.

PSO3. The student completing the course can design and execute experiments related to

medical laboratory technology which will help in the solving all forms of medical health sciences.

PSO4. The student completing the course can execute short research projects incorporating various tools and techniques in any of the basic specializations of medical laboratory technology under supervision.

5. Teaching Learning Process

Teaching and learning in this programme involve classroom lectures as well as tutorial and remedial classes.

Tutorial classes: Tutorials allow closer interaction between students and teacher as each student gets individual attention. The tutorials are conducted for students who are unable to achieve average grades in their weekly assessments. Tutorials are divided into three categories, viz. discussion-based tutorials (focusing on deeper exploration of course content through discussions and debates), problem-solving tutorials (focusing on problem solving processes and quantitative reasoning), and Q&A tutorials (students ask questions about course content and assignments and consolidate their learning in the guiding presence of the tutor).

Flip classroom: Flip classroom allows lecture content from face-to-face class time to before class by assigning it as homework. This allows for more interactive forms of learning to take place during class.

Remedial classes: The remedial classes are conducted for students who achieve average and above average grades in their weekly assessments. The focus is laid to equip the students to perform better in the exams/assessments. The students are divided into small groups to provide dedicated learning support. Tutors are assigned to provide extra time and resources to help them understand concepts with advanced nuances. Small groups allow tutors to address their specific needs and monitor them. Following methods are adopted for tutorial and remedial classes:

- Written assignments and projects submitted by students
- Project-based learning
- Group discussions
- Home assignments
- Class tests, quizzes, debates organized in the department
- Seminars and conferences
- Extra-curricular activities like cultural activities, community outreach programmes etc.

• Field trip, excursions, study tour, interacting with eminent authors, etc.

Experiential Learning: Experiential learning is a part of the curricular structure of the Graphic Design program. E.g., projects/OJT/internship/industrial attachments etc. This could be either within the program- internship/ summer project undertaken relevant to the program being studied or as a part time employment.

6. Assessment Methods

Sl. No.	Components of evaluation	Marks	Frequency	Code	Weightage (%)
A. Continuous Evaluation					
i.	Analysis/ Class Test	Combination of any 3 from i. to v. with 5 marks each (15 marks)	1 – 3	C	25%
ii	Home assignments		1 – 3	H	
iii	Project		1	P	
iv	Seminar		1 – 2	S	
v	Viva-Voce/ Presentations		1 – 2	V	
vi	Mid sem Examinations	10	1	Q/CT	
vii	Attendance	5	Every month	A	5%
B. Semester End Evaluation					
i.	Semester End examination	70	1	SEE	70%
Total					100%

Semester-wise and component wise distribution of credit (Four Year UGP – Single Major)

1st SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M101/MLT242M111	Basic Anatomy Human Physiology (Theory+ Lab)	100	4	3-0-2
Major (Core)	MLT242M102	Orientation to Medical laboratory Technology	100	3	3-0-0
Interdisciplinary (IDC)	IKS992K101	IKS-I	100	3	3-0-0
Ability Enhancement course (AEC)	CEN982A101	Communicative English I	100	1	1-0-0
Ability Enhancement course (AEC)	BHS982A102	Behavioural Science I	100	1	1-0-0
Skill Enhancement Course (SEC)	MLT242S111	HDPC	100	4	0-0-8
Value Added Course (VAC)	-	Selected from the pool of courses offered	100	3	3-0-0
SWAYAM Course	MOOC (SWAYAM COURSE)			3	
			TOTAL CREDIT FOR 1st SEMESTER	22	
2nd SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M201/MLT242M211	Fundamentals of biochemistry (Theory +Lab)	100	4	3-0-2
Major (Core)	MLT242M202/MLT242M212	Basic Microbiology (Theory +Lab)	100	4	3-0-2
IDC	IKS992K201	IKS-2	100	3	3-0-0
AEC	CEN982A201	Communicative English II	100	1	1-0-0
AEC	BHS982A202	Behavioural Science I	100	1	1-0-0
SEC	MLT242S211	Diagnostic Instrumentation I	100	4	0-0-8
VAC	-	Selected from the pool of courses offered	100	3	3-0-0
SWAYAM Course	MOOC (SWAYAM COURSE)			3	
			TOTAL CREDIT FOR 2nd SEMESTER	23	

3rd SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M301/MLT242M311	Immunology and Serology (Theory + Lab)	200	4	3-0-2
Major (Core)	MLT242M302/MLT242M312	Advanced clinical Biochemistry (Theory + Lab)	200	4	3-0-2
Major (Core)	MLT242M303/ MLT242M313	Basic Hematology (Theory + Lab)	200	4	3-0-2
IDC	MLT242I301	Fundamentals of MLT (offered to other departments)	200	3	3-0-0
AEC	CEN982A301	Communicative English-III	200	1	1-0-0
AEC	BHS982A302	Behavioral science-III	200	1	1-0-0
SWAYAM Course	MOOC (SWAYAM COURSE)			3	
		TOTAL CREDIT FOR 3rd SEMESTER		20	
4th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M401/MLT242M411	Advanced Haematolgy (Theory+Lab)	200	4	3-0-2
Major (Core)	MLT242M402/MLT242M412	Histopathology & Cytopathology (Theory+Lab)	200	4	3-0-2
Major (Core)	MLT242M403/MLT242M413	Systemic bacteriology (Theory + Lab)	200	4	3-0-2
Major (Core)	MLT242M405	General Pathology	200	3	3-0-0
AEC	CEN982A401	Communicative English-IV	200	1	1-0-0
AEC	BHS982A402	Behavioural science-IV	200	1	1-0-0
SWAYAM Course	MOOC (SWAYAM COURSE)			3	
		TOTAL CREDIT FOR 4th SEMESTER		20	
5th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M501/MLT242M511	Mycology (Theory+Lab)	300	4	3-0-2
Major (Core)	MLT242M502/MLT242M512	Diagnostic Molecular Biology (Theory+Lab)	300	4	3-0-2
Major (Core)	MLT242M503/MLT242M513	Blood Banking (Theory+Lab)	300	4	3-0-2

Major (Core)	MLT242M504/MLT242M514	Clinical Parasitology (Theory+Lab)	300	4	3-0-2
Major (Core)	MLT242I521	Clinical Posting	300	4	-
		TOTAL CREDIT FOR 5th SEMESTER		20	
6th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M601/MLT242M611	Virology (Theory+Lab)	300	4	3-0-2
Major (Core)	MLT242M602	Enzymology & Nutrition	300	3	3-0-0
Major (Core)	MLT242M603	Medical Law and Patient Safety	300	3	3-0-0
Major (Core)	MLT242M604	Biostatistics and Research Methodology	300	3	3-0-0
Major (Core)	MLT242M605	Quality control and Bio safety	300	3	3-0-0
		TOTAL CREDIT FOR 6th SEMESTER		16	
7th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M711	Internship/ Apprenticeship	400	15	
		TOTAL CREDIT FOR 7th SEMESTER		15	
8th SEMESTER					
COMPONENT	**COURSE CODE**	**COURSE TITLE**	**LEVEL**	**CREDIT**	**L-T-P**
Major (Core)	MLT242M811	Internship/ Apprenticeship	400	15	
Project / Dissertation	MLT242M822	Project / Dissertation	400	12	
		TOTAL CREDIT FOR 8th SEMESTER		27	
		TOTAL CREDITS		163	

SYLLABUS (1st SEMESTER)

Semester -I

Detailed Syllabus

Name of the Subject: Basic Anatomy Human Physiology(Theory +Lab)		**Type of Course: Major**
Paper Code: MLT242M101		**Course Level: 100**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Human Anatomy and Physiology.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic knowledge on the structure and function of the human body.	**BT 1**
CO 2	**Explain** the relation between the different organs and circulating system and the importance of body immunity, blood coagulation, blood grouping etc.	**BT 2**
CO 3	**Organize a**pplication of anatomical knowledge with various diseases. **Apply** the acquainted knowledge about the digestive system and its different role and actions.	**BT 3**
CO 4	**Analyse** the various experiments related to special senses and nervous system.	**BT 4**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	General Anatomy: Introduction to Anatomy, terms and terminology. Regions of Body, Cavities and systems. Surface anatomy – Musculo- skeletal, vascular, cardiopulmonary system General Embryology. Applied anatomy Musculoskeletal system: Connective tissue & its modification, tendons, membranes, special connective tissue. Bone structure, blood supply, growth, ossification, and classification.	16

	Muscle classification, structure and functional aspect. Joints – classification, structures of joints, movements, range, limiting factors, stability, blood supply, nerve supply, dislocations and applied anatomy.	
II	Hypothalamus Structure and features of meninges Ventricles of brain, CSF circulation Development of nervous system & defects Cranial nerves – (course, distribution, functions, and palsy) Sympathetic nervous system, its parts and components Parasympathetic nervous system Applied anatomy. Sensory system: Structure and function of, Visual system, Auditory system, Gustatory system, Olfactory system, Somato sensory system.	16
III	General Physiology- Cell: morphology, Structure and function ofcell organelles, Structure of cell membrane, Transport across cell membrane, Intercellular communication, Homeostasis. Blood- Introduction-composition & function of blood, W.B.C., R.B.C., Platelets formation & functions, Immunity, Plasma: composition, formation & functions, Plasma Proteins: -types &functions, Blood Groups- types, significance, determination Hemoglobin, Haemostasis, Lymph-composition, formation, circulation &functions	16
IV	Cardiovascular system- Conducting system- components, impulse conduction, Heart valves, Cardiac cycle-definition, phases of cardiac cycle, Cardiac output- definition, normal value, determinants. Stroke volume and its regulation, Heart rate and its regulation, Arterial pulse, Blood pressure-definition, normal values, factors affecting blood pressure, Shock-definition, classification, causes and features, Basic idea of ECG, Cardiovascular changes during exercise. Nerve Muscle Physiology- Muscles- classification, structure, properties, Excitation contraction coupling, Motor unit, EMG, factors affecting muscle tension,Muscle tone, fatigue, exercise, Nerve –structure and function of neurons, classification, properties, Resting membrane potential & Action potential their ionic basis, All or None phenomenon, Neuromuscular transmission, Ionic basis of nerve conduction, Concept of nerve injury &Wallerian degeneration, Synapses, Electrical events in postsynaptic neurons, Inhibition & facilitation at synapses, Chemical transmission of synaptic activity, neurotransmitters.	16
TOTAL		64

Title of the Paper: Basic Anatomy Human Physiology (Lab) **Paper code: MLT242M111**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Identification and description of all anatomical structures. The learning of Anatomy is by demonstration only through dissected parts, slides.	9
II	Demonstrationof skeleton- articulated and disarticulated. Demonstration of dissected parts (upper extremity, lower extremity, thoracic & abdominal viscera, face and brain).	9
III	Identification of blood cells by study of peripheral blood smear. Introduction to hemocytometry. Enumeration of white blood cell (WBC) count. Determination of blood group. Determination of erythrocyte sedimentation rate (ESR). Recording of blood pressure. Special senses Structure and functions of eye, ear, nose and tongue and their Determination of heart rate and pulse rate disorders.	9
IV	Enumeration of total red blood corpuscles (RBC) count Determination of bleeding time Determination of clotting time Estimation of hemoglobin content	9
	TOTAL	36

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- The students are acquainted with normal bodily functions(homeostasis) and learn the capacity to distinguish what is normal state and diseased state.
- Students examine the effectiveness of yoga poses as experiential learning techniques for the musculoskeletal system.
- They can learn experientially about the blood pressure measurement and learn about hypertension and hypotension.

- They can visit Anatomy and Physiology Lab and learn about the physiology and anatomy with the help of skeleton models and physiology models.

Texts:

1. Alison,G.Anne,W.(2014). Ross and Wilson Anatomy and Physiology in Health and Illness. Elsevier Health; UK, 13th edition
2. Anand&Manchanda,Textbook of Physiology, Tata McGrawHill. 5th Edition
3. Sembulingam.K,Human Physiology- Vol. 1&2,MedicalAllied, 7th Edition.
4. Singh, S.H. (2017). Principles of human physiology for allied health sciences: CBS Publishers & Distributors

Reference Book:

1. Tortora,GJ. &Derrickson. (2008). Principles of Anatomy and Physiology. Wiley, Global edition.
2. Venkatesh D. Sudhakar H.H. (2016). Basics of anatomy, physiology &microbiology level 1: CBS Publishers & Distributors, 4th edition
3. YalayyaswamyN.N.(2018). Human anatomy and physiology for courses in nursing and allied health sciences, 3rd edition

Name of the Subject: Orientation to Medical laboratory Technology		**Type of Course: Major**
Paper Code: MLT242M102		**Course Level: 100**
Total credits: 3	**Scheme of Evaluation: T**	**T-P-C: 3-0-0-3**

Course Objectives: The course is designed to provide a wholesome Understand the basic concept on Medical laboratory Technology and orient the students regarding the course.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Bloom's Taxonomy Level**
CO 1	**Recall** the scope, importance, and responsibilities of medical laboratory professionals in healthcare.	**BT 1**
CO 2	**Explain** the importance of ethical principles and code of conduct for laboratory professionals and able to explain the working of lab instruments.	**BT 2**
CO 3	**Develop** the ethical principles and code of conduct for laboratory professionals.	**BT 3**
CO 4	**Analyze** how diagnostic technology has evolved to support modern healthcare.	**BT 4**

DETAILED SYLLABUS:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I	Definition and Goals- History of Laboratory Medicine Scope of MLT, -Basic Laboratory Principles- Code of conduct of Laboratory Personnel- Significance of diagnosis – Conventional methods of diagnosis –Role of Lab Technician	**16**
II	Organization of Lab and Design- Importance of Health care – Misdiagnosis –Lab Medicine- Quality Matrics - Basic equipments- Calibration- Record Maintenance- Purchase- Consumables- Non consumables – Reports -	**16**

III	General approach to specimen collection, transport and disposal - Safety measures- Pre analytical Phase – Post analytical Phase of Diagnosis- Preparation of Report and Interpretation Medical laboratory professional - professionalism in laboratory workers, code of conduct, communication between physician and lab technician-	**16**
IV	Basic Techniques- Basics of emergency care and life support skills - first aid and triage, Ventilations including use of bag-valve-masks (BVMs), Choking, rescue breathing methods, One- and Two-rescuer CPR -	**16**
TOTAL		**64**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**00**	**26**

Experiential learning activities may include:

- Students can create physical models or visual models or visual representations of the lab infrastructure.
- Students performed tests in the royal diagnosticlab.
- Students visit to BBCI and GMCH for diagnostic exposure

Textbook:

1. P. Godkar; Textbook of Medical Laboratory Technology, 3rd edition (Revised Reprint 2021), Bhalani Publishing House.
2. Barbara J. Bain, Imelda Bates, & Mike A. Laffan; Dacie and Lewis Practical Hematology, 12th edition (2016), Elsevier Health Sciences.

Recommended Books

1. Ramnik Sood; Medical Laboratory Technology: Methods and Interpretation Vol. 1& 2, 6th edition (2009), Jaypee Brother Publishing house.
2. Harald Theml, Heinz Diem & T. Haferlach; Color Atlas of Hematology Practical Microscopic and Clinical Diagnosis, 2nd edition (2004), Thieme

Semester -I

Detailed Syllabus

Name of the Subject: HDPC		**Type of Course: SEC**
Paper Code: MLT242S111		**Course Level: 100**
Total credits: 4	**Scheme of Evaluation: P**	**L-T-P-C: 0-0-8-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Hospital Duty and Patient Care

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** on the importance of quality control, and other processes required for patient care and hospital management.	**BT 1**
CO 2	**Classify** the chart on quality control, the methods to deal with poisoning and management of the outcome.	**BT 2**
CO 3	**Apply** the knowledge on practical aspect to deal with critical cases, to treat patients with drugs poisoning and on the process of automatic techniques.	**BT 3**
CO 4	**Analyze** the waste categories, analyse the symptoms of poisoning, legal aspects in medical profession and will be able to perform quality control.	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	Concept of accuracy, precision, reliability, reproducilibilty, reference ranges, Quality control, LJ graph, collection, distribution, preservation, storage of specimen for appropriate test, introduction to NABL, NABH and ISO guidelines, Automatic Techniques	**22**

II	Poisoning: Definition, Causes of poisoning, Sources of Poisoning, Symptoms of poisoning, First aid & Management, Antidotes, Common drugs poisoning, Carbon monoxide poisoning, Legal hazards of medical profession: Malpractice, Clinical negligence, Corporate negligence	**22**
III	Drugs: Definition, Names & classification of drugs, Different preparations of drugs, Adverse effects of drugs, Different routes of drug administration, Consumer protection Act:	**22**
IV	Bio-medical waste – Introduction, Waste Generation Segregation, Disposal, Planning, Objectives, Policies of BMW Management, Management of Bio-medical Waste, Technologies for Treatment for BMW, Training, Occupational Safety and Health Issues, Criteria for selecting appropriate Medical Waste Technologies	**22**
TOTAL		**88**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
00	**88**	**32**

Experiential learning activities may include:

- Students can classify the different types of biomedical waste
- Students can understand the different types of error occurring in the laboratory
- Students can discuss on the different type of diagnosis and treatment required for patient care.

Recommended Books:

- Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states.
- The Book of Hospital Waste Management: Dr. D.B. Acharya & Dr. Meeta Singh (Minerva Press, New Delhi)
- Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications

Reference Book:

- Hugo W.B and Russel A.D, Pharmaceutical Microbiology, 7thedn, 2004, Blackwell Scientific publications, Oxford London.
- Hospital Management & its Monitoring: Madhuri Sharma (Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi)
- Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications

Level: Semester I

Detailed Syllabus

Name of the Subject: Behavioural Sciences -1	**Type of Course: BHS**
Paper Code: BHS982A104	
Total credits: 1	

Course Objectives

To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations.

Course Outcomes:

SI No	Course Outcome
CO 1	Understand self & process of self exploration
CO 2	Learn about strategies for development of a healthy self esteem
CO 3	Apply the concepts to build emotional competencies.

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Introduction to Behavioral Science** Definition and need of Behavioral Science, Self: Definition components, Importance of knowing self, Identity Crisis, Gender and Identity, Peer Pressure, Self image: Self Esteem, Johari Window ,Erikson's model.	**4**
II	**Foundations of individual behavior** Personality- structure, determinants, types of personalities. Perception: Attribution, Errors in perception. Learning- Theories of learning: Classical, Operant and Social.	**4**

III	**Behaviour and communication.** Defining Communication, types of communication, barriers to communication, ways to overcome barriers to Communication, Importance of Non-Verbal Communication/Kinesics, Understanding Kinesics, Relation between behaviour and communication.	**4**
IV	**Time and Stress Management** Time management: Introduction-the 80:20, sense of time management, Secrets of time management, Effective scheduling. Stress management: effects of stress, kinds of stress-sources of stress, Coping Mechanisms. Relation between Time and Stress.	**4**
TOTAL		**16**

Text books

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc
- K.Alex, Soft skills; S.Chand.

Level: Semester I

Detailed Syllabus

Name of the Subject: Introduction to Effective Communication **Type of Course: AEC**

Paper Code: CEN982A101 **Course level:** 100

Total credits: 1 **L-T-P-C:** 1-0-0-1

Course Objectives

To understand the four major aspects of communication by closely examining the processes and figuring the most effective ways to communicate with interactive activities.

Course Outcomes:

SI No	Course Outcome
CO 1	**Identify** the elements and processes that make for successful communication and recognise everyday activities that deserve closer attention in order to improve communication skills.

CO 2	**Contrast** situations that create barriers to effective communication and relate them to methods that are consciously devised to overcome such hindrance.
CO 3	**Use** language, gestures, and para-language effectively to avoid miscommunication and articulate one's thoughts and build arguments more effectively

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Introduction to Effective Communication • Listening Skills - The Art of Listening - Factors that affect Listening - Characteristics of Effective Listening • Guidelines for improving Listening skills	**5**
II	• Speaking Skills - The Art of Speaking - Styles of Speaking - Guidelines for improving Speaking skills - Oral Communication: importance, guidelines, and 5 barriers	**5**
III	• Reading Skills - The Art of Reading - Styles of Reading: skimming, surveying, scanning • Guidelines for developing Reading skills	**5**
IV	• Writing Skills - The Art of Writing - Purpose and Clarity in Writing - Principles of Effective Writing	**5**
TOTAL		**16**

Keywords: Communication, Listening, Speaking, Reading, Writing

Text:

1. Business Communication by Shalini Verma

References:

1. Business Communication by P.D. Chaturvedi and Mukesh Chaturvedi
2. Technical Communication by Meenakshi Raman and Sangeeta Sharma

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
15 hrs	**-**	10 hours - Movie/ Documentary screening - Peer teaching - Seminars - Field Visit

SYLLABUS (2nd SEMESTER)

Semester -II

Detailed Syllabus

Name of the Subject: Fundamentals of Biochemistry (Theory +Lab)		**Type of Course: Major**
Paper Code: MLT242M201		**Course Level: 100**
Total credits: 4	**Scheme of Evaluation: T +P**	**L-T-P-C: 3-0-2-4**

Course Objectives: The course is designed to provide a wholesome understand the basic chemistry of nutrients required by our body

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Bloom's Taxonomy Level**
CO 1	**Recall** the core knowledge of metabolism of Carbohydrates, lipids, nucleic acids and their applied aspects.	**BT 1**
CO 2	**Explain** the role, classifications, and functions of lipids, carbohydrates, and proteins.	**BT 2**
CO 3	**Develop** a wide knowledge of the nucleic acids, DNA, RNA and their applied importance.	**BT 3**
CO 4	**Analyze** the various biochemical experiments related to carbohydrates, proteins and fats etc	**BT 4**

DETAILED SYLLABUS:

Modules	Topics (if applicable) & Course Contents	Periods
I	CARBOHYDRATES: Definition and classification of carbohydrates Common carbohydrates (Glucose, Fructose, Starch, Glycogen, Starch) and their sources. Biological significance of Carbohydrate	16
II	PROTEINS: Definition of Proteins along with the biological significance. Amino acids and its classification Essential and Non-essential amino acids	16

III	LIPIDS: Definition and classification of lipids. Classification of Fatty Acids with examples and functions of some common lipids (Phospholipids, Glycolipids, Steroids).	16
IV	NUCLEIC ACIDS: Basic idea of the structure of DNA and RNA, Function of DNA and RNA acid-base buffers, Basic idea of acids, bases, Ph, buffer Acid base balance	16
TOTAL		64

Title of the Paper: Fundamentals of Biochemistry (Lab) **Paper code: MLT242M211**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	To study the general laboratory safety rules. To demonstrate glasswares, apparatus and plasticwares used in laboratory.	**9**
II	To collect blood samples Anticoagulant vials. Code of conduct of medical laboratory personnel.	**9**
III	Preparation of different percentage solution Preparation of normal and molar solution. Hazard signs and precautions to be taken in case of acid, base, burns.	**9**
IV	Demonstration of photocolorimeter Demonstration of centrifuge. Demonstration of ph meter Demostration of spectrophotometer.	**9**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Preparation of model of DNA

- Creating physical models of different carbohydrate structure
- Students can create physical models or visual models or visual representations of the Krebs cycle.
- Students performed biochemistry tests in the royal diagnosticlab.
- Students visit to BBCI and GMCH for diagnostic exposure

Textbook:

1. Leininger , Principles of Biochemistry. 7th Edition, 2017.
2. Robert K. Murry, Daryl K. Granner and Victor W. Rodwell., Harper's Biochemistry. 30th Edition, 2015
3. D. Satyanarayana and Chakrapani, Biochemistry.5th Edition, 2017.

Reference Book:

1. Robert Horton H, Laurence A Moran, Gray Scrimgeour K. Principles of Biochemistry, 4th Edition, 2006, Pearsarson Publisher. ISBN-13: 978-0321707338
2. Conn and Stumpf, Outlines of Biochemistry, 5th Edition, 2006.

Semester -II

Detailed Syllabus

Name of the Subject: Basic Microbiology(Theory +Lab)		**Type of Course: Major**
Paper code: MLT242M202		**Course Level: 100**
Total credits: 4	**Scheme of Evaluation: T +P**	**L-T-P-C: 3-0-2-4**

Course Objectives:

This course has been formulated to impart comprehensive knowledge on Microbiology. The students will learn to identify and classify bacteria, as well as different medias used to identify microorganisms.

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**

CO 1	**Recall** the microorganisms name and relate their growth and nutrition factors.	**BT 1**
CO 2	**Classify** the different media used for growth and nourishment of microbes	**BT 2**
CO 3	**Apply** a basic technique of Microscopes and its importance.	**BT 3**
CO 4	**Analyze** the morphology, pathogenesis and laboratory diagnosis of the microorganisms.	**BT 4**

DETAILED SYLLABUS

Modules	Course Content	Periods
I.	Introduction to Microbiology: Microscopy, Bright-field Microscopy, Dark field Microscopy, Phase contrast Microscopy, Fluorescence Microscopy, Electron Microscopy Transmission electron Microscopy, Scanning electron Microscopy Stains in microbiology:Preparation of smear, simple staining, classification of stains: Gram staining, Acid fast staining, Negative staining	**16**
II.	Shapes and structure of bacteria: Bacterial cell- structure and function, capsule, spores, flagella, Virulence factor of Bacteria, Operation and Principles of Incubator, Autoclave, Hot air oven, Inspissator, Distillation plant.	**16**
III.	Antisepsis, Autoclave, Dry heat Sterilisation Moist heat Sterilisation	**16**
IV	Bacteriological medias: -Simple Media, Differential Media, Special; media, Enrichment media Bacterial growth curve	**16**
TOTAL		**64**

Title of the Paper: Basic Biochemistry (Lab) **Paper code: MLT242M212**

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Periods
I.	Care and operation of Microscopes viz. Light, Dark ground, Phase contrast, Inverted, Fluorescent microscopes. Collection of specimens for Microbiological investigations such as blood, urine, throat swab, rectal swab, stool, pus, OT specimens	**9**
II.	Special tests – Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for mycobacterium, satellitism, CAMP test, catalase test and slide agglutination tests, and other as applicable for identification of bacteria upto species level	**9**
III.	Preparation of swabs/sterile tubes & bottles. Preparation of smear. Staining.: Gram & Ziehl -Neelsen staining. Identification of Culture media. Identification of instruments. Identification of common microbes.	**9**
IV	Performance of antimicrobial susceptibility testing by Kirby-Bauer disk diffusion method; estimation of Minimum inhibitory/Bactericidal concentrations by tube/plate dilution methods. Tests for drug susceptibility of Mycobacterium tuberculosis. Testing of disinfectants- Phenol coefficient and 'in use' tests.Quality control of media reagents etc. and validation of sterilization procedures. Aseptic practices in laboratory and safety precautions. Disposal of contaminated material like cultures	**9**
TOTAL		**36**

Text Books:

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 9th Edition, 2014.
2. HarshMohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 5th Edition, 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.

Reference Books:

1. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
2. William and Wilkins, Baltimore;1991 [1990 printing].
3. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- They can learn experientially about microorganism.
- Experiential learning on health camp conduction and detection of disorders as well as hands-on training.
- They can visit hospitals to get to learn about hospital setup and laboratory setup and function specially microbiology lab.

Semester -II

Detailed Syllabus

Subject: Diagnostic Instrumentation I		**Type of course: SEC**
Code: MLT242S211		**Level: 100**
Total Credit: 4	**Scheme of Evaluation: T**	**L-T-P-C: 0-0-8-4**

Course Objectives:

The course is with the objective of giving the students wholesome practical knowledge on Instrumentation.

On successful completion of the course the students will be able to:		
SI. No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** Understand the basic principles and working mechanisms of common diagnostic instruments used in medical laboratories.	**BT 1**
CO 2	**Classify** he calibration, quality control, and maintenance procedures required for accurate and reliable instrument performance.	**BT 2**

CO 3	**Apply** basic skills to operate fundamental diagnostic devices such as spectrophotometers, centrifuges, microscopes, and hematology analyzers.	**BT 3**
CO 4	**Analyse** the limitations, sources of error, and troubleshooting methods for diagnostic instruments used in clinical testing.	**BT 4**

Course outcomes:

Modules	Course Content	Periods
I	Instruments in Clinical Labs Principles and Mechansims: Microscopy: Light microscope, Field Microscope, Fluorescent microscope, Phase contrast microscope, AFM, SCM, TEM,SEM, STM.	**22**
II	Electrophoresis: Theory, different methods of electrophoresis for proteins and nucleic acids. Basic Principle of electrophoresis, Paperelectrophoresis,Gel electrophoresis, PAGE, SDS-PAGE, Agarose gel electrophoresis, buffer systems in electrophoresis	**22**
III	Chromatography, its principle, types and applications. Paper Chromatography. Thin layer chromatography. HPLC, Gas liquid chromatography, Ion exchange chromatography and their application in diagnosis. Centrifugation, fixed angle and swinging bucket rotors, RCF and sedimentation coefficient, differential centrifugation, density gradient centrifugation and Ultracentrifugation	**22**
IV	Crystallography and X-Ray diffraction, Electron diffraction, Neutron diffraction. Radioisotope techniques: radiotracers GM Counter, Proportional and Scintillation counters, autoradiography, GCMS, LCMS, MALDI-ToF Radioisotopes Radioactivity, instruments for radio activity measurement, Spectrophotometer, Centrifugation	**22**
TOTAL		**88**

Reference Books:

1. Advances in Chromatography. Eli Grushka and NeluGrinberg (2007). Publisher: CRC: 1st edition.ISBN-10: 1420060252, ISBN-13: 978-1420060256, Volume 46.
2. Understanding NMR Spectroscopy. James Keeler (2005). Publisher: Wiley; 1st edition ISBN-10:0470017872, ISBN-13: 978-0470017876.
3. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM. Ray F.Egerton (2005). Publisher: Springer; 1st ed.. ISBN-10: 0387258000, ISBN-13:

978-0387258003.

Text Books:

1. Fundamentals of Light Microscopy and Electronic Imaging. Douglas B. Murphy (2001). Publisher:Wiley-Liss; 1st edition ISBN-10: 047125391X, ISBN-13: 978-0471253914.

2. Principles and Techniques of Practical Biochemistry. Keith Wilson & John Walker(2000).Cambridge University Press.

3. Introduction to Spectroscopy. Donald L. Pavia, Gary M. Lampman, and George S. Kriz (2000).Publisher: Brooks Cole; 3rd edition. ISBN-10: 0030319617, ISBN-13: 978-0030319617

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
00	**88 hrs**	**32 hrs**

Experiential learning activities may include:

- They can learn about instruments by visiting the lab
- They can visit hospitals to get to learn about hospital setup and laboratory setup and function.

Level: Semester II

Detailed Syllabus

Name of the Subject: Behavioural Sciences - II **Type of Course: BHS**

Paper Code: BHS982A204

Total credits: 1

Course Objectives

To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations.

Course Outcomes:

SI No	Course Outcome

CO 1	Develop an elementary level of understanding of culture and its implications on personality of people.
CO 2	Understand the concept of leadership spirit and to know its impact on performance of employees.
CO 3	Understand and apply the concept of Motivation in real life.

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Culture and Personality** Culture: Definition, Effect, relation with Personality, Cultural Iceberg, Overview of Hofstede's Framework, Discussion of the four dimensions of Hofstede's Framework..	**4**
II	**Attitudes and Values** Attitude's definition: changing our own attitudes, Process of cognitive dissonance Types of Values, Value conflicts, Merging personal and Organisational values.	**4**
III	**Motivation** Definition of motivation with example, Theories of Motivation (Maslow, McClelland's theory& Theory X and Y).	**4**
IV	**Leadership** Definition of leadership, Leadership continuum, types of leadership, Importance of Leadership, New age leaderships: Transformational & transactional Leadership, Leaders as role models.	**4**
TOTAL		**16**

Text books

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc.
- Organizational Behaviour by Kavita Singh (Vikas publishers, 3rd Edition).

Level: Semester II

Detailed Syllabus

Name of the Subject: Approaches to Verbal and Non-Verbal Communication	
Type of Course: AEC	
Paper Code: CEN982A201	**Course level:** 100
Total credits: 1	**L-T-P-C:** 1-0-0-1

Course Objectives

To introduce the students to the various forms of technical communication and enhance their knowledge in the application of both verbal and non-verbal skills in communicative processes. **Course Outcomes:**

SI No	Course Outcome	Blooms Taxonomy Level
CO 1	**Identify** the different types of technical communication, their characteristics, their advantages and disadvantages	BT 1
CO 2	**Explain** the barriers to communication and ways to overcome them.	BT 2
CO 3	**Discover** the means to enhance conversation skills.	BT 3
CO 4	**Determine** the different types of non-verbal communication and their significance.	BT 4

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Technology Enabled Communication** Communicating about technical or specialized topics, Different forms of technology-enabled communication tools used in organisations Telephone, Teleconferencing, Fax, Email, Instant messaging , Blog, podcast, Videos, videoconferencing, social media	**5**
II	**Communication Barriers** Types of barriers: Semantic, Psychological, Organisational, Cultural, Physical, and Physiological. - Methods to overcome barriers to communication.	**5**
III	**Conversation skills/Verbal Communication** Conversation – Types of Conversation, Strategies for Effectiveness,	**5**

	Conversation Practice, Persuasive Functions in Conversation, Telephonic Conversation and Etiquette Dialogue Writing, Conversation Control.	
IV	**Non-verbal Communication** Introduction; Body language- Personal Appearance, Postures, Gestures, Eye Contact, Facial expressions Paralinguistic Features-Rate, Pause, Volume, Pitch/Intonation/ Voice/ modulation Proxemics , Haptics, Artifactics, Chronemics	**5**
TOTAL		**16**

Texts:

1. Rizvi, M. Ashraf. (2017). Effective Technical Communication. McGraw-Hill.

2. Chaturvedi, P. D. and Chaturvedi, Mukesh. (2014). Business Communication.Pearson.

3. Raman, Meenakshi and Sharma, Sangeeta. (2011). Technical Communication: Principles and Practice (2nd Edition): Oxford University Press.

References:

1. Hair, Dan O., Rubenstein, Hannah and Stewart, Rob. (2015). A Pocket Guide to Public Speaking. (5th edition). St. Martin's. ISBN-13:978-1457670404

2. Koneru, Aruna.(2017) Professional Communication. New Delhi: Tata McGraw Hill ISBN-13: 978-0070660021

3. Raman, Meenakshi and Singh, Prakash.(2012). Business Communication (2nd Edition): Oxford University Press

4. Sengupta, Sailesh.(2011) Business and Managerial Communication. New Delhi : PHI Learning Pvt. Ltd.

SYLLABUS (3rdSEMESTER)

Semester -III

Detailed Syllabus

Name of the Subject: Immunology and Serology (Theory +Lab)		**Type of Course: Major**
Paper Code: MLT242M301		**Course Level: 200**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding immune system and serological techniques.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic knowledge on immunity and explain the immunological process at molecular and cellular level.	**BT 1**
CO 2	**Explain** the basic concepts of antigen-antibody interactions and the immunological basis of serological tests.	**BT 2**
CO 3	**Apply** the use of serological techniques in diagnosis	**BT 3**
CO 4	**Analyse** and differentiate between various serological techniques	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	**Immunology:** Historical background, general concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response, Cell and organs of immune system, Phagocytosis. **Antigens and Antibodies:** Properties, foreignness, molecular size, heterogeneity, B and T cell epitopes; T dependent and T independent antigens	**16**

II	**Antibodies:** Historical perspective of antibody structure; structure, function, and properties of the antibodies; different classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype. Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody. Immunological disorders: primary and secondary immunodeficiency, SCID. Interleukins, MHC-I, MHC-II and other types.	**16**
III	Slide agglutination and tube agglutination Widal tests, complement fixation test principle, Immunoflourescence test. Principle and interpretation of various, immunological tests done by the Laboratory.Pregnancy test, (including the historical background and Bioassays). A S O, CRP, RP, ANF and autoimmune disorder, Widal, TPI, RPCF, FLA, ABS).	**16**
IV	EIA and RIA – Principle; Viral Hepatitis and the markers. Syphilitic Serology – Kahn, VDRL, RPR. Indirect passive agglutination a/ using RBC as carriers (Coated RBC) Pregnancy tests HBs Ag. b/ Latex coated particles fixation, Bentonite, Rheumatoid factor; Pregnancy latest (Gravindex) pregtel ASL and CRPA.	**16**
TOTAL		**64**

Title of the Paper: Immunology and serology (Lab) **Paper code: MLT242M311**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Diagnostic tests by kit method: WIDAL,VDRL,RPR,ASO,CRP,TPHA,HCG,	**18**
II.	Latex agglutination test, Pregnancy test HIV, tridot, HbSAg	**18**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Students can have exposure to labs and identify different microorganisms in microscope.
- They can visit hospitals to get to learn about microbiology
- Students making a model or chart explaining on HIV virus and its impact on our society

Texts:

1. Textbook of Microbiology, Ananthanarayann, Paniker, Arti Kapil,9thedition, universities press
2. Laboratory immunology & Serology – Neville J. Bryant.
3. C.P.Baveja, Textbook of microbiology,6thedition,Arya Publications
4.

Reference Book:

1. TEXTBOOK OF IMMUNOLOGY by Dr. Ajoy Paul
2. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication
3. Textbook of Medical Virology By Baijayantimala Mishra

Semester -III

Detailed Syllabus

Name of the Subject: Advanced Clinical Biochemistry (Theory +Lab)		**Type of Course: Major**
Paper Code: MLT242M302		**Course Level: 200**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding biochemistry related to metabolisms and different enzymes.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic knowledge on enzymes, its classification and their mode of action.	**BT 1**
CO 2	**Explain** the relation between the different types of metabolic pathway and its relation to the other.	**BT 2**

CO 3	**Apply** the knowledge of the key metabolic pathway involved in energy production, storage and utilization in living organisms.	**BT 3**
CO 4	**Analyse** the biological charts to understand the metabolic pathways of protein, carbohydrates and fats.	**BT 4**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Metabolism of carbohydrates:** Glycogenesis, Glycogenolysis, Clinical orientation of glycogen, Glycolysis, Citric acid cycle, energetic of citric acid cycle, Glyconeogenesis, Regulation of glucose metabolism, Metabolism of Fructose, Metabolism of Galactose, Regulation of blood glucose concentration.	**16**
II	**Metabolism of Proteins:** General pathway of protein metabolism, Nitrogen metabolism, catabolism of proteins - Transamination, Oxidative Deamination, transdeamination. Synthesis of urea, metabolism of individual amino acids overview, Structural orientation of protein, Protein synthesis: Translation, Transcription	**16**
III	**Metabolism of Lipids** Role of liver in fat metabolism, B Oxidation of fatty acid, Biosynthesis of lipids, Prostaglandin, Cholesterol metabolism, formation of bile acids, plasma lipoproteins,	**16**
IV	Integration of metabolic pathways of carbohydrate, proteins, and fats. Formation of bile pigments, catabolism of heme. Enzymes: Definition, classification, co-enzyme, iso-enzyme, mechanism of action, factors affecting enzyme activity.	**16**
TOTAL		**64**

Title of the Paper: Advanced Clinicall Biochemistry (Lab) Paper code: MLT242M312

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Liver function tests – Total Bilirubin, direct and Indirect Bilirubin, Urinary Bile salt, Urinary Bile pigments, Urinary Urobilinogen, Total Protein, Albumin, SGOT, SGPT.	**12**

III	Renal Function Test – Estimation of urea, Uric acid and Creatinine, Urine Examination R/E Protein Estimation.	**12**
III	Gastric Function Test – Examination of resting Content Quality control in Biochemistry laboratory.	**12**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

1. Students can make model of different metabolic pathway.
2. Students can visit hospitals and have exposure to biochemistry labs
3. With the help of chart they can explain the functions of different enzymes.

Textbook:

1. 1.Leininger , Principles of Biochemistry. 7th Edition, 2017.
2. 2.Robert K. Murry, Daryl K. Granner and Victor W. Rodwell., Harper's Biochemistry. 30th Edition, 2015
3. 3.D. Satyanarayana and Chakrapani, Biochemistry.5th Edition, 2017.

Reference Book:

1. Robert Horton H, Laurence A Moran, Gray Scrimgeour K. Principles of Biochemistry, 4th Edition, 2006, Pearsarson Publisher. ISBN-13: 978-0321707338
2. Conn and Stumpf, Outlines of Biochemistry, 5th Edition, 2006.

Semester -III

Detailed Syllabus

Name of the Subject: Basic Haematology (Theory+Lab)		**Type of Course: Major**
Paper Code: MLT242M303		**Course Level: 200**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Haematology

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic knowledge on the blood cells, their formation, and the lab investigations.	**BT 1**
CO 2	**Classify** the different disorders of Red blood cell.	**BT 2**
CO 3	**Organize** the knowledge on formation of WBC, platelets, methods of counting and clinical importance.	**BT 3**
CO 4	**Analyse** the importance of haemostasis, coagulation and preparation of bone marrow smear and process and types of staining.	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	**Introduction of Haematology:** Blood – formation, composition, Method of collections, Preservation of blood for routine examination and Anticoagulant, **Red Blood Cells/ Erythrocytes:** Formation, Morphology, Functions, Count methods and its clinical importance, Haemoglobin, Reticulocyte, PCV, ESR	**16**
II	**Anaemia**: Definition, Morphology & Etiology classification, Microcytic Hypochromic anaemia – Causes, Types, Lab investigation, Laboratory pictures, Clinical importance. Normocytic Hypochromic anaemia and Diamorphicanaemia. ,other types of anaemia in details - sickle cell anemia, Thalassaemia.	**16**

III	**White Blood Cells (WBC):** Formations, Functions, life span, morphology, Types, Methods of counting, total WBC and differential counts (preparation of smears), Leukaemia and its classification.	**16**
IV	**Platelets:** Formation, Morphology, Functions, Method of counting, normal & abnormal counts with clinical importance **Haemostasis:** Haemostasis in detail, Haemophilia – Definition, Types & Investigation, Clinical importance	**16**
TOTAL		**64**

Title of the Paper: Basic Haematology (Lab) **Paper code: MLT242M313**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	• Study of Microscopes • Collection of blood • Study of instruments and glassware's	**12**
III	• Preparation of blood thin film and staining and study of RBC morphology • Preparation of blood thick film and staining and study of blood parasite	**12**
III	• BT,CT • Haemoglobin estimation by various methods, • ESR estimation	**12**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Students can draw the chart on Erythropoiesis.
- Students can explain the different lab investigations for blood with the help of chart.
- Students can show a diagrammatic representation of hemostasis.

Text Books:

1. Textbook of pathology, Harsh mohan, 8th edition, Jaypee publishers
2. Textbook of Medical laboratory Technology, 3rd edition, Godkar PB, Bhalani publishing house
3. Textbook of Medical laboratory Technology , RamnikSood, Jaypee publishers

References:

1. Dacie and lewis practical Haematology, Barbara J Bain, Imedla Bates, Mike A Laffan,12th edition, Elsevier publications
2. Manual of Medical Laboratory Technology, K.N.Sulochana and S. Ramakrishnan, Jaypee publishers

Level: Semester III

Detailed Syllabus

Name of the Subject: Behavioural Sciences - III	**Type of Course: BHS**
Paper Code: BHS982A304	
Total credits: 1	

Course Objectives

To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations .To enable the students to understand the process of problem solving and creative thinking.

Course Outcomes:

SI No	Course Outcome
CO 1	Understand the process of problem solving and creative thinking.
CO 2	Develop and enhance of skills required for decision-making.

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Problem Solving Process** Defining problem, the process of problem solving, Barriers to problem solving(Perception, Expression, Emotions, Intellect ,surrounding environment)	4
II	**Thinking as a tool for Problem Solving** What is thinking: The Mind/Brain/Behaviour Critical Thinking and Learning: -Making Predictions and Reasoning. -Memory and Critical Thinking. - Emotions and Critical Thinking.	4
III	**Creative Thinking** - Definition and meaning of creativity , - The nature of creative thinking :Convergent and Divergent thinking, - Idea generation and evaluation (Brain Storming) - Image generation and evaluation. - The six-phase model of Creative Thinking: ICEDIP model	4
IV	**Building Emotional Competence** Emotional Intelligence – Meaning, components, Importance and Relevance Positive and Negative emotions Healthy and Unhealthy expression of emotions	4
TOTAL		**16**

Text books

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc.

Level: Semester III

Detailed Syllabus

Name of the Subject: Fundamentals of Business Communication **Type of Course: AEC**

Paper Code: CEN982A301 **Course level:** 200

Total credits: 1 **L-T-P-C:** 1-0-0-1

Course Objectives

The aim if the course is to develop essential business communication skills, including effective writing, speaking, and interpersonal communication, to enhance professional interactions, collaboration, and successful communication strategies within diverse corporate environments. **Course Outcomes:**

SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Define and list business documents using appropriate formats and styles, demonstrating proficiency in written communication for various business contexts.	**BT 1**
CO 2	Demonstrate confident verbal communication skills through persuasive presentations, active listening, and clear articulation to engage and influence diverse stakeholders.	**BT 2**
CO 3	Apply effective interpersonal communication strategies, including conflict resolution and active teamwork, to foster positive relationships and contribute to successful organizational communication dynamics	**BT 3**

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Business Communication: Spoken and Written** • The Role of Business Communication • Classification and Purpose of Business Communication • The Importance of Communication in Management • Communication Training for Managers • Communication Structures in Organizations • Information to be Communicated at the Workplace • Writing Business Letters, Notice, Agenda and Minutes	**5**
II	**Negotiation Skills in Business Communication** • The Nature and Need for Negotiation o Situations requiring and not requiring negotiations • Factors Affecting Negotiation o Location, Timing, Subjective Factors • Stages in the Negotiation Process o Preparation, Negotiation, Implementation - • Negotiation Strategies	**5**
III	**Ethics in Business Communication** • Ethical Communication • Values, Ethics and Communication • Ethical Dilemmas Facing Managers	**5**

	• A Strategic Approach to Business Ethics • Ethical Communication on Internet • Ethics in Advertising	
IV	**Business Etiquettes and Professionalism** • Introduction to Business Etiquette • Interview Etiquette • Social Etiquette • Workplace Etiquette - • Netiquette	**5**

Text:

1. Business Communication by Shalini Verma

References:

1. Business Communication by PD Chaturvedi and Mukesh Chaturvedi
2. Technical Communication by Meenakshi Raman and Sangeeta Sharma

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
15 hrs	-	10 hours - Group Discussion - Presentation - Quiz - Case Study

SYLLABUS (4th SEMESTER)

Semester -IV

Detailed Syllabus

Name of the Subject: Advance Haematology (Theory+Lab)		**Type of Course: Major**
Paper Code: MLT242M401		**Course Level: 200**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to upgrade the students to gain knowledge regarding Haematology in more details

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Define** the basic knowledge on the blood cells, their formation, and the lab investigations.	**BT 1**
CO 2	**Classify** the different disorders of Red blood cell.	**BT 2**
CO 3	**Organize** the knowledge on formation of WBC, platelets, methods of counting and clinical importance.	**BT 3**
CO 4	**Analyse** the importance of haemostasis, coagulation and preparation of bone marrow smear and process and types of staining.	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	Haematopoiesis: Origin, development, function and fate of blood cells. Erythropoiesis- Origin, development of RBCs, Disorders of RBC: Anaemia. Different types of Anemia in details	**16**

II	Disorders of white blood cells- Leucocytosis, Leukopenia, Leukaemias Classification- (French American British- FAB classification) Lab investigation, Chronic myeloid leukaemia, Chronic Lymphocytic Leukaemia.	**16**
III	Plasma cell disorder- classification, Plasma cell myeloma- definition, clinical features, Haemorrhagic disorders, vascular disorders, platelet disorder, coagulation disorders	**16**
IV	**Bone marrow:** Method of preparation of bone marrow smears, Different types of staining of bone marrow smear. **Coagulation:** Definition, Principle & mechanism of coagulation, Factors of coagulation, In brief coagulation profile.	**16**
TOTAL		**64**

Title of the Paper: Advanced Haematology (Lab) **Paper code: MLT242M411**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	• PCV estimation • Total RBC counts, Total WBC counts • ,PTT and APTT	**18**
III	• Preparation of blood thin film and staining and study of Differential leucocyte counts • Absolute Platelet count • Reticulocyte count • Eosinophil count	**18**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Students can draw the chart on Erythropoiesis.
- Students can explain the different lab investigations for blood with the help of chart.

- Students can show a diagrammatic representation of hemostasis.

Text Books:

4. Textbook of pathology, Harsh mohan, 8th edition, Jaypee publishers
5. Textbook of Medical laboratory Technology, 3rd edition, Godkar PB, Bhalani publishing house
6. Textbook of Medical laboratory Technology , RamnikSood, Jaypee publishers

References:

3. Dacie and lewis practical Haematology, Barbara J Bain, Imedla Bates, Mike A Laffan,12th edition, Elsevier publications
4. Manual of Medical Laboratory Technology, K.N.Sulochana and S. Ramakrishnan, Jaypee publishers

Semester -IV

Detailed Syllabus

Name of the Subject: Histopathology and Cytopathology (Theory+Lab)		**Type of Course: Major**
Paper Code: MLT242M402		**Course Level: 200**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding histopathology and cytopathology

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** normal histological structures and identify pathological changes such as cellular abnormalities	**BT 1**
CO 2	**Classify** the different types of microtomes, methods of staining tissues, mounting etc.	**BT 2**

CO 3	**Apply** the concept of cellular specimen collection, demonstrating the ability to diagnose by identify normal and abnormal cell morphology**.**	**BT 3**
CO 4	**Analyze** the skills to accurately prepare cell block, staining procedure based on different types of stains and skills for lab establishment.	**BT 4**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Introduction of histopathology, laboratory organization, care & maintenance of equipment's used in histotechnology lab, Basic concepts of fixation and various types of fixative used in histopathology. Grossing of tissues, whole mount, sections, smears, tissue processing and its steps, manual and automated method, Decalcification, decalcification methods, Embedding media, its type and properties	**16**
II	Microtome, its type and working, various type of microtome, Microtome knives, its type and knife sharpening, Cryostat, frozen sections of fresh, fixed and unfixed tissue, Stains and dyes, natural dye, acidic dye, basic dye, neutral dyes, fluorescence dye, mordant, metachromatic dyes, types of hematoxylin, Hematoxylin and eosin staining, use of control sections in tissue staining, mounting and mounting media, advantages & disadvantages.	**16**
III	Definition of cytology, Cells & tissues, Normal tissues, Classification of cytology- Exfoliative and interventional cytology, Collection of specimens from female genital tract specimen for routine screening, **Urinary cytology**: Collection of `urinary tract specimens, Diagnostic utility of urinary cytology, Progressive changes of the cells.	**16**
IV	Cell block preparation, Cytological fixative and mailing Definition, Types/classification, Aims & object, Materials for establishments of cytological lab, Staining: R/E stain types-Methods, Maintenance, Preparation of stain, Pap's stain, Special stains- MGG, PAS, ZN, Mucicarmineetc, Mounting and Labelling, Establishments of lab-Manpower, Space, Ventilation, Light, Water, working benches, Room arrangements, Reception of specimens, Instruments required.	**16**
TOTAL		**64**

Detailed syllabus:

Title of the Paper: Histopathology and Cytopathology (Lab) **Paper code: MLT242M412**

Modules	Topics (if applicable) & Course Contents	Periods
I.	Labelling of specimen, Filling of forms, Receiving and labelling of sample and maintenance of register, Slide demonstration of different types of cells, Common instruments for histopathology, Fixative preparation, Preparations of graded alcohols, grossing, Tissue Processing, Decalcification Preparation of blocking and section cutting, staining, mounting and labelling. Staining- Haematoxylene& Eosin stain, PAS stain, Oil Red O'/ Sudan Black stain,	**18**
II	Receiving of Sample, Labelling and maintanence of registers Preparation of Exfoliative cytological smears Fixation – types and methods, Preparation of smears in interventional cytology, Fixation and stains, . Staining R/E: Preparations of stains, Methods – MGG & PAPs, Mounting, Labelling, Record keeping of reports and blocks, Lab Safety and Quality control.	**18**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Students can draw a chart on systematic procedure of tissue processing along with diagram.
- Students can draw a chart on systemetic staining procedure with colourfull diagrams.
- Students can demonstrate on the working of microtome

Texts Books:-

1. Textbook of pathology, Harsh mohan, 8th edition, Jaypee publishers
2. Bancroft's theory and practice of Histological techniques by S. Kim Suvarna, Christopher Layton, John D. Bancroft, 7th edition, Churchill Livingstone publishers
3. General and Systemic Pathology, James underwood, Simon Cross,5th edition, Elsevier

References:

1. Textbook of Medical laboratory Technology, 3rd edition, Godkar PB, Bhalani publishing house

2. Histotechnology, A self-instructional text by Freida L. Carson,1st edition, Lippincott Williams publishers

Semester -IV

Detailed Syllabus

Name of the Subject: Systemic bacteriology (Theory+Lab)		**Type of Course: Major**
Paper Code: MLT242M403		**Course Level: 200**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Bacteriology

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** the basic knowledge on bacteria and its different classification.	**BT 1**
CO 2	**Explain** bacteria based on taxonomy, staining characteristics, and biochemical properties.	**BT 2**
CO 3	**Identify** different types of bacteria and the different methods of laboratory diagnosis.	**BT 3**
CO 4	**Analyse** standard aseptic techniques and perform bacterial cultivation using various culture media.	**BT 4** **BT 4**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**BACTERIOLOGY** Systemic bacteriology Study of - Staphylococcus, Streptococcus, Pneumococcus, Cornybacteriumdiptheriae, Mycobaterium, E. coli, Klebsiella, Salmonella, Pseudomonas, Vibrio, Neisseria	**16**
II	Systemic study of morphologic biochemical and antigenic characters, pathogenesis , Laboratory diagnosis of Gram Positive Bacilli- Corynebacterium, Mycobacterium, Actinomycetes Listeria, Bacillus, _Clostridia.	**16**
III	Systemic study of morphologic biochemical and antigenic characters, pathogenesis , Laboratory diagnosis of Gram Negative Bacilli- Enterobacteriaceae, Pseudomonas Alcaligenes, Vibrio, Aeromonas, Plesiomonas, Campylobacter, Bacteroides,	**16**
IV	Fusobacterium, Brucella, Haemophilus, Bordetella, Pasteurella, Francisella Miscellaneous Bacteria - Spirochaetes, Chlamydia, Rickettsia, Mycoplasma, L forms, etc.	**16**
TOTAL		**64**

Title of the Paper: Systemic bacteriology (Lab) **Paper code: MLT242M413**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Culture Techniques Composition of culture media Preparation of media	**18**
III	Identification of media & their uses Culture methods & identification of common bacteria on media. Antibiotic sensitivity testing.	**18**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Can identify different microorganism under the microscope.
- Make a chart on different classification of bacteria with examples

Texts:

1. Medical Microbiology by R. Cruickshanketal, vol.I ELBS
2. Medical Laboratory Manual for Tropical Countries, Volume II : Microbiology, by Monica Cheesbrough ELBS
3. Text book of practical Microbiology by S.C.Parija

Reference Book:

1. Mackie and McCartne; Practical Medical Microbiology Volume 1 & 2, 14th edition (2007), Elsevier.
2. Textbook of Microbiology, Ananthanarayann, Paniker, Arti Kapil,9thedition, universities press
3. C.P.Baveja, Textbook of microbiology,6thedition,Arya Publications

Subject: General Pathology		**Type of course: Major**
Subject Code: MLT242M405		**Course Level: 200**
Total credits: 3	**Scheme of Evaluation:T**	**L- T-P-C: 3-0-0-3**

Course Objectives:

The course with an objective to give the students a wholesome practical knowledge on collecting different biological specimen and its role in analyzing different pathological disorders, on performing different biochemical and microscopic examination of urine and the different methods to perform ABO blood grouping.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI. No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Name** the biological specimen commonly collected in clinical laboratory.	**BT 1**
CO 2	**Explain** the clinical importance of 24 hours urine examination for proteins.	**BT 2**
CO 3	**Apply** the knowledge of the principle of blood grouping and perform both forward and reverse grouping.	**BT 3**
CO 4	**Analyze** the physical and microscopic examination of the various biological specimen	**BT 4**

DETAILED SYLLABUS

Modules	**Course Content**	**Periods**
I	**CLINICAL PATHOLOGY** Urine collection for Routine examination. Midstream Urine Collection 24 hrs. Urine examination for proteins. Urine R/E- Physical Examination Biochemical Examination Microscopic Examination in detail.	**16**

II	Peripheral Blood examination -Physical, Chemical, Cell count – DLC/TLC, Cerebrospinal Fluid (CSF) examination: Physical, Chemical, Cell cou DLC/TLC	**16**
III	Sputum analysis: Physical Examination, Chemical examination, Microscopy examination. Acid-Fast Bacilli (AFB) Staining in details Stool analysis in detail.	**16**
IV	Preparation of Blood cells for ABO grouping ,Preparation of Serum Cells for reverse grouping, Blood grouping Forward grouping - Moist Chamber Slide method and tube method Reverse Grouping – Moist Chamber Slide method and tube metho Cross matching, Donor Screening	**16**
TOTAL		**64**

Suggested Books:

1. Textbook of pathology, Harsh mohan, 8th edition, Jaypee publishers
2. Textbook of Medical laboratory Technology, 3rd edition, Godkar PB, Bhalani publishing house
3. Textbook of Medical laboratory Technology, RamnikSood, Jaypee publishers

References:

1. Dacie and lewis practical Haematology, Barbara J Bain, Imedla Bates, Mike A Laffan,12th edition, Elsevier publications
2. Manual of Medical Laboratory Technology, K.N.Sulochana and S. Ramakrishnan, Jaypee publishers

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**00**	**26**

Experiential learning activities may include:

- The students know about the specimen collection in the clinical laboratory.
- They can have exponential learning as regards ABO and Rh blood group types and their disorders as well as hemoglobinopathies.
- Experiential learning on health camp conduction and detection of disorders as well as hands on training.

Level: Semester IV

Detailed Syllabus

Name of the Subject: Behavioural Sciences – IV **Type of Course: BHS**

Paper Code: BHS982A404

Total credits: 1

Course Objectives

To increase one's ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations.

Course Outcomes:

SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Understand the importance of individual differences	BT 1
CO 2	Develop a better understanding of self in relation to society and nation	BT 1
CO 3	Facilitation for a meaningful existence and adjustment in society	BT 1

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Managing Personal Effectiveness** Setting goals to maintain focus, Dimensions of personal effectiveness (self disclosure, openness to feedback and perceptiveness), Integration of personal and organizational vision for effectiveness, A healthy balance of work and play, Defining Criticism: Types of Criticism, Destructive vs Constructive Criticism, Handling criticism and interruptions.	4
II	**Positive Personal Growth** Understanding & Developing positive emotions, Positive approach towards future, Impact of positive thinking, Importance of discipline and hard work, Integrity and accountability, Importance of ethics in achieving personal growth.	4

III	**Handling Diversity** Defining Diversity, Affirmation Action and Managing Diversity, Increasing Diversity in Work Force, Barriers and Challenges in Managing Diversity.	**4**
IV	**Developing Negotiation Skills** Meaning and Negotiation approaches (Traditional and Contemporary) Process and strategies of negotiations. Negotiation and interpersonal communication. Rapport Building – NLP.	**4**
TOTAL		**16**

Text books

- J William Pfeiffer (ed.) Theories and Models in Applied Behavioural Science, Vol 3, Management; Pfeiffer &Company
- Blair J. Kolasa, Introduction to Behavioural Science for Business, John Wiley & Sons Inc.

Level: Semester IV

Detailed Syllabus

Name of the Subject: Employability and Communication	**Type of Course: AEC**
Paper Code: CEN982A401	**Course level:** 200
Total credits: 1	**L-T-P-C:** 1-0-0-1

Course Objectives

This course is designed to enhance employability and maximize the students' potential by introducing them to the principles that determine personal and professional success, thereby helping them acquire the skills needed to apply these principles in their lives and careers.

Course Outcomes:

SI No	Course Outcome	Blooms Taxonomy Level
CO 1	**Demonstrate** understanding the importance of verbal and non-verbal skills while delivering an effective presentation.	**BT 1**

CO 2	**Develop** professional documents to meet the objectives of the workplace	**BT 2**
CO 3	**Define** and identify different life skills and internet competencies required in personal and professional life.	**BT 3**

COURSE OUTLINE:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Presentation Skills** Importance of presentation skills, Essential characteristics of a good presentation, Stages of a presentation, Visual aids in presentation, Effective delivery of a presentation	**5**
II	**Business Writing** Report writing: Importance of reports, Types of reports, Format of reports, Structure of formal reports Proposal writing: Importance of proposal, Types of proposal, structure of formal proposals Technical articles: Types and structure	**5**
III	**Preparing for jobs** Employment Communication and its Importance, Knowing the four step employment process, writing resumes, Guidelines for a good resume, Writing cover letters. Interviews: Types of interview, what does a job interview assess, strategies of success at interviews, participating in group discussions.	**5**
IV	**Digital Literacy and Life Skills** **Digital literacy**: Digital skills for the '21st century', College students and technology, information management using Webspace, Dropbox, directory, and folder renaming conventions. Social Media Technology and Safety, Web 2.0. **Life Skills:** Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problemsolving, Effective communication, interpersonal relationship, coping with stress, coping with emotion. Application of life skills: opening and operating bank accounts, applying for pan, passport, online bill payments, ticket booking, gas booking	**5**

Keywords: Employability, business writing, presentation skills, life skills

Text:

1. Business Communication by PD Chaturvedi and Mukesh Chaturvedi

References:

1. Business Communication by Shalini Verma References:

2. Technical Communication by Meenakshi Raman and Sangeeta Sharma

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
15 hrs	**-**	10 hours - Movie/ Documentary - screening - Field visits - Peer teaching - Seminars - Library visits

SYLLABUS (5th SEMESTER)

Semester -V

Detailed Syllabus

Name of the Subject: Mycology (Theory+Lab)		**Type of Course: Major**
Paper Code: MLT242M501		**Course Level: 300**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Medical Bacteriology.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** basic facts and definitions related to including the names and features of various fungi	**BT 1**
CO 2	**Explain** the importance of fungi in both the environment and human health, explaining their biological roles and impact on individuals**.**	**BT 2**
CO 3	**Organize** the practical skills to work with samples, employing methods like staining, culturing, and microscopy to identify fungi and parasites in real-world scenarios.	**BT 3**
CO 4	**Analyse** and evaluate clinical data and case studies, interpreting symptoms and laboratory results to diagnose infections and suggest effective treatments.	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	Introduction to Mycology, Characteristics of fungi. Taxonomical & morphological classification of fungi. Nutrition and cultivation of fungi. Reproduction and sporulation of fungi. Types & structure of fungal spores. Formation of fungal spore. Classification of fungal diseases: superficial, subcutaneous & systemic & opportunistic mycoses	**16**

II	Morphological, cultural characteristics of common fungal laboratory contaminants. Preservation of fungal cultures.Superficial Mycoses (morphology, life cycle, culture characteristics, pathogenesis, infection with clinical feature and laboratory diagnosis): Dermatophytes, Pityriasis versicolor (Tinea versicolor), Tinea nigra, Piedra. Subcutaneous Mycoses (morphology, life cycle culture characteristics, pathogenesis, disease with clinical feature and laboratory diagnosis): Actinomycetes & filamentous fungi (causative agent of mycetoma), Dematiaceae family fungi (causative agent of chromomycosis), Sporothrix schenckii (causative agent of sporotricosis), Rhinosporidium seeberi (causative agent of Rhinosporidiosis).	**16**
III	Systemic Mycoses (morphology, life cycle culture characteristics, pathogenesis, disease with clinical feature and laboratory diagnosis): Histoplasma capsulatum (causative agent of Histoplasmosis), Blastomyces dermatititis (causative agent of Blastomycoses), Paracoccidioides brasiliensis (causative agent of Paracoccidioidomycosis), Coccidioides immitis (causative agent of Coccidioidomycosis), Cyptococcus neoformance (causative agent of Cyptococcosis)	**16**
IV	Common laboratory diagnosis of mycoses: Direct microscopy – KOH preparation, gram staining, Lacto phenol cotton blue, Indian ink preparation. Culture methods for fungus - colony characteristics on special media. Examination of tissues section for fungal infections. Processing of clinical samples for diagnosis of fungal infections: Skin, nail, hair, pus, sputum, CSF and other body fluids. Routine myco-serological tests.	**16**
TOTAL		**64**

Title of the Paper: Mycology (Lab) **Paper code: MLT242M511**

Modules	Topics (if applicable) & Course Contents	Periods
I.	Media and stains preparation for Mycology, Diagnostic methods in Mycotic infections, Study of Growth characteristics, Microscopic examination and identification of Medically important fungi,	**18**
II	Collection, transportation and processing of specimens for mycological examination, Slide culture technique, Germ tube test for yeast identification, Serological tests in Mycology.	**18**
TOTAL		**36**

Detailed syllabus:

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

1. Exposure to microbiology samples in the lab
2. Perform different experiment on detection of fungus

Text Books:

1.Peppler J H, Microbial Technology, 2nd edn, 1979, Academic press.
2.Ananthnarayan and Panikar's Text Book of Microbiology, 10th edn, 2017, Orient-Longman, Chennai
3.Sastry SA, Bhat S, Essentials of medical microbiology, 2nd edn, 2018, CBS publisher and distributors.
4. Edward Alcamo, Fundamentals of Microbiology, 4th edn, 2004,Benjamin-cummings Pub. Co. Ltd.
5. Bergeys manual of systematic bacteriology, 2nd edn, 2012, Vol-I to V, Williams and Wilkins- A Waverly company.

Reference Books:

1. Harvey AR, Lippincott's Illustrated Reviews Microbiology, 3rd edn, 2012, wolter and klower publications.
2. Mims R, Medical microbiology, 1st edn, 2020, Mosby publisher.
3. Prescott and Dunn., Industrial Microbiology, 8th edn, 2011, CBS Publishers & Distributors, Delhi.
4. Pelczar, Chan Kreig, Microbiology, 5th edn, 2001, Tata McGraw Hill publisher ltd.
5. Martin frobisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. 1987, Saunders, Philadelphia.

Semester -V

Detailed Syllabus

Name of the Subject: Diagnostic Molecular Biology (Theory+Lab)		**Type of Course: Major**
Paper Code: MLT242M502		**Course Level: 300**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Diagnostic Molecular Biology.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** the fundamental principles of molecular biology techniques used in diagnostics, such as PCR, sequencing, and gene expression analysis.	**BT 1**
CO 2	**Explain** the role of molecular biology in the detection and diagnosis of infectious diseases and genetic disorders.	**BT 2**
CO 3	**Apply** perform and interpret basic molecular diagnostic tests, including PCR amplification and radioisotopes application for clinical samples.	**BT 3**
CO 4	**Analyze t**he effectiveness, sensitivity, and limitations of various molecular diagnostic techniques in different clinical settings.	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	Nucleic Acids, DNA, RNA, composition, structure, types, denaturation andrenaturation of DNA, chemistry of DNA synthesis, general principles of replication,enzyme involved in DNA replication,– DNA polymerases, DNA ligase, primase, telomerase and other accessory proteins	**16**

II	Basic transcription apparatus, Initiation, elongation and termination of transcription, Eukaryotic Transcription of mRNA, tRNA and rRNA, types of RNA polymerases, transcription factors Introduction of translation	**16**
III	Nucleic acid amplification testing, PCR, Principle, Types, applications, Thermal cycler, RT PCR, reverse transcriptase PCR, Nested PCRBlotting techniques, southern blotting and Western blotting . Introduction to chromosomes, its structure and disorder, Karyotyping, Chromosomal studies in hematological disorders (PBLC and Bone marrow), FISH	**16**
IV	Radioisotopes and its application in measurement of blood volume, determination of red cell volume and plasma volume, red cell life span, platelet life span, radiation hazards and its prevention disposal of radioactive material. Introduction and applications of Flow cytometry, Stem cell banking, Prenatal Diagnosis	**16**
TOTAL		**64**

Title of the Paper: Diagnostic Molecular Biology (Lab) **Paper code: MLT242M512**

Modules	Topics (if applicable) & Course Contents	Periods
I.	• Isolation of DNA fromblood and bacterial cells • Estimation of DNA • Isolation of plasmids from bacterial cells • Separation of DNA by Agarose gel electrophoresis • Demonstration of thermal cycler and PCR Gel documentation & photography	**18**
II	• HIV test by Western Blotting • Demonstration of PCR HLA B-27 • Demonstration of PCR HIV • Demonstration of PCR MTB • Mitotic and meiotic stages • Separation of haemoglobin	**18**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Students can explored the structure and function of nucleic acids, learning how DNA replication and transcription occur in living cells.
- Students can gained practical experience with PCR techniques for amplifying DNA and applying blotting methods like Southern and Western blotting for molecular analysis.
- Students can worked with flow cytometry, stem cell banking, and prenatal diagnosis to understand their real-world applications in clinical settings.

Recommended Books:

- Basic Biotechnology (Paperback) By Colin Ratledge and Bjorn Kristiansen. Cambridge University Press.
- Introduction to Biotechnology (Paperback) By William J. Thieman and Michael A. Palladino. Benjamin Cummings; US Ed edition.
- Recombinant DNA Principles and Methodologies By James Joseph Greene, CRC Press.

Reference Book:

- Molecular Biotechnology: Principles and Applications of Recombinant DNA (Paper-back) By Bernard J Glick and Jack J Pasternak. Publisher: American Society for Microbiology.
- Laboratory Techniques in Biochemistry and Molecular Biology; DNA sequencing (Vol 10). By J Hindley. Elsevier Biomedical

Semester -V

Detailed Syllabus

Name of the Subject: Blood banking (Theory and Lab)		**Type of Course: Major**
Paper Code: MLT242M503		**Course Level: 300**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding blood banking.

Course Outcomes:

On successful completion of the course the students will be able to:

SI No	Course Outcome	Blooms Taxonomy Level
CO 1	**Define** the basic knowledge on blood banking understanding its history and types of blood grouping.	BT 1
CO 2	**Explain** about the blood grouping and different types of cross matching.	BT 2
CO 3	**Apply** the knowledge of blood banking enabling them the criteria for donor selection and care.	BT 3
CO 4	**Analyse** the various blood components and the QC used in blood banking.	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	History of blood group , ABO blood grouping and Other Blood grouping system. Donor selection & phlebotomy, preservation and storage of blood. Importance types and principle of blood grouping systems methods.	16
II	Blood grouping- forward and reverse grouping. Preparation of pooled ABO cells. Cross matching grading of reactions. Rh typing slide and tube method, DU testing Coombs test direct and indirect	16
III	Compatibility testing and emergency crossmatching Donor selection, post donation care, adverse effect of blood transfusion, Testing for transfusion transmitted diseases	16
IV	Blood components preparation and their uses- PRBC, FFP, Platelet concentrate, cryoprecipitate. Quality control – methods, reagents, tests methods, products.	16
TOTAL		64

Title of the Paper: Blood Banking (Lab) **Paper code: MLT242M513**

Modules	Topics (if applicable) & Course Contents	Periods

I.	ABO blood grouping (forward and reverse) tube and slide method. Preparation of pooled red cells (A, B and O). Procedure of blood collection in blood bank.	**18**
II	Crossmatching Techniques, Major, Minor, Saline, Albumin, Coomb's Coomb's test (direct and indirect) Testing for transfusion transmitted diseases	**18**
TOTAL		**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Students can draw the chart showing blood components separation
- Students can make a chart explaining the different types of blood group system.

Text Books:

1. Textbook of pathology, Harsh mohan, 8th edition, Jaypee publishers
2. Textbook of Medical laboratory Technology, 3rd edition, Godkar PB, Bhalani publishing house

References:

1. Manual of Medical Laboratory Technology, K.N.Sulochana and S. Ramakrishnan, Jaypee publishers
2. Textbook of Medical laboratory Technology , RamnikSood, Jaypee publishers

Semester -V

Detailed Syllabus

Name of the Subject: Clinical Parasitology (Theory+Lab) **Type of Course: Major**
Paper Code: MLT242M504 **Course Level: 300**

Total credits: 4 **Scheme of Evaluation: T+P** **L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Medical Parasitology.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	Recall basic facts and definitions related to parasitology, including the names and features of various and parasites	**BT 1**
CO 2	Explain the importance of parasites in both the environment and human health, explaining their biological roles and impact on individuals.	**BT 2**
CO 3	Organize the practical skills to work with samples, employing methods like staining, culturing, and microscopy to identify fungi and parasites in real-world scenarios.	**BT 3**
CO 4	Analyse and evaluate clinical data and case studies, interpreting symptoms and laboratory results to diagnose infections and suggest effective treatments.	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	An elementary study of the types of animal associations parasitism commensalisms and symbiosis. Types of parasites. Classification of protozoan & Helminthes	**16**
II	Protozoa: Entamoeba, Dientamoeba, Iodamoeba, Embadomonas, Trichomonas, Chilomastix, Enteromonas, Trypnosomes, Leishmania, Giardia, Plasmodium, Isospora, Eilmeria and Balantidium, Toxoplasma	**16**
III	Platyhelminthes, Diphyllobothrium, Sparganum, Taenia, Echinococcus, Hymenolepis, Schistosoma, Fasciola, Fasciolopsis, Clonorchis, Peragonimus. Nemathelminthes: Ascaris, Ancylostoma, Necator, Strongloides, Trichinella Enterobius, Trichurias, Wucherei, Brugia, Loaloa, Onchocerca, Dracunculus	**16**
IV	Collection and preservation of specimens for parasitological examination, preservation of specimens of parasitic eggs and embryos, Preserving Fluids, Transport of specimens Detection of intestinal parasites: Detection	**16**

	and identification of amoebae and other intestinal protozoa and other parasites. Examination of Blood parasites: Thick and Thin smears for malaria and Filaria and other parasites. Concentration methods.	
TOTAL		**64**

Title of the Paper: Parasitology (Lab) **Paper code: MLT242M514**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Preparation of stains and reagents: Leishman, Giemsa, Fields, Carbol fuschin and phosphate buffer, Macroscopic and microscopic examination of stool for adult worms, ova, cysts, larvae.	**18**
II	Concentration techniques for intestinal parasites in stool, Preparation of culture media for parasite cultivation, Preparation of thick and thin smear	**18**
TOTAL		**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- Exposure to microbiology samples in the lab
- Perform different experiment on detection of parasites

Text Books:

1. Text Book of Parasitology by K.D. Chatterjee, Chatterjee Medical Publishers, Calcutta.
2. Parasitic diseases in man by Richard Knight English Language Book Society (ELBS)
3. .Mackie and McCartne; Practical Medical

Reference Books:

4. Microbiology Volume 1 & 2, 14th edition (2007),Elsevier
5. Geo. F. Brooks,Stephen A. Morse & Karen C. Carroll; Jawetz, Melnick, & Adelberg'sMedical Microbiology, 27th edition (2016),
6. Text book of Medical Parasitology by S.C.Parija

SYLLABUS (6th SEMESTER)

Semester -VI

Detailed Syllabus

Name of the Subject: Virology (Theory+Lab)		**Type of Course: Major**
Paper Code: MLT242M601		**Course Level: 300**
Total credits: 4	**Scheme of Evaluation: T+P**	**L-T-P-C: 3-0-2-4**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding medical virology

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	Recall the medically important parasites, including protozoa and helminths, and their life cycles along with principles of methods	**BT 1**
CO 2	Explain on the structure, classification, and replication of viruses relevant to human health	**BT 2**
CO 3	Apply appropriate analytical equipment and molecular diagnostic methods for parasite identification test.	**BT 3**
CO 4	Analyze the process of antiviral therapy, vaccine development, and emerging viral infections.	**BT 4**

Detailed syllabus:

Modules	**Topics (if applicable) & Course Contents**	**Periods**
I.	General properties of virus. Structure & symmetry of virus. Classification of viruses. Cultivation of viruses. Viral Replication Cycles. Lab diagnosis of viral disease. Pathogenesis & control of viral disease. Bacteriophages.	**16**
II	Common viral disease – mode of infection, spread. Laboratory Diagnosis – Polio, Influenza, Para influenza, Mumps, Measles, Rubella, Respiratory syncitial, Rhino, Rota, Hepatitis, arbo viruses prevalent in India (Dengue, West Nile, Japanese Encephalitis,	**16**

	KFD), Chicken pox, Adeno, Papova, Herpes, HIV, Cytomegalo viruses, etc..	
III	Slow and oncogenic viruses: scrapie, kuru and animal virus. Viral Diseases (Pathogenesis, clinical features & Lab. Diagnosis): Rabies, Chikungunya, . Cell culture and observation of effect viruses on cell culture: Technique, procedure and interpretation of result.	**16**
IV	Emerging viral infections: SARS, MERS CoV, Zika, Crimean Congo hemorrhagic Fever, Nipah, Influenza viruses etc. Elementary Knowledge of viral vaccines, types and its biological role in humans. Bacteriophage- general characters, growth, multiplication, lytic cyle, lysogenic cycle, Phage typing.	**16**
TOTAL		**64**

Title of the Paper: Virology (Lab) **Paper code: MLT242M611**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Quantitative estimation HIV by ELIZA method and demonstration of RIA staining.	**18**
II	Quantitative estimation HbSAg by ELIZA method and demonstration of RIA staining.	**18**
	TOTAL	**36**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**36**	**20**

Experiential learning activities may include:

- ELISA technique demonstration
- Exposure to microbiology samples in the lab

Text Books:

- Textbook of pathology, Harsh mohan, 8th edition, Jaypee publishers
- Textbook of Medical laboratory Technology, 3rd edition, Godkar PB, Bhalani publishing house
- Textbook of Medical laboratory Technology , RamnikSood, Jaypee publishers

References:

- Dacie and lewis practical Haematology, Barbara J Bain, Imedla Bates, Mike A Laffan,12th edition, Elsevier publications
- Manual of Medical Laboratory Technology, K.N.Sulochana and S. Ramakrishnan, Jaypee publishers

Semester -VI

Detailed Syllabus

Name of the Subject: Enzymology and Nutrition		**Type of Course: Major**
Paper Code: MLT242M602		**Course Level: 300**
Total credits: 3	**Scheme of Evaluation: T**	**L-T-P-C: 3-0-0-3**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Advance Biochemistry and Enzymology.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** the properties of enzymes and nutrition and process of diagnosis of various laboratory test related to liver function and kidney function test	**BT 1**
CO 2	**Explain** the various experiments related to renal, thyroid and liver disorder and the disorders due to nutrition deficiency	**BT 2**

CO 3	**Identify** the specific organ failure based on the different parameters of liver, thyroid and kidneys and nutritional disorders	**BT 3**
CO 4	**Analyse** and understanding the reaction and properties od isoenzymes and their causes of elevation.	**BT 4**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Iso-enzymes:Lactate dehydrogenase, creatine kinase, aspartate amino amylase, isocitrate dehydrogenase., Enzymes as therapeutic agents, Enzymes used for diagnosis . Specimen collection and analysis.Collection of sample, sample acceptance and rejection criteria, transport of sample, Post-Collection Handling, Ethical and Legal Considerations, Time Sensitivity of Samples, Additional Factors Affecting Sample Integrit storage of specimen for appropriate test, reference ranges.	**16**
II	Organ Function Test: Liver function tests- Tests for Liver Function, Serum bilirubin, Classification of jaundice, Bile acids and bile salts, Tests based on metabolic capacity of liver, Tests based on synthetic function. Renal function tests- Urea clearance tests, Endogenous creatine clearance tests, Tests for renal blood flow, Test based on tubular function, Water dilution tests.	**16**
III	Gastric function tests- Test for determining gastric function, Examination of resting contents, Fractional gastric analysis, Histamine stimulation tests. Thyroid function tests- Tests based on primary function – RIU,PBI131. Test based on blood levels of thyroid hormones – T3, T4,TSH. Test based on metabolic effects of thyroid hormone, Scanning of thyroid gland.	**16**
IV	Importance of food and nutrition in day today life, Role of nutrition in maintaining health, Recommended Dietary Allowances (RDA). Macronutrients: Carbohydrates, Proteins and Fats – definition, Function, Source, Digestion and Absorbtion, disorders. **Micronutrients: Definition**, Classification – water soluble and fat soluble, Fat soluble – A,D,E,K vitamins, Water soluble – C,B, Pectin, lipoic acid, inositol etc., RDA, Rickets, osteomalasia, scurvy, beri-beri, pellagra, pernicious anaemia. Principal mineral elements, essential trace elements, Calcium and phosphorus metabolism, Magnesium metabolism, Iron, zinc, copper metabolism.	**16**
TOTAL		**64**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**00**	**26**

Experiential learning activities may include:

- Students can perform various laboratory test such as lactate dehydrogenase and creatine kinase to learn how they help diagnose and treat diseases.
- Students can perform various organ function tests, including liver, renal, and gastric function assays, to assess metabolic and synthetic activities
- Students can apply proper specimen collection techniques, and understanding factors affecting sample integrity
- They can prepare a chart to identify RDA of food and vitamins.

Texts:

1.Lehinger Principle of Biochemistry, David L Nelson, 7th edition, WH freeman Publishers

2. Fundamentals of biochemistry,JLjain and Sanjay Jain,S Chand Publishers.

Reference Book:

1. Text book of Medical Biochemistry – MN Chaterjee, Rana Shinde, Jaypee publishers.
2. Biochemistry, U. Sathyanarayana, Elsevier
3. Harper's Biochemistry,28thedition, Robert K Murray, Tata McGraw publishers

Semester -VI

Detailed Syllabus

Name of the Subject: Medical Law and Patient Safety		**Type of Course: Major**
Paper Code: MLT242M603		**Course Level: 300**
Total credits: 3	**Scheme of Evaluation: T**	**L-T-P-C: 3-0-0-3**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding the medical

laws and requirements needed to follow for patient safety.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** and identify risks and implement strategies for minimizing harm in clinical settings.	**BT 1**
CO 2	**Classify** the roles and responsibilities of medical professionals in accordance with national and international health laws.	**BT 2**
CO 3	**Apply** principles of patient safety to identify risks and implement evidence-based strategies for minimizing harm in clinical settings.	**BT 3**
CO 4	**Analyze** ethical and legal issues in medical practice including informed consent, negligence, malpractice, and patient rights.	**BT 4**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Medical ethics –Definition-Goal-scope , Introduction to code of conduct Basic principles of medical ethics – confidentiality Malpractice and negligence – rational and irrational drug therapy Ethics in the profession of Medical Laboratory Science	**16**
II	Medico legal aspects of medical records – Medico legal case and type-Records and document related to MLC – ownership of medical records – Confidentiality Privilege communication – Release of medical information – Unauthorized disclosure – retention of medical records – other various aspects	**16**
III	Role Of Medical Records In Health Care Management: Computers for Medical records, Developments of computerized medical record information processing system(EMR's), Computer stored (Vs) Manual hand written record, Advantages of EMR (Vs) Manual	**16**
IV	Infection prevention and control – Evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective	**16**

	hand hygiene and use of Personal Protective Equipment (PPE)], Prevention & control of common healthcare associated infections, Components of an effective infection control program, and Guidelines (NABH and JCI) for Hospital Infection Control	
TOTAL		**64**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**00**	**26**

Experiential learning activities may include:

- Students can understand the different laws implemented for governing healthcare.
- Students can discuss on the different type of diagnosis and treatment required for patient care.

Recommended Books:

1. VP Singh; Legal Issues In Medical Practice: Medicolegal Guidelines For Safe Practice., 1st edition (2015) Jaypee Brothers Medical Publishers.
2. S.A. Kelkar; Hospital Information Systems: A Concise Study, Estern Economy edition (2010), Prentice Hall India Learning Private Limited.
3. GD Mogli; Medical Records Organization and Management, 2nd edition (2016), Jaypee Brothers Medical Publishers

4.

Reference Book:

1. The Essentials of Patient Safety by Charles Vincent
2. Laboratory quality control and patient safety by De Gruyter

Semester -VI

Detailed Syllabus

Name of the Subject: Biostatistic and Research Methodology		**Type of Course: Major**
Paper Code: MLT242M604		**Course Level: 300**
Total credits: 3	**Scheme of Evaluation: T**	**L-T-P-C: 3-0-0-3**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Biostatistics and Research Methodology.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** basic definitions and facts related to biostatistics and research methodology.	**BT 1**
CO 2	**Explain** their significance in research, particularly in terms of data analysis and result interpretation.	**BT 2**
CO 3	**Identify** with the help of biostatistical tools and research methodology to handle actual data, analyze it, and make decisions based on their findings.	**BT 3**
CO 4	**Analyse** and break down complex research articles or data sets to evaluate their design, methodology, and statistical rigor.	**BT 4**

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Introduction:** Introduction to research methodology: meaning, objectives of research, types of research, research approaches, significance of research, research process, criteria of good research, defining research problem: selecting the problem necessity and techniques in defining the problem.	**16**
II	**Research, sample design and data collection: Research Design**: need and features of good design, types, basic principles of experimental design, developing a research plan. **Sample design:** criteria for selecting a sample procedure, characteristics of good sampling procedure types of sample design, selecting random samples. **Methods of data collection:** Collection of primary data, observation method, interview method, collection of data through questionnaire and schedules and other methods. Collection of secondary data, selection of appropriate method for data, collection, case study method, guidelines for developing questionnaire, successful interviewing, survey vs. experiment	**16**
III	**Processing and analysis of data:** data analysis (elements), statistics in research, measures of central tendency, dispersion, asymmetry, regression analysis, multiple correlation and regression, partial correlation, association in case attributes **Sampling Fundamentals**: Definition, need, central limit theorem, sampling theory, concept of standard error, estimation, estimating population mean, proportion, sample size and its determination	**16**
IV	**Testing of hypothesis:** Meaning basic concepts, important parametric tests, limitations of tests of hypothesis. Chi-square test: Applications, steps characteristics, limitations. Analysis of variance and co-variance: basic principles, techniques, applications, assumptions and limitations. Analysis of non-parametric tests	**16**
TOTAL		**64**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**00**	**26**

Experiential learning activities may include:

- Students can study research articles and apply their skills
- Apply statistical knowledge for analysis of data.

Texts Books:

1. "Biostatistics: A Foundation for Analysis in the Health Sciences" by Wayne W. Daniel
2. "Biostatistics for the Biological and Health Sciences" by Marc M. Triola and Mario F. Triola

Reference Book:

1. "Fundamentals of Biostatistics" by Bernard Rosner
2. "Research Methodology: A Step-by-Step Guide for Beginners" by Ranjit Kumar

Semester -VI

Detailed Syllabus

Name of the Subject: Quality control and Bio safety		**Type of Course: Major**
Paper Code: MLT242M605		**Course Level: 300**
Total credits: 3	**Scheme of Evaluation: T**	**L-T-P-C: 3-0-0-3**

Course Objectives

The objective of the course is to introduce students to gain knowledge regarding Quality control and Bio safety

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	**Course Outcome**	**Blooms Taxonomy Level**
CO 1	**Recall** on the importance of quality control, and other processes required for patient care and hospital management.	**BT 1**
CO 2	**Classify** the chart on quality control, the methods to deal with poisoning and management of the outcome.	**BT 2**
CO 3	**Apply** the knowledge on practical aspect to deal with critical cases, to treat patients with drugs poisoning and on the process of automatic techniques.	**BT 3**

CO 4	**Analyze** the waste categories, analyse the symptoms of poisoning, legal aspects in medical profession and will be able to perform quality control.	**BT 4**

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	**Laboratory Planning**: General principle, Classifications of labs, Space requirement, Components and functions of lab, Staffing the laboratory, job specifications, Ethical principle and standard for Clinical laboratory professional, Good laboratory practice	**16**
II	**Awareness/Safety in a clinical laboratory:** Laboratory hazards, Safety programs, First Aid, Hazardous waste and transport of Hazardous material. HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines, drug Resistant Tuberculosis **Care of Laboratory Glassware, Equipments, Instruments and Chemic al:** Care and Cleaning of Glassware, Lab chemicals, their proper use and care, Labelling, Biomedical Introduction and importance of calibration and Validation of Clinical Laboratory instrument	**16**
III	**Quality Management system:** Introduction, Quality assurance, Quality control system, Internal and External quality control, quality control chart Sample analysis: Introduction, factors affecting sample analysis (Sample rejection criteria), reporting results, basic format of a test report, reported reference range, clinical alerts, abnormal results, results from referral laboratories, release of examination results, alteration in reports, Ethics in relation to Pre-Examination procedures, Examination procedures, reporting of results, preserving medical records	**16**
IV	**Audit in a Medical Laboratory:** Introduction and Importance, NABL & CAP, (LJ curves, Westguard rules, NABL, ISO guidelines), Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit, Documentation	**16**
TOTAL		**64**

CREDIT DISTRIBUTION		
LECTURE/TUTORIAL	PRACTICUM	EXPERIENTIAL LEARNING
64	**00**	**26**

Experiential learning activities may include:

- Students can understand the different types of error occurring in the laboratory
- Students can discuss on the different type of diagnosis and treatment required for patient care.

Recommended Books:

- Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states.
- Bishop(2013),Clinical Chemistry,7th edition, Wiley Publications

Reference Book:

- Hugo W.B and Russel A.D, Pharmaceutical Microbiology, 7thedn, 2004, Blackwell Scientific publications, Oxford London.
- Hospital Management & its Monitoring: Madhuri Sharma (Jaypee Brothers, Medical Publishers (P) Ltd. New Delhi)
- Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition, Elsevier Publications

Semester -VII & VIII

Detailed Syllabus

12 MONTH INTERNSHIP

Subject Name: Internship/ Apprenticeship	
Subject Code: MLT242M711/ MLT242M811	
Credit Units: 30	**Scheme of Evaluation: (P)**

- There shall be 12 months of Internship after the final year examination for candidates declared to have passed the examination in all the subjects.
- During the internship candidate shall have to devote 20 hours per week for 12 Calendar months.

- The Internship should be rotatory and cover Haematology, Histology & Cytology, Biochemistry, Microbiology, Endocrinology & Automation sections of Pathology laboratory.
- Based on the attendance and work done during posting the Director/Principal/ head of institution/department shall issue 'Certificate of Satisfactory Completion' of training following which the University shall award the B.Sc. in Medical Laboratory Technology Degree or declare the candidate eligible for the same.
- No candidate shall be awarded degree without successfully completing 12 months internship.
- Institute's Director / Principal can at his discretion grant NOC to the students to do the Internship at the place of his choice provided the concerned Hospital/Pathology Laboratory fully satisfies the above criteria. For the purpose of granting NOC the candidate shall have to submit to the Institution the status of Pathology Laboratory services available at the place where he intends to do his Internship.

Level: Semester VI

DISSERTATION/PROJECT

CODE: MLT242M822
CREDIT : 12

Each candidate pursuing BMLT course is required to carry out work on selected research to carry out work on selected research project/dissertation under the guidance of a recognised post graduate teacher in same field. The dissertation/research project is aimed to train a graduate student in research methods and techniques. It includes identification of problem, formulation, formulation of hypothesis, search and review of the literature, design of the research study, collection of data, analysis of data, interpretation of results and finally frame conclusions. The dissertation / research project should be written under following heading:

INTRODUCTION

AIMS OR OBJECTIVES OF STUDY

FORMULATION HYPOTHESIS

REVIEW OF LITERATURE

MATERIALS AND METHODS

RESULTS

DISCUSION AND INTERPRETATION

CONCLUSION
SUMMARY
REFERENCES
TABLES
ANNEXURE

SYNOPSIS Every candidate should submit a synopsis to the registrar of the university in the prescribed format containing particulars of proposed dissertation work after obtaining ethical clearance from the Institutional Ethical Committee comprising principal and other senior faculty of the college from the date of admission on or before the date notified by the university. The synopsis shall be sent through the proper channel. Such synopsis will be reviewed and the dissertation topic will be registered by the university. Synopsis should be written under following heading:-

Proposed research project topic
Introduction
Aim of Study
Objective of the study
Formulation hypothesis
Review of literature
Materials and methods
Statistics
References

The written text of synopsis shall not exceed 8(eight) pages including all the above mentioned topics.

DISSERTATION SUBMISSION

The candidate should submit their dissertation work at the end of 10 months of second year of the M.sc. MLT course.

The candidate should submit six (6) copies of dissertation (with hard binding) to the Principle/Head of the Institution. Institute shall be submitted four (4) copies of dissertation to the registrar on the 22nd month of the commencement of course on or before the date notified by the

university.

EVALUATION OF DISSERTATION

Dissertation valuation of the candidates will be conducted by the Internal and External examiners together on the basis of work, presentation and defense viva at the time of practical examination.

STANDARD FORMAT OF DISSERTATION

The written text of dissertation shall not be less than 100 pages and shall not exceed 150 pages excluding references, tables, questionnaires and annexure. It should be neatly typed (font size 12 – Time New Roman or font size 123 Arial) in double line spacing on one side of the bond paper (A-4 Size) and bound properly. The Guide and the head of the Institution shall certify the dissertation.

CHANGE OF DISSERTATION TOPIC/ GUIDE

No change in the dissertation topic/guide shall be made without prior approval from the university.

ABSTRACT

Abstract provides a brief summary of the dissertation/thesis, summing up clearly the problem examined, the methods used, and the main findings. The abstract is a one-paragraph self-contained summary of the most important elements of the paper. The abstract word limit is between 250 and 300 words. All numbers in the abstract (except those beginning a sentence) should be typed as digits rather than words. Key words (max.10) should be given, chosen from subject concerned headings. Each word should be separated by semicolon.

GENERAL PRINCIPLES

PAPER

Use only one side of high quality, plain white (unlined in any way) bond paper, minimum 20-lb weight, and "8 ½ x 11" in size. Erasable paper should not be used.

TYPE SIZE AND PRINT

The fond size should be visible to the reader, preferably Times New Roman 12 pt .No italicization.68 Size of the title should be 14 and bold; the size of sub-title should be 12 and bold.

Print should be letter quality or laser (not dot matrix) printing with dark black characters that are consistently clear and dense. Use the same type of print and print size throughout the document.

PAGINATION

Number all of the pages of your document, including not only the principal text, but also all Plates, tables, diagrams, maps and so on. Roman numerals are used on the preliminary pages (Pages up to the first page of text) and Arabic numerals are used on the text pages. The numbers themselves can be placed anywhere on the page, however they should be consistent.

SPACING

Use double spacing except for long quotations and foot notes which are single spaced.

MARGINS

Margin size; "generous"- Use plenty of room on the top, bottom, left & right (1"minimum). To allow for binding, the left hand margin must be 1.5". Other margin should be 1.0". Diagrams or photographs in any form should be a standard page size, or if larger, folded so that a free left-hand margin of 1.5" remains and the folded sheet is not larger than the standard page.

PHOTOGRAPHS

Professional quality black-and-white photographs are necessary for clear reproduction. Colors are allowed, but you should be certain the colored figure will copy clearly and will not be confusing when printed in black and white.

FILE FORMAT

Dissertation format should be in Doc (Ms Word document) or PDF (portable document Format), Image file in JPG or TIFF format and audio visual in AVI (Audio Video Interleave), GIF, MPEG (moving picture expert) files format.