



॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'B++' grade

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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या बी. व्होक (व्होकेशनल कोर्सेसचे) पदवी अभ्यासक्रमाचे Syllabus शैक्षणिक वर्ष २०२१-२२ मध्ये द्वितीय वर्ष व शैक्षणिक वर्ष २०२२-२३ पासून तृतीय वर्षाचे अभ्यासक्रम लागू करणे बाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या बी. व्होक (व्होकेशनल कोर्सेस) पदवी अभ्यासक्रमाचे Syllabus शैक्षणिक वर्ष २०२१-२२ पासून द्वितीय वर्ष आणि २०२२-२३ मध्ये तृतीय वर्षाचे Syllabus लागू करण्यास मा. विद्यापरिषदेच्या मान्यतेच्या अधीन राहून मा. कुलगुरू महोदयांनी मान्यता दिली आहे. त्या नुसार खालील अभ्यासक्रम लागू करण्यात येत आहेत.

1. B. Voc Software Development. II & III year
2. B. Voc. Bachelor of Medical Laboratory Technology. II & III year
3. Advance Diploma in Radiological Physics II year

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक-१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-

२०२१-२२/३२९

दिनांक : १७.०२.२०२२

प्रत माहिती व पुढील कार्यवाहीस्तव :

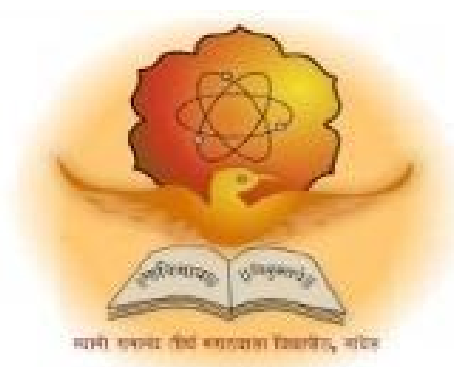
- १) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या संकेतस्थळावर प्रसिध्द करण्यात यावे.

स्वाक्षरित

सहा.कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

**SwamiRamanandTeerthMarathwadaUniversity,
Nanded(Maharashtra)
(NAAC Re-accreditedwith‘B++’Grade)**



**Syllabusof
B.Voc.Medical Laboratory Technology(SecondYear)
(3yearsDegreeCourse)
IntroducedfromAcademicYear2020-21**

B.Voc. Medical Laboratory Technology

1. Preamble:

Skills and knowledge are the driving forces of economic growth and social development for any country. Presently, the country faces a demand – supply mismatch, as the economy needs more ‘skilled’ workforce than that is available. In the higher education sphere, knowledge and skills are required for diverse forms of employment in the sectors of education, healthcare, manufacturing and other services.

Government of India, taking note of the requirement for skill development among students, launched National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

In view of this our University initiated to start skill based courses which are in demand of industries to be carry responsibilities of society. The programme is highly relevant for all those who want to pursue a professional career in software development.

2. Aim:

3. Objective:

4. Eligibility and Fees

5. Program outcome:

First Exit Point (Diploma) and Outcome of First Year

Second Exit Point (Advance Diploma) and Outcome of Second Year

• Third Exit Point (B. Voc. Degree) and Outcome of Third Year

Students will be awarded:

Certificate	Students shall be required to appear in examinations of all courses. However, to award the Certificate (Medical Laboratory Technology) a student shall study the minimum of 30 credits course and opt minimum passing credits as per university rule.
Diploma:	Student shall be required to appear in examinations of all courses. However, to award the Diploma (Medical Laboratory Technology) a student shall study the minimum of 60 credits course and opt minimum passing credits as per university rule.
Advanced Diploma	Students shall be required to appear in examinations of all courses. However, to award the Advanced Diploma (Medical Laboratory Technology) a student shall be required to study minimum of 120 credits course and opt minimum passing credits as per university rule.
B.Voc Degree	Students shall be required to appear in examinations of all courses. However, to award the degree a student shall be required to study minimum of 180 credits course and opt minimum passing credits as per university rule..

6. Assessment:

The Skill component of the course will be generally assessed by the respective Sector Skill Councils. In case, there is no Sector Skill Council for a specific trade, the assessment may be done by an allied Sector Council or the Industry partner. Further if Sector Skill Council in concerned / relevant trade has no approved QP which can be mapped progressively or due to any other reason, if the SSC expresses its inability to conduct the assessment cannot conduct the skill assessment in stipulated time frames as per academic calendar, the institutions may conduct skill assessment through a Skill Assessment Board by 'Certified Assessors' as per the provisions enumerated in MHRD Skill Assessment Matrix for Vocational Advancement of Youth (SAMVAY). The Skill Assessment Board may have Vice-Chancellor/Principal/Director/Nodal officer/Coordinator of the programme /Centre, representatives of the partner industry(s),

one nominee of the Controller of Examination or his/her Nominee of affiliating University / Autonomous College and at least one external expert. The affiliating university may nominate additional experts on the Skill Assessment Board, if required.

The certifying bodies may comply with/obtain accreditation from the National Accreditation Board for Certification Bodies (NABCB) set up under Quality Council of India (QCI). Wherever the university/college may deem fit, it may issue a joint certificate for the course(s) with the respective Sector Skill Council(s).

The general education component will be assessed by the concerned university as per the prevailing standards and procedures. General Education credit refers to a unit by which the course work is measured. It determines the number of hours of instructions required per week.

One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/fieldwork per week. Accordingly, one Credit would mean equivalent of 14-15 periods of 60 minutes each or 28 – 30 hrs of workshops/ labs. For internship / field work, the credit weightage for equivalent hours shall be 50% of that for lectures/tutorials. For self-learning, based on content or otherwise, the credit weightage for equivalent hours of study shall be 50% of that for lectures/tutorials.

The institutions offering B. Voc degree programmes should adopt and integrate the guidelines and recommendations of the respective Sector Skill Councils (SSCs) for the assessment and evaluation of the vocational component, wherever available.

Letter Grades and Grade Points: it is recommended to adopt 10- point grading system with the Letter grades as given below:

Grades and Grade Points

Letter Grade	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

Passing percentage for each paper each course is 40%. Separate passing for continuous assessment and end semester examination and/or as per time to time guidelines of the university.

A student obtaining Grade F and Ab shall be considered failed and he/she will be required to reappear in the examination.

Computation of Semester Grade Point Average System (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the course components taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e.

$$SGPA(S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where 'C_i' is the number of credits of the ith course component and 'G_i' is the grade points scored by the student in the ith course component.

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where 'S_i' is the SGPA of the ith semester and C_i is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

The skill component would be taken as one of the course components in calculation of SGPA and CGPA with given credit weightage at respective level.

SwamiRamanandTeerthMarathwadaUniversity,Nanded

B.Voc. Medical Laboratory Technology

Syllabuswitheffectivefrom2020-2021

SemesterI

Sr. No.	Course Code	Course Title	Continuous Assessment Credits(CA)			End Semester Exam Credits (ESE)			Total Credits / Marks	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT101	English language and communicative skills	2	50	20	2	50	20	4	100
2	BMLT102	Computer Fundamentals & IT	2	50	20	2	50	20	4	100
3	BMLT103	Fundamentals of Microbiology-I	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT104	Fundamentals of Anatomy and Physiology	2	50	20	2	50	20	4	100
5	BMLT105	Laboratory Science & Human Body	2	50	20	2	50	20	4	100
6	BMLT106	Hematology	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLL 107	LAB1: Fundamentals of Anatomy and Physiology	1	25	10	1	25	10	2	50
8	BMLL 108	LAB2: Laboratory Science & Human Body	1	25	10	1	25	10	2	50
9	BMLL 109	LAB3: Hematology	1	25	10	1	25	10	2	50
Total									30	750

SemesterII

Sr. No.	CourseCode		CourseTitle	ContinuousAssessmentCredits(CA)			EndSemesterExamCredits (ESE)			TotalCredits / Marks	
				Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
GeneralEducation											
1	BMLT201	Soft Skill & Personality Development I	2	50	20	2	50	20	4	100	
2	BMLT202	EnvironmentalStudies	2	50	20	2	50	20	4	100	
3	BMLT203	Microbiology-II	2	50	20	2	50	20	4	100	
Skill Courses											
4	BMLT204	AdvancedLaboratoryScienceTechniques&TestingProcess	2	50	20	2	50	20	4	100	
5	BMLT205	Biochemistry-I	2	50	20	2	50	20	4	100	
6	BMLT206	Bioinstrumentation,HaematologicalTechniques	2	50	20	2	50	20	4	100	
PracticalSkillCourses											
7	BMLL207	LAB4:AdvancedLaboratoryScienceTechniques&TestingProcess	1	25	10	1	25	10	2	50	
8	BMLL208	LAB5:Biochemistry-I	1	25	10	1	25	10	2	50	
9	BMLL209	LAB6:Bioinstrumentation,HaematologicalTechniques	1	25	10	1	25	10	2	50	
Total									30	750	

B.Voc.Medical Laboratory Technology, Second Year Semester III

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)			End Semester Exam Credits (ESE)			Total Credits	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT 301	Value Education	2	50	20	2	50	20	4	100
2	BMLT302	Biostatistics	2	50	20	2	50	20	4	100
3	BMLT303	Soft Skills & Personality Development - II	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT304	Advanced Virology	2	50	20	2	50	20	4	100
5	BMLT 305	Medical Pathology - I	2	50	20	2	50	20	4	100
6	BMLT 306	Essentials of Immunology	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLL307	LAB7- Advanced Virology	1	25	10	1	25	10	2	50
8	BMLL 308	LAB 8: Medical Pathology - I	1	25	10	1	25	10	2	50
9	BMLL 309	LAB 9 Essentials of Immunology	1	25	10	1	25	10	2	50
Total									30	750

**B.Voc.Medical Laboratory Technology, Second Year
Semester - IV**

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)			End Semester Exam Credits (ESE)			Total Credits	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT 401	Medical Ethics	2	50	20	2	50	20	4	100
2	BMLT402	Biomedical Waste Management	2	50	20	2	50	20	4	100
3	BMLT403	Metabolism - I	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT404	Bioinstrumentation Techniques - II	2	50	20	2	50	20	4	100
5	BMLT 405	Microbial Physiology	2	50	20	2	50	20	4	100
6	BMLT 406	Diagnostic Microbiology	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLL407	LAB 10-Bioinstrumentation Techniques - II	1	25	10	1	25	10	2	50
8	BMLL 408	LAB 11: Microbial Physiology	1	25	10	1	25	10	2	50
9	BMLL 409	LAB 12: Diagnostic Microbiology	1	25	10	1	25	10	2	50
Total									30	750

Semester III

Paper Title - BMLT 301	Value Education	Credits - 4
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Objective – The objective of this paper is to familiarize the students with the basic value of education for mankind purpose.

Unit 1 - Concepts and Concerns- Introduction, Why Education for Values, Values and the Contemporary Realities, What Value Education Aims at, Renewing the Purpose of Schooling, What are Values, How Values are Acquired, Value Concerns at School Stage.

Unit 2- Approaches and Strategies - The Whole School Approach, Pedagogy of Values,Some General Strategies,The Stage Specific Focus.

Unit 3 - Mapping Value Contexts in Schools – Leadership, School Ethos, Policies and Practices School Activities and Programmes, Relationship and Modelling, Teacher and Classroom Practices Proactive Strategies,Teaching of Subjects,Evaluation System,Home-School-Community Partnership,Teacher Development and Staff Orientation.

Unit 4 - Guidelines for Implementation and Evaluation ,The Five Cs, Preparing and Implementing the School Plan, The Process of Planning, The Implementation and Evaluation Process
– Evaluation of the Action Taken
– Assessment of the Change Process
– Overall Appraisal at the School level.

Books Recommended -

- 1)Allport, G.A. (1955). *Becoming*. New Haven : Yale University Press.
- 2) Clarke, P. (2001). *Teaching and Learning : The Culture of Pedagogy*. New Delhi/ Thousand Oaks/London : Sage Publications.
- 3) DeRoche, E. F. and Williams, M. M. (1998). *Educating Hearts and Minds*. California: Corusin Press.
- 4) Long, N. J., Morse, W.C., Fecser, F. A. and Newman, R. G. (2007). *Conflict in the Classroom*. Austin, Texas : 8700 Shoal Creek Boulevard.
- 5) Leicester, M., Modgil, C. and Modgil S. (2000). *Classroom Issues : Practice, Pedagogy and Curriculum* (Vol.III). London: Falmer Press, 11 New Fetter Lane.
- 6) National Council of Educational Research and Training (2005). *National Curriculum Framework*. New Delhi : NCERT.

Paper Title - BMLT 302	Biostatistics	Credits - 4
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Objective :- The student will understand and be able to explain different branches of Microbiology such as Bacteriology and Virology. The student will be able to explain about various applications of Statistics in the field of Medical, Pathology, Immunological Science.

Unit 1:-Introduction to Statistical Concepts

Introductory biostatistics: Sampling. Data collection and presentation: Types of data, Methods of data collection. Graphical (Histogram, frequency polygon and ogive curves, Box plot, Scatter plot, survival curves) and diagrammatic (Simple bar diagram, percentage bar diagram, multiple bar diagram, sub-divided bar diagram and pie diagram) representation of data. Applications of Biostatistics.

Unit 2 :- Measures of Central Tendency

Measures of central tendency: Arithmetic mean, mode, and median. Empirical relationship between mean, median and mode. Merits & De-merits of Central Tendency. Quartile and percentile.

Unit 3 :- Measures of Dispersion, Probability

Range, Standard deviation, variance and coefficient of variance. Merits & De-merits of Dispersion Standard Error and its significance, Measures of Skewness and Kurtosis. Probability: Definition, Elementary properties, Types, Rules of probability. Its applications to biological problems. Probability distributions- Binomial, Poisson, Normal (Only definitions and problems)

Unit 4 :- Tests of Significance and Designing of Experiments

Tests of Significance: The concept of Null and alternative hypothesis. Parametric and non-parametric tests of significance (Chisquare, t-test, F-test, H test, U test, and Z test). Correlation and Regression: Bivariate data and scatter diagram, Simple (linear) correlation and regression, Coefficient of correlation and regression and their properties. Analysis of Variance: ANOVA. Experimental designs- Completely Randomized Design, Randomized Block Design. Latin square design. Factorial designs.

Books Recommended -

1. Biostatistical methods by John M. Lachin. John Wiley & Sons.
2. Biostatistics- 7th edition by Wayne W. Daniel. John Wiley & Sons.
3. Sampling methods by Murthy M.N., Indian Statistical Institute, Kolkata.
4. Biostatistics by Arora and Malhan, Himalaya Publishing House
5. Fundamentals of Biostatistics (5th) by Bernard Rosner, Ed. Duxbury Thomson
6. Fundamentals of biostatistics by Irfan A Khan, Atiya Khanum. Ukaaz Publications.
7. Statistics for biologist by Campbell R.C (1974). Cambridge University Press, UK.
8. Statistics in biology Vol: 1 by Bliss, C.I.K (1967) Mc Graw Hill, New York.

Paper Title - BMLT 303	Soft Skills & Personality Development - II	Credits - 4
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- Objectives :-**
1. A comprehensive use of English in day-to-day life.
 2. To help Students develop the ability to learn and contribute critically.
 3. To develop the writing skills of the students.
 4. To help the students to understand the basic usages of English.

Unit 1 :- Phonetics: Study of Speech Sounds

1. Phonemes: Consonants (24) Vowels (20),
2. Stress; Three Term Label,
3. Intonation,
4. Word Transcription,
5. Sentence Transcription.

Unit 2 :- Soft Skills

1. Soft Skills: Leadership Skills, 2. Soft Skills: Time management,
3. Soft Skills: Stress management, 4. Conflict Management, 5. Meditation

Unit 3 :- Career Skills

1. Group Discussion,
2. Personal Employment Interview,
3. Telephonic Etiquettes & Interview,
4. Report Writing: Formal & Informal Report Writing,
5. Meetings.

Unit 4 :- Creative Writing & Situational English

1. Creative writing: Narrating a situation,
2. Situational English: Greetings, Introducing, Inviting, Thanking, Enquiring, Complimenting, Complaining etc. 3. Note Making & Note Taking ,
4. Dialogue writing,
5. Formal Letters Writing: Job Application, Curriculum Vitae, Supply Orders, Complaint letters.

Books Recommended :-

1. Mac Millan Foundation English by - R. K. Dwivedi, A. Kumar.
2. Developing communication Skills by - Krishna Mohan, Meera Banerji
3. Soft Skills by - K Alex. 4. Spoken English- Level one by - G Radhakrishana Pillai, K Rajeevan
5. Personality Development & Communicative English by - Dr. T. Bharti & Dr. M. Hariprasad
6. Effective Telephone Skills by - Thomas J. Farrell
7. Written & Spoken English by - V. H. Savant & S. R. Madan 8. Art of public speaking by - Dr. B. R. Kishore
9. Better English Pronunciation by – J.D.O.Connor

Paper Title - BMLT 304	Advanced Virology	Credits - 4
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Objectives :- The main objective of this paper is that student can analyze the various morphological, physiological features of Viruses. They can understand various mechanisms found in viral activity.

Unit 1 :- Classification, Cultivation and Detection of Viruses

Definitive properties of viruses, Cataloguing of Viruses-International Committee on Taxonomy of viruses (ICTV), Structure based classification, Baltimore classification and Homes classification, LHT system of classification, Morphology and Ultra structure of Viruses. Cultivation of Viruses: Introduction, Cell culture, Embryonated egg and Laboratory animals. Detection of viruses in the host, Measurement of infectious units, Measurement of virus particles and their components, One step growth cycle, Assay of viruses, Physical (Electron microscopy) and Chemical methods (Protein and Nucleic acid studies), Infectivity assay.

Unit 2 :- : Multiplication of Viruses

Introduction, Architecture of cell surfaces, Interaction of viruses with cell receptors, Uptake of macromolecules by cells, Mechanism of virus entry into cells, Transport of viral genome into the cell nucleus. Genomic replication of Viruses (DNA/RNA), mRNA production by animal viruses, Mechanism of RNA synthesis, Transcription mechanism and Post transcriptional processing, Translation of viral protein, Assembly, Exit and Maturation of progeny virions. Multiplication of bacteriophages.

Unit 3: Viral Pathogenesis

Host and virus factors involved in pathogenesis, Patterns of infection, Pathogenesis of animal viruses (Adenovirus, Herpes virus, Hepatitis virus, Picorna virus, Poxivirus and Orthomyxovirus), Pathogenesis of plant viruses (TMV) and Insect viruses (NPV). Host cell transformation by viruses and oncogenesis of DNA and RNA viruses.

Unit 4 : Prevention and Control of Viruses

Introduction, Viral vaccines, Preparation of viral vaccines, New vaccine technology, Antiviral drugs, Virus evolution and Emergence of new viruses.

Books Recommended :-

1. An Introduction to Viruses by S. B. Biswas & Amita Biswas (2009), Vikas Publishing House PVT LT
2. Applied Virology Research: New Diagnostic Procedures by Edouard Kurstak, R. G. Marusyk, F. A. Murphy (1984), Academic press Inc.
3. Brocks Biology of Microorganisms (Eleventh Edition) by Michael T. Madigan, John M. Martinko (2006), Pearson Prentice Hall.
4. Clinical Virology Manual by Steven C. Specter, Richard L. Hodinka, Danny L. Wiedbrauk, Stephen A. Young (2009), ASM Press.
5. Introduction to Modern Virology 4th Edition by N. J. Dimmock & S. B. Primrose (1994), Blackwell Scientific publications, Oxford.

Paper Title - BMLT 305	Medical Pathology - I	Credits - 4
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Objectives :- Students can understand various concepts such as Etiology, pathogenesis, Clinical features, laboratory diagnosis, epidemiology, treatment and prophylaxis various microbial Infections.

Unit-1 Bacterial infection

Etiology, pathogenesis, Clinical features, laboratory diagnosis, epidemiology, treatment and prophylaxis of the following:

- a. Cholera
- b. Typhoid

Unit – 2 Bacterial infection

Etiology, pathogenesis, Clinical features, laboratory diagnosis, epidemiology, treatment and prophylaxis of the following:

- a. Diphtheria
- b. Pulmonary Tuberculosis
- c. Syphilis

Unit- 3 Viral infections

Etiology, pathogenesis, Clinical features, laboratory diagnosis, epidemiology, treatment and prophylaxis of the following:

- a. AIDS
- b. Hepatitis A and B only
- c Respiratory infections (e.g. Covid – 19)

Unit – 4 Infection by other Microorganisms

- a. Morphology, life cycle, pathogenicity, etiology, laboratory diagnosis, treatment and prophylaxis of Malaria.
- b. Etiology, pathogenesis, Clinical features, laboratory diagnosis and treatment of Candidiosis.

Books Recommended :-

1. Medical Microbiology. N.C.Dey and T.K. Dey. Allied agency, Culcutta.
2. Microbiology by Davis, Dulbecco, Eisen Harper and Row Maryland.
3. Text book of Microbiology by R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman, Mumbai.
4. Medical microbiology by Chakraborty.
5. Medical Microbiology: Prep Manual for Under Graduates by Nagoba, Elsevier.

Paper Title - BMLT 306	Essentials of Immunology	Credits - 4
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Objectives - Students can understand the human body defence mechanism, its role against external pathogens.

Unit- 1 Infection, Immunity and Immune response.

Infection: Definition, types of infections, sources of infection, modes of transmission,

Microbial pathogenicity, Aggressive factors of pathogens.

Immunity: Definition and classification with suitable examples.

Unit- 2 Antigens, Antibodies and Immune Response

Antigen: Definition, general properties, antigen specificity, bacterial antigens with reference to *S. typhi*.

Antibody: Definition, properties, structure of immunoglobulin, immunoglobulin classes.

Immune response: Definition, types and mechanism- Humoral and cellular, list of effector

Molecules, Theories of antibody production.

Unit – 3 Antigen antibody reactions

Mechanism and applications of the following reaction with suitable examples: Agglutination, precipitation, complement fixation, virus neutralization, toxin neutralization reaction

Principle and applications of recent techniques: Enzyme linked immunosorbent assay,

Radioimmunoassay, Immunofluorescence test.

Unit- 4 Hypersensitivity

Definition, classification on the basis of time (Delayed and immediate) and mechanism (Type I, II, III and IV) with one example of each.

Books Recommended :-

1. Basic Immunology by Joshi and Osarano. Agrobotanical publishers Ltd. Bikaner.
2. Elementary Microbiology Vol. I and II Dr. A. H Modi. AktaPrakashan. Nadiad.
3. Medical Microbiology. N. C. Dey and T. K. Dey. Allied agency, Calcutta.
4. Microbiology by Davis, Dulbecco, Eisen Harper and Row Maryland.
5. Molecular biology by David Frifelder, Narosa Publishing house, New Delhi.
6. Immunology by B. S. Nagoba and D. V. Vedpathak. BI publications, New Delhi.
7. Text book of Microbiology by R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman, Mumbai.

Paper Title - BMLL 307	Practical - LAB 7- Advanced Virology	Credits - 2
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List of Experiments :-

1. Isolation of coliphage by plaque formation assay.
2. One-step growth curve for determination of virus titre.
3. Induction of lambda lysogeny by UV radiations.
4. Studies on Specialized transduction.
5. Isolation of lambda DNA and their characterization.
6. Amplification of lambda DNA by PCR.
7. Cultivation and assay of virus using embryonated eggs and tissue culture Technique.
8. Study of symptoms of plant viruses by simple detached leaf technique.

Paper Title - BMLL 308	Practical - LAB8: Medical Pathology - I	Credits - 2
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List of Experiments :-

laboratory diagnosis, epidemiology, treatment and prophylaxis of

- Cholera
- Typhoid
- Diphtheria
- Pulmonary Tuberculosis
- Syphilis
- AIDS
- Hepatitis A and B only
- Respiratory infections (e.g. Covid – 19)
- Malaria.
- Candidiosis.

Paper Title - BMLL 309	Practical - LAB 9 Essentials of Immunology	Credits - 2
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List of Experiments :-

1. Blood staining by Leishman's / Giemasa's method.
2. Metachromatic granule staining (Albert's Method)
3. Acid fast staining.
4. RBC counting.
5. WBC counting.
6. Blood grouping. Rh Factor
7. Widal test: Qualitative and Quantitative by slide method.
8. RPR test.

Semester – VI

Paper Title - BMLT 401	Medical Ethics	Credits - 4
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Objectives :- Students can understand moral values of Humanity.

Unit 1:- Definition and scope

- General principles
- Doctors' relationships with patients
- Quality of care
- Medical secrecy

Unit 2:- Conscientious objection

- Medical care at the end of life
- Relations with doctors and relations with other health professionals
- Relations with the Medical Association

Unit 3 :- Work in health institutions

- Organ transplants
- Human reproduction
- Genetic testing
- Medical research on humans

Unit 4 :- Torture and humiliation

- Sports doping
- Medical experts
- Medical education
- Professional publications
- Medical advertising
- Economy and fees

Books Recommended :-

- 1) Module for Teaching Medical Ethics to Undergraduates – WHO
- 2) K. R. Srikanta Murthy, Ind.J.Hist.Med.18, 46, 1973.
- 3) Kuwait, International Conference on Islamic Medicine, January 1981(1401 in the Islamic Calendar).
- 4) C. Singer and E. A. Underwood, A short History of Medicine, P.189, 1962,(Clarendon Press, Oxford).
- 5) C. D. Leake (Ed), Percival's Medical Ethics, 1927 (Williams and Wilkins, Baltimore).
- 6) T. L. Beauchamp and J. F. Childress, Principles of Biomedical Ethics, Third Edition, 1989 (Oxford University Press, Oxford/New York).
- 7) R. Gillon, Brit.Med.J.309, 184, 1994.

Paper Title - BMLT 402	Biomedical Waste Management	Credits - 4
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Objectives :- After studying this subject, students have idea about handling, disposal of biomedical waste. Its effects on environment.

Unit 1 :- HEALTHCARE WASTE& BIOMEDICAL WASTE

Definitions, Classification of Healthcare Waste, Steps involved in Bio-medical Waste Management, Bio Medical Waste Segregation, Color Coding and Type of Container/ Bags to be used for Waste Segregation & Collection. Storage of Biomedical Waste, Bio Medical Waste Collection, Time of Collection, Packaging, Labeling, Interim Storage, In House Transportation of Bio Medical Waste, Transportation Trolleys, Route of intramural transportation of bio-medical waste, Central Waste Collection Room for Bio-medical Waste, Central Storage for HCFs Having Captive Treatment and Disposal System, Record Keeping, Updating of Information in Website

Unit 2:- SEGREGATION, TREATMENT AND DISPOSAL OF BMW

Treatment Option for Bio-medical Waste, Yellow Category, Red Category, White Category, Blue Category, Spill Management Procedures, Standards for Treatment and Disposal as per BMW Rules, 2016, Standards for Incineration, Operating and Emission Standards for Disposal, Standards for Autoclave, Microwaving, Efficacy of Chemical Disinfection, Dry Heat Sterilization, Liquid Waste, Deep Burial.

Unit 3:- BMW MANAGEMENT AT OUTREACH ACTIVITIES AND BY OCCASIONAL GENERATORS

Responsibility, Out Reach Activities

Steps for Bio Medical Waste Management for Out Reach Activities ...

Bio-Medical Waste Management by Occasional Waste Generators

Unit 4 :- MANAGEMENT REQUIREMENTS.

Role of Health Care Facility, Responsibility of the Healthcare Facility. Authorization, Responsibility, Authorization under Bio-Medical Waste Management Rules, 2016. Approval for Deep Burial Pits (For HCFs Not Under Agreement with CBWTF), Agreement with Common Bio Medical Waste Treatment Facility (CBWTF). Reporting to State Pollution Control Board or Pollution Control Committee. Annual Reporting. Accident Reporting.

Books Recommended :-

- 1) Safe Management of Waste from Health Care Activities 2nd Edition: WHO
- 2) Management of Solid Health Care Waste at Primary Health Center: A Decision Making Guide: WHO
- 3) Hospital waste disposal system and technology, Journal of Academy of Hospital Administration, Vol - 8 no - 2 July 1996.
- 4) World Health Organisation Guidelines for Safe Transport of Infectious Substances and Diagnostic Specimen – WHO/EMC/97.3

Paper Title - BMLT 403	Metabolism I	Credits - 4
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Objectives :- The course is aimed to impart knowledge of structural and functional aspects of biomolecules in living systems. To understand the role of carbohydrate and fatty acids in providing the energy to the living system by its oxidation. To understand the biosynthesis of carbohydrate and fatty acids.

UNIT 1: Carbohydrate Metabolism

Photosynthesis: - Trapping of solar energy into chemical energy (PS-I & PS-II) in green plants, utilization of this energy to synthesize carbohydrate (Calvin cycle, cycle in C-4 and CAM plants), photorespiration (C-2 cycle).

UNIT 2: Carbohydrate Catabolism

Concept of respiration, Aerobic respiration: - Glycolysis, Krebs cycle and electron transport chain and anaerobic respiration

UNIT 3:- Fatty acid oxidation

Oxidation of saturated fatty acids, role of carnitine, oxidation of unsaturated fatty acids & odd carbon fatty acids.

Metabolic breakdown of amino acids, Transamination (mechanism). Oxidative & Non-oxidative Deamination. Urea cycle, metabolic disorders of urea cycle.

UNIT 4 Biosynthesis of Fatty acids:

The fatty acid synthase complex, regulation, Microsomal & Mitochondrial system of chain elongation and synthesis of unsaturated fatty acids.

Books Recommended :-

1. Hayne -Biological thermodynamics –Oxford
2. G Gottschalk-Bacterial Metabolism (2nd Ed) - Springer
3. Nelson & Cox- Lehninger Principles of Biochemistry – W.H. Freeman
4. Lehninger Principles of Biochemistry- Kalyani Publication
5. Stryer- Biochemistry –W.H. Freeman
6. Voet&Voet- Biochemistry – Wiley
7. Cohn and stumpf- Outlines of Biochemistry – Wiley India
8. P.M.Dey- Plant Biochemistry-Academic Press
9. B.P. Pandey- Plant Physiology –Vikas
10. Herper -Biochemistry – McGraw Hill
11. S.K. Verma- Plant Physiology & Biochemistry- S.Chand
12. Bioenergetics by Lehninger- W. A. Benjamin

Paper Title - BMLT 404	Bioinstrumentation Techniques - II	Credits - 4
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Objectives - Students can understand the knowledge of various bioinstruments, its working mechanism & handling.

Unit 1: Laboratory techniques

Biosafety in microbiological laboratories: General safety measures, Personal protection, Chemical and Biological hazards, Spillage and Waste disposal, First aid. Theory, Principle, Working and Applications of: pH meter and Laminar Air Flow. Efficacy testing protocols for Autoclave, pH meter and Laminar Air Flow. Centrifuge machine types and Centrifugation: Differential, Rate zonal, Isopycnic, Density gradient, Rotor types and Ultra centrifugation.

Unit 2 : Chromatography Techniques

Theory, Principle, Apparatus, Methods and Applications of Paper Chromatography, TLC, HPTLC, Gel Filtration Chromatography, Ion Exchange Chromatography, Affinity Chromatography, Gas Chromatography, and HPLC.

Unit 3 : Electrophoretic Techniques

Theory, Principle, Apparatus, Methods and Applications of Paper Electrophoresis, PolyAcrylamide Gel Electrophoresis (PAGE), Agarose Gel Electrophoresis. Principle and Applications of: Iso-electric Focusing, Immuno Electrophoresis, Enzyme-Linked Immunosorbant Assay (ELISA), Southern, Northern and Western Blotting.

Unit 4 : Spectroscopic and Radio-isotopic Techniques

Principle, Working, Instrumentation and Applications of: UV/Vis spectroscopy, IR spectroscopy, Atomic absorption spectroscopy, NMR spectroscopy, Mass spectroscopy, Raman spectroscopy. Introduction to radioisotopes and their biological applications, Principles and Applications of Geiger Muller (GM) counter, Solid and Liquid scintillation counter, Autoradiography, Radioimmunoassay (RIA) and Radiation Dosimeters.

Books Recommended :-

- 1) Biochemistry. 6th Edition by Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Freeman, New York.
2. Biophysics: An Introduction by Cotterill, R. M. J. (2002). John Wiley & Sons, England.
3. Principles of protein X-ray crystallography by Drenth, J. (2007). 3rd Ed. Springer, Germany.
4. Biochemistry. 3rd edition by Garrett, R. H. and Grisham, C. M. (2004). Brooks/Cole, Publishing Company, California.
5. Understanding NMR Spectroscopy by Keeler, J. (2002). John Wiley & Sons, England.
6. Bioinformatics: sequence and genome analysis by Mount, D. W. (2001). ColdSpringHarbor Laboratory Press, New York.
7. Methods in Modern Biophysics. Second Edition by Nölting, B. (2006). Springer, Germany.

Paper Title - BMLT 405	Microbial Physiology	Credits - 4
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Objectives :- After studying this paper students can understand the Microbial Nutrition, Growth & Reproduction mechanism.

UNIT I: Microbial Nutrition

Concept of microbial nutrition The common nutrient requirements (Basic Nutrient requirements of Microorganisms/macronutrient and micronutrient) Requirement for C, H, O and Electron with their significance

Requirements for N, P and S with their significance Growth factors Nutritional categories of microorganisms on the basis of carbon and energy source.

UNIT II: Permeation (in brief) Periods:

Passivediffusion

Facilitateddiffusion

Active transport mechanism

Group translocation

Uptake of amino acids and sugars (as examples)

UNIT III: Reproduction and Growth Periods:

Concept of growth

Microbial Reproduction: Binary fission, budding.

Bacterial growth: Definition, growth curve – Phases of growth, Growth Kinetics,

Generation time, Methods of measurement of growth, different types of culture system:

Batch culture system, Continuous culture system (Chemostat and Turbidostat).

Factors affecting growth-Temperature, pH,Osmotic pressure and Nutrients.

UNIT IV Bacterial Sporulation Periods:

Bacterial Sporulation- Structure of endospore, Endospore formation (Stages) in Bacillus,

Spore germination, Significance of Ca-dipicolinate (DPA) and soluble Proteins (SASP),

Books Recommended :-

1. Handbook of Microbiology. Bisen P.S., Varma K.: CBS Publishers and Distributors, Delhi.
2. Introduction to viruses: Vikas Publishing House Pvt. Ltd., New Delhi.
3. A textbook of fungi and Viruses by Dubey H.C.: Vikas Publishing House Pvt. Ltd. Delhi.
4. A textbook of Microbiology by Dubey R.C. and D. K, Maheshwary, S Chand and Co. New Delhi.
5. Fundamentals of Microbiology by Frobisher, Hinsdill, Crabtee, Goodheart:: W.B. Saunders Company, U.S.A. Toppan Company Ltd., Japan.
6. General Virology by Luria
7. Elementary Microbiology (Fundamentals of Microbiology) Vol. II, Modi H.A.: Ekta Prakashan, Nadiad, Gujrat
8. Modern Microbiology by Parasher Y.K. Campas Books International, New Delhi.
9. Elements of Microbiology by Pelczar Michael J. Jr./E.C.S Chan, McGraw, Hill International Book Company, New Delhi.
10. Microbiology: Concepts and applications by Pelczar Michael J., Jr. E.C.S Chan, Noel R. Krieg: - McGraw Hill Inc

Paper Title - BMLT 406	Diagnostic Microbiology	Credits - 4
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Objectives :- To create awareness about infectious diseases.

- To develop the essential skills among students in diagnostic laboratory techniques
- To increase the job opportunities.

Unit I Importance of diagnosis of diseases

Common Bacterial, Viral , Fungal and Protozoal diseases

Unit II Collection and Examination of clinical samples.

Collection of clinical samples and precautions required (oral cavity, throat ,skin ,blood, Urine, Feces).

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria.

Unit III Diagnosis of pathogen using culture media

MacConkey's agar, Blood agar, Chocolate agar, Lowenstein-Jensen agar.

Unit IV - Serological methods for diagnosis

Agglutination , Precipitation, ELISA, Immuno fluorescence ,Kits for rapid detection of Pathogens

Books Recommended :-

- 1) Ananthanarayan R and Paniker CKJ (2009)Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
- 2) Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
- 3) Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
- 4) Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
- 5) Collee JG, Fraser, AG, Marmion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.

Paper Title - BMLL 407	Practical – LAB 10 Bioinstrumentation Techniques - II	Credits - 2
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List of Experiments

1. Efficacy testing of autoclave employing chemical and biological autoclaveindicators.
2. Standardization of pH meter using standard buffers.
3. Studies on pH titration curves of amino acids/acetic acid and determination of pKa values and Handerson-Hasselbach equation.
4. Separation of bacterial lipids/amino acids/sugars/organic acids by TLC and Paper Chromatography.
5. Study of UV absorption spectra of macromolecules (protein, nucleic acid, bacterial pigments).
6. Paper Electrophoresis of proteins.
7. Separation of Proteins/Nucleic acids by gel electrophoresis.
8. Density gradient centrifugation.

Paper Title - BMLL 408	Practical – LAB 11 Microbial Physiology	Credits - 2
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List of Experiments

- 1) Microscopy- Different parts of compound microscope. Use and care of compound microscope
- 2) Construction, Operation and utility of laboratory equipments.(any Six)
 - a) Autoclave b) Hot air oven c) Incubator
 - d) pH meter e) High speed centrifuge f) Colorimeter/Spectrophotometer
 - g) Anaerobic jar h) Bacterial filters i) Laminar air flow
- 3) Staining
 - a. Simple staining: Monochrome, Negative b. Differential : Gram's staining
 - c. Structural staining:
 - i. Cell wall staining (Chance's method) ii. PHB staining (Burdon's method.)
- 4) Hanging drop technique.
- 5) Micrometry
- 6) Preparation of culture media a) Nutrient broth and Agar b) MacConkey's Broth and Agar
 - c) Sugar Media
- 7) Isolation of bacteria from mixed culture
 - a) Streak plate method b) Spread plate method
 - c) Pour plate method
- 8) Effect of physical and chemical agents on growth of bacteria
 - a) pH b) Temperature
 - c) U.V. rays d) Antibiotics
- 9) Qualitative tests for
 - a) Carbohydrates: Benedict's test
 - b) Protein: Biuret test
 - c) Nucleic acid: Diphenylamine test (DPA) for DNA and Orcinol test for RNA.
- 10) Demonstration of Yeast, Fungi, Actinomycetes, Algae and Protozoa.
- 11) Study of Bacterial Growth curve..

Paper Title - BMLL 409	Practical – LAB 12 Diagnostic Microbiology	Credits - 2
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List of Experiments

- 1) Clinical sample collection from throat & Skin,
- 2) Blood staining for Malarial parasite (MP).
- 3) Preparation of Blood agar.
- 4) Preparation of Chocolate agar
- 5) Detection of Typhoid by WIDAL
- 6) Detection of Syphillis by RPR.
- 7) Various diagnostic kits (Demonstration)

॥ सा विद्या या विमुक्तये ॥



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

“ज्ञानतीर्थ” परिसर, विष्णुपुरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

“Dnyanteerth”, Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसचे (बी.व्होक पदवी, अॅडव्हॉस डिप्लोमा, डिप्लोमा व सर्टिफिकेट) अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करणे बाबत.

परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या व्होकेशनल कोर्सेसच्या (बी. व्होक पदवी, अॅडव्हॉस डिप्लोमा, डिप्लोमा व सर्टिफिकेट्स) अभ्यासक्रमांना मा विज्ञान व तंत्रज्ञान विद्याशाखेने दिनांक ३१ मे २०२१ रोजीच्या बैठकीतील केलेल्या शिफारशीप्रमाणे व मा. विद्यापरिषदेच्या दिनांक १२ जून २०२१ रोजीच्या बैठकीतील विषय क्रमांक २६/५१-२०२१ च्या ठरावानुसार खालील अभ्यासक्रमांस मान्यता देण्यात आली आहे.

1. B. Voc. IT/Hardware and Networking.
2. B. Voc Software Development.
3. B. Voc. Medical Laboratory Technology.
4. B. Voc. Horticulture and Post-Harvest Technology.
5. B. Voc. Herbal Medicine.
6. B. Voc. Commercial Aquaculture.
7. B. Voc. Food Processing Technology.
8. B. Voc. Skill Based Zoology.
9. B. Voc. Vocational Biotechnology.
10. B. Voc. Plant Tissue Culture Secretary.
11. Advance Diploma Radiological Physics.
12. Diploma – Computer Hardware.
13. Diploma – Computer Network Assistant.
14. Diploma – PGDMLT.
15. Diploma – Embedded System Design.
16. Diploma- Biofertilizer.
17. Diploma- Fisheries and Farm Management.
18. Diploma - Bee Keeping.

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक-१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-
२०२०-२१/६८

दिनांक : ०५.०७.२०२१

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

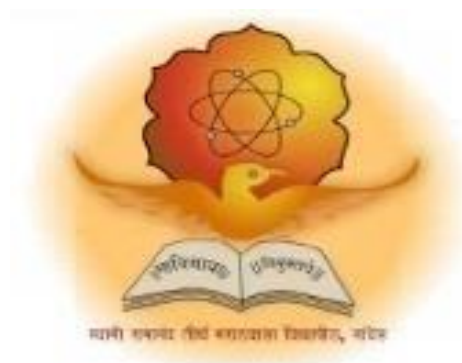
स्वाक्षरित

सहा कुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग

Swami Ramanand Teerth Marathwada University, Nanded

(NAAC Re-accredited with 'A' Grade)



Syllabus of

B. Voc. Medical Laboratory Technology (First Year)
(3 years Degree Course)

Introduced from Academic Year 2020-21

TITLE OF THE PROGRAMME

B. Voc. Medical Laboratory Technology

1. Preamble:

Skills and knowledge are the driving forces of economic growth and social development for any country. Presently, the country faces a demand – supply mismatch, as the economy needs more ‘skilled’ workforce than that is available. In the higher education sphere, knowledge and skills are required for diverse forms of employment in the sectors of education, health care, manufacturing and other services.

Government of India, taking note of the requirement for skill development among students, launched National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

2. Aim:

1. To develop a healthy attitude among students towards work and life.
2. To enhance individual employability.
3. To reduce the mismatch between the demand and supply of skill man-power.
4. To provide an alternative for those intending to pursue higher education without particular interest or purpose.
5. To prepare students for identified vocations spanning several area of activity.
6. An emphasis in vocational education will also be on development of attitudes, knowledge, and skills for entrepreneurship and self-employment.
7. To provide opportunities to fulfil the needs of women, rural and tribal students and the deprived sections of society.

3. Objective:

- (1) To increase the productive potential of the country.
- (2) To raise the economic standard of people.
- (3) To reduce the level of unemployment by providing self- employment schemes.
- (4) To utilize man-power to fullest extent.
- (5) To make the students skilled technician.
- (6) To help for equitable sharing of benefits of economic development to ensure social and economic justice.
- (7) To help students understand the scientific and technological aspects of contemporary civilization.
- (8) To make use of material and human resources.
- (9) To exploit the scientific and technical knowledge for betterment of the society.
- (10) To generate in pupils a love and appreciation for work.

4. Eligibility and Fees

10+2 Pass

Students will be awarded:

Certificate	Student shall be required to appear in examinations of all courses. However, to award the Certificate a student shall study the minimum of 30 credits course and opt minimum passing credits as per university rule.
Diploma:	Student shall be required to appear in examinations of all courses. However, to award the Diploma a student shall study the minimum of 60 credits course and opt minimum passing credits as per university rule.
Advanced Diploma	Student shall be required to appear in examinations of all courses. However, to award the Advanced Diploma a student shall be required to study minimum of 120 credits course and opt minimum passing credits as per university rule.
B.Voc Degree	Student shall be required to appear in examinations of all courses. However, to award the degree a student shall be required to study minimum of 180 credits course and opt minimum passing credits as per university rule.

6. Assessment:

The Skill component of the course will be generally assessed by the respective Sector Skill Councils. In case, there is no Sector Skill Council for a specific trade, the assessment may be done by an allied Sector Council or the Industry partner. Further if Sector Skill Council in concerned / relevant trade has no approved QP which can be mapped progressively or due to any other reason, if the SSC expresses its inability to conduct the assessment or cannot conduct the skill assessment in stipulated time frames as per academic calendar, the institutions may conduct skill assessment through a Skill Assessment Board by ‘Certified Assessors’ as per the provisions enumerated in MHRD Skill Assessment Matrix for Vocational Advancement of Youth (SAMVAY). The Skill Assessment Board may have Vice-Chancellor/Principal/Director/Nodal officer/Coordinator of the programme / Centre, representatives of the partner industry(s), one nominee of the Controller of Examination or his/her Nominee of affiliating University / Autonomous College and at least one external expert. The affiliating university may nominate additional experts on the Skill Assessment Board, if required.

The certifying bodies may comply with / obtain accreditation from the National Accreditation Board for Certification Bodies (NABCB) set up under Quality Council of India (QCI). Wherever the

university/college may deem fit, it may issue a joint certificate for the course(s) with the respective Sector Skill Council(s).

The general education component will be assessed by the concerned university as per the prevailing standards and procedures. General Education credit refers to a unit by which the course work is measured. It determines the number of hours of instructions required per week.

One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week. Accordingly, one Credit would mean equivalent of 14-15 periods of 60 minutes each or 28 – 30 hrs of workshops/ labs. For internship / field work, the credit weighage for equivalent hours shall be 50% of that for lectures /tutorials. For self-learning, based on e-content or otherwise, the credit weighage for equivalent hours of study shall be 50% of that for lectures / tutorials.

The institutions offering B.Voc degree programme should adopt and integrate the guidelines and recommendations of the respective Sector Skill Councils (SSCs) for the assessment and evaluation of the vocational component, wherever available.

Letter Grades and Grade Points: it is recommended to adopt 10- point grading system with the Letter grades as given below:

Grades and Grade Points

Letter Grade	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F(Fail)	0
Ab (Absent)	0

Passing percentage for each paper each course is 40%. Separate passing for continuous assessment and end semester examination and/or as per time to time guidelines of the university.

A student obtaining Grade F and Ab shall be considered failed and he/she will be required to reappear in the examination.

Computation of Semester Grade Point Average System (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the course components taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e

$$SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where 'C_i' is the number of credits of the ith course component and 'G_i' is the grade point scored by the student in the ith course component.

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where 'S_i' is the SGPA of the ith semester and C_i is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

The skill component would be taken as one of the course components in calculation of SGPA and CGPA with given credit weightage at respective level.

Swami Ramanand Teerth Marathwada University, Nanded

B. Voc. Medical Laboratory Technology

Syllabus with effective from 2020-2021

Semester I

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BMLT101	English language and communicative skills	2	2	4
2	BMLT 102	Computer fundamentals & IT	2	2	4
3	BMLT 103	Fundamentals of Microbiology -I	2	2	4
Skill Courses					
4	BMLT 104	Fundamentals of anatomy and physiology	2	2	4
5	BMLT105	Laboratory science & human body	2	2	4
6	BMLT106	Hematology	2	2	4
Practical Skill Courses					
7	BMLT 107	LAB1: Fundamentals of anatomy and physiology	1	1	2
8	BMLT108	LAB 2:Laboratory science & human body	1	1	2
9	BMLT109	LAB3: Hematology	1	1	2
Total					30

Semester II

Sr. No.	Course Code	Course Title	Continuous Assessment Credits (CA)	End Semester Exam Credits (ESE)	Total Credits
General Education					
1	BMLT 201	Soft skill & Personality Development	2	2	4
2	BMLT 202	Environmental Studies	2	2	4
3	BMLT 203	Microbiology - II	2	2	4
Skill Courses					
4	BMLT 204	Advanced Laboratory Science Techniques & Testing Process	2	2	4
5	BMLT 205	Biochemistry - I	2	2	4
6	BMLT 206	Bioinstrumentation, Haematological Techniques	2	2	4
Practical Skill Courses					
7	BMLT 207	LAB4: Advanced Laboratory Science Techniques & Testing Process	1	1	2
8	BMLT 208	LAB5: Biochemistry - I	1	1	2
9	BMLT 209	LAB6: Bioinstrumentation, Haematological Techniques	1	1	2
Total					30

SEMESTER-I

Paper Title: BMLT – 101:	ENGLISH LANGUAGE AND COMMUNICATIVE SKILLS
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Objective: The objective of this paper is to familiarize the students with the importance of Communication and its associated components in the hard core corporate sector.

UNIT I- The Sentence and Its Structure - How to Write Effective Sentence -- Phrases - What Are They? - The Noun Clauses - The Adverb Clause - The Relative Clause - How the Clauses Are Conjoined - Word - Classes and Related Topics - Understanding the Verb - Understanding the Auxiliary Verb - Understanding the Adverbs - Understanding the Pronoun - Prepositions.

UNIT II- Spelling and Pronunciation - Pronunciation, The Tense and Related topics- Presentness and Present Tenses - The Presentences of a Past Action - Interrogatives and Negatives - Negatives - How to Frame Questions - What's What? - Polite Expressions – Some Time Expressions - In Conversation – Letter Writing - Academic Assignments.

UNIT III - Self - Assessment; Identifying Strength & Limitations; Habits, Will-Power and Drives, Developing Self - Esteem and Building Self - Confidence, Significance of Self - Discipline, Understanding Perceptions, Attitudes, and Personality Types, Mind - Set: Growth and Fixed, Values and Beliefs, Motivation and Achieving Excellence; Goal Setting, Life and Career Planning , Constructive Thinking, Communicating Clearly: Understanding and Overcoming barriers.

UNIT IV - Active Listening, Persuasive Speaking and Presentation skills conducting Meetings, Writing Minutes, Sending Memos and Notices; etiquette: Effective E - mail Communication; Telephone Etiquette, Body Language in Group Discussion and Interview.

Books Recommended:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kulbhushan Kumar, Effective Business Communications, Khanna Publishing House (AICTE Recommended-2018)
3. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders Washington, DC: Pfeiffer & Company, 2013.
4. Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E - books, 2007.
5. Petes S. J. , Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw - Hill Education, 2011.
6. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.

Objectives: The objective of this course is to familiarize students with Fundamentals of Computer and IT applications. It enablesthe student to get practical exposure towards MS - Office tools.

UNIT I - KNOWING COMPUTER: Introduction, Objectives, Basic Applications of Computer, Components of Computer System: Central Processing Unit, Keyboard, mouse and VDU, Other Input devices, Other Output devices, Computer Memory. Concept of Hardware and Software: Hardware, Software: Application Software, Systems software. Concept of computing, data and information. Bringing computer to life: Connecting keyboard, mouse, monitor and printer to CPU, Checking power supply.

UNIT II - OPERATING COMPUTER USING GUI BASED OPERATING SYSTEM: Introduction, Objectives, Basics of Operating System: Operating system, Basics of popular operating system (LINUX, WINDOWS). The User Interface: Task Bar, Icons, Menu, Running an Application. Operating System Simple Setting: Changing System Date And Time, Changing Display Properties, To Add Or Remove A Windows Component, Changing Mouse Properties, Adding and removing Printers. File and Directory Management: Creating and renaming of files and directories, Common utilities.

UNIT III - INTRODUCTION TO INTERNET, WWW AND WEB BROWSERS: Introduction, Objectives. Basic of Computer Networks: Local Area Network (LAN), Wide Area Network (WAN). Internet: Concept of Internet, Applications of Internet, Connecting to the Internet, Troubleshooting, World Wide Web (WWW), Web Browsing Software, Popular Web Browsing Software. Search Engines: Popular Search Engines / Search for content, Accessing Web Browser, Using Favorites Folder, Downloading Web Pages, Printing Web Pages. Understanding URL, Surfing the web: Using e - governance website.

UNIT IV - COMMUNICATIONS AND COLLABORATION: Introduction, objectives, Basics of E - mail: What is an Electronic Mail, Email Addressing, Using E - mails: Opening Email account, Mailbox: Inbox and Outbox, Creating and Sending a new E - mail, Replying to an E - mail message, Forwarding an E - mail message, Sorting and Searching emails. Introduction to MS - Office: MS - Word, MS - Excel, MS - Power Point.

Books Recommended:

1. Computer Fundamentals, R.S. Salaria, Khanna Publishing House (AICTE Recommended Textbook – 2018)
2. Handbook of Computer Fundamentals, N.S. Gill, Khanna Publishing House (AICTE Recommended Textbook – 2018)
3. Fundamentals of Computers, V. Rajaraman, PHI Publication
4. Computer Fundamentals, P. K. Sinha, BPB Publication
5. Introduction to Computers with MS - Office 2007, Leon, TMH Publication

Objectives: The structure of the course comprises the instrumental use, study of microscopes, micro organisms, sterilization and the other related concepts.

UNIT I – Classification, morphology and physiology of bacteria, anatomy of bacterial cell, growth requirement of bacteria-growth curve, nutrients required. Gram positive & Gram negative Bacteria. Normal flora of human body.

UNIT II – Use of microscope in examination of unstained bacteria, fungi, algae, parasites and stained cell preparations including simple staining, Gram's staining, acid fast staining, capsule staining, spore staining using prokaryotic and eukaryotic cells, hanging drop preparation, Preparation of culture media, spread plates, pour plates, selective media, differential media.

UNIT III - Separation of pure cultures and study the effect of selective nutrients on prokaryotes. Isolation of Soil Bacteria, Soil Fungi, Soil Actinomycetes

UNIT IV - Selective media for Soil microflora and use of growth factors, Study of Rhizosphere interactions, Quantitative measurements of Soil nutrients and Rhizosphere microflora and preparation of starter cultures of Rhizobia, Azotobacter.

Suggested Readings:

1. Textbook of Pathology - Harsh Mohan; Jaypee
- 2 Basic Pathology - V.Kumar, S.Robbins; Harcourt
3. Text Book of Microbiology - Pelczar, Chan, Kreig
4. Bacteriology - A.J. Salle
5. Text Book of Microbiology - Vol I and Vol II - Powar and Dagainawala
- 6 Text Book of Microbiology - Stanier
7. Human Anatomy, Physiology & Health Education by Harie R. Berasari, Gandhi & Goel
8. Textbook of Medical Physiology by Guyton and Hall

Objectives: The course offers a classic blend of anatomy and physiology, enabling the students to understand the fundamentals as well as the advanced level of the course.

Unit-I

A) Body as a whole and its constituents

The cells, tissues and organization of the body

Tissues- epithelial, connective, muscle, nervous

Cell regeneration, membranes, glands, Organization of the body

Bones of the skeleton, Axial skeleton, Appendicular skeleton, Cavities of the body, Cranial, thoracic, abdominal, pelvic.

B) Blood

Composition of blood

Erythrocytes-Structure and functions

Leucocytes-Types, Structure and functions

Platelets- Structure and functions, Hemostasis

Haemoglobin, Blood groups, Coagulation Factors, Anaemia & Immunoglobulins

C) Cardiovascular System

Heart-Functional anatomy; Properties of heart muscle; Heart as a pump; Cardiac output and venous return; Vascular system; Systemic arterial blood pressure

Unit-II

A) Respiratory System

Basic features and functional anatomy, Ventilation, Functions, Lungs Volumes and capacities

B) Digestive System

Elementary functional anatomy; Salivary glands; Stomach and its secretion; Liver, pancreas and their role in digestion, Bile, Small and large intestine; Movement of alimentary tract; Gastrointestinal hormones and their functions

C) Excretory system

Functional anatomy of kidney; Mechanism of formation of urine; Water, electrolyte and acid-base balance; Skin and its functions

Unit-III

A) Nervous System

Elementary neuroanatomy; Properties of neurons; Nerve impulse, Types of nerves; Synapse and chemical transmitters; Central nervous system-Neuroglia, membranes of; brain and spinal cord, Ventricles of brain and cerebrospinal fluid.

Brain- cerebrum, cerebellum

Spinal cord- structure

Peripheral nervous system-Spinal nerves and cranial nerves

Autonomic nervous system-Sympathetic NS, Parasympathetic NS.

Functions of ANS

Central visceral regulations

B) Special senses and Endocrinology

Eye and Ear (in brief)-

a) List of Endocrine Glands; Hormones : Their secretion and functions (in brief)

Unit-IV: A) Reproductive System

Female reproductive system; Anatomy- External and internal parts; Puberty, menstrual cycle, Fertilization.

Male reproductive system- Elementary anatomy; Functions of male reproductive system

B) Muscular System

Muscles characteristics

Properties of skeletal muscles

Properties of smooth muscles

Suggested Readings:

1. Anatomy and physiology in health and illness - Wilson Katheen, Anne Waugh ; Churchill livingstone
2. Concise medical physiology - Sujit Chaudhari; Central
3. Textbook of medical physiology - Arthur Guyton and Hall; W.B. Saunders
4. Understanding medical physiology R. L. Bijlani, Jaypee

Objectives: The aim of the course is to familiarize the students not only with the human anatomy but also the practical edge to understand the various organs and functions as well.

UNIT I- Basic Understanding of Healthcare Service Providers (Primary, secondary & tertiary), Basic Understanding of Hospital Functions, Basic Understanding of Diagnostic Centers and medical laboratory facilities, Understanding of Laboratory at different level (National / State / District).

UNIT II - To develop broad understanding of the Role of MLT, To understand laboratory maintenance needs to be taken care by MLT, To develop Understanding of Patient Comforts and Safety, To develop understanding of Laboratory Test Results, To exhibit Ethical behavior

UNIT III - Basic understanding of organization of body cells, tissue Organs, organ systems, membranes and glands in human body, Understanding basic unit of body - Cell, Understanding different types of tissues, Understanding different types of organ systems, Understanding different types of body fluids, secretions and excretions, Understanding different parts of body, Understanding Endocrine system in human body Understanding cardiovascular system and blood, vessels in human body.

UNIT IV- Understanding musculo - skeletal system in human body, Describe digestive System in human body, Describe Respiratory system in human body, Describe Urinary System in human body, Describe Nervous System in human body, Describe Sense organs in human body, Describe Reproductive System in human body, Describe Integumentary system and Lymphatic system

Books Recommended:

1. Solomon. E. A. , (2008) Introduction to Human Anatomy and Physiology 3rd Ed, Saunders: St Louis.
2. Chaurasia, B. D. , & Garg, K. , (2012) Human Anatomy Regional and Applied. CBS Publications: New Delhi
3. T. S. Ranganathan - A text book of Human Anatomy
4. Fattana, Human anatomy (Description and applied) Saunder's & C P Prism Publishers, Bangalore - 1991

1. Hematological Disorders

- a. Classification of Anemia : Morphological & etiological.
- b. Iron Deficiency Anemia : Distribution of body Iron, Iron Absorption, causes of iron deficiency, lab findings.
- c. Megaloblastic Anemia : Causes, Lab findings.
- d. Hemolytic Anemia : Definition, causes, classification & lab findings.
- e. Bone Marrow : Cell composition of normal adult Bone marrow, Aspiration, Indication, Preparation & Staining, Special Stain for Bone Marrow -Periodic Acid Schiff, Sudan Black, Myeloperoxidase.
- f. Leukemia : Classification, Blood Picture, Differentiation of Blast Cells.

2. Basic Hematological Techniques

- a. Characteristics of good technician
- b. Preparation of specimen collection material.
- c. Lab. request form.
- d. Basic steps for drawing a blood specimen by veinipuncture. Complications of veinipuncture.
- e. Patient after care
- f. Specimen rejection criteria for blood specimen
- g. Hemolysis of blood
- h. Blood collection by skin puncture (Capillary Blood)
- i. Arterial puncture.
- j. Deciding specimen types and selection of -
 - o Anticoagulant- EDTA, Citrate, Oxalate, Heparin, sodium fluoride.
- k. Separation of serum
- l. Separation of plasma
- m. Changes in blood on keeping
- n. Maintenance of specimen identification
- o. Transport of the specimen.
- p. Effect of storage on Blood Cell Morphology
- q. Universal precautions

Suggested Readings:

- 1. Text book of medical laboratory technology by Praful Godkar; Bhalani
- 2. Text book of biochemistry for medical students by D M Vasudevan; Jaypee
- 3. Fundamentals of biochemistry by J L Jain; S Chand
- 4. Biochemistry by D Voet, J Voet; Wiley
- 5. TB of biochemistry and human biology by G P Talwar; Prentice Hall
- 6. MOLBIO by Avinash and Kakoli Upadyay; Himalaya Publishing house
- 7. Clinical Biochemistry by G.Guru
- 8. Principal of Biochemistry by Lehninger

List of Experiments: (Based on BMLT – 104)

1. Measurement of pulse, blood pressure.
2. Elicitation of Reflexes and jerks.
3. Identification of blood cells by study of peripheral blood smear.
4. Preparation of sterile swabs / sterile tubes and bottles
5. Preparation of smear
6. Staining: Germ & Ziehl – Neelson staining
7. Identification of culture media
8. Identification of instruments commonly used in Microbiology laboratory
9. Identification of common microbes
10. Microscopy:
 - a) Components and setting of the compound Microscope
 - b) Focusing of object
 - c) Use of low & high power objectives of Microscope
 - d) Use of oil immersion lens
 - e) Care and maintenance of the Microscope Different types of Microscopy:
 - a) Dark field Microscopy
 - b) Fluorescence Microscopy

Practical session: (Based on BMLT – 105)

1. PPT on role and importance of a medical lab technologist in the society
2. PPT/Audio visual demonstration of a qualified medical technologist working in sophisticated medical lab
3. Video demonstration on the mechanism of blood coagulation
4. Video demonstration on the mechanism of urine formation
5. Video demonstration on the mechanism of respiration
6. An audio visual presentation on the “Ethical behavior” of a medical lab technician
7. An audio visual presentation on the complication of the medical lab work
8. PPT presentation on the life and career of a professionally sound lab technologist
9. PPT presentation on the statutory regulations of a good medical lab technologist
10. Video demonstration of identification of different equipments of a medical lab
11. PPT on the history of a medical lab technologist in India
12. Video demonstration on “How to deal with patient” and professional medical history compilation

Practical session: (Based on BMLT – 106)

PRACTICAL

1. Basic requirements for hematology laboratory.
2. Glasswares for Hematology.
3. Equipments for Hematology.
4. Anticoagulant vial preparation.
5. Complete Blood Counts.
6. Determination of Hemoglobin.
7. TRBC Count by Hemocytometers.
8. TLC by Hemocytometer.
9. Differential Leukocyte count.
10. Determination of Platelet Count.
11. Determination of ESR by wintrobes.
12. Determination of ESR by Westergren's method.
13. Determination of PCV by Wintrobes.
14. Erythrocyte Indices- MCV, MCH, MCHC.
15. Reticulocyte Count.
16. Absolute Eosinophil Count.
17. Morphology of Red Blood Cells.

SEMESTER-II

Paper Title: BMLT – 201:	SOFT SKILL & PERSONALITY DEVELOPMENT
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Objective: On completion of the course, the students will be able to listen to lectures, public announcements, news on TV, radio and engage in telephonic conversation to communicate effectively and accurately in English used as spoken language for various purposes.

UNIT I - Listening Skills: Barriers to listening; effective listening skills, feedback skills. Attending telephone calls; note taking. Activities: Listening exercises - Listening to conversation, News and TV reports. Taking notes on a speech / lecture.

UNIT II - Speaking and Conversational Skills: Components of a meaningful and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics. The study of sounds of English, stress and intonation. Situation based Conversation in English.

UNIT III - Essentials of Spoken English: Activities, Making conversation and taking turns, Oral description or explanation of a common object, situation or concept, Giving interviews.

UNIT IV - Oral Presentation with / without audio visual aids. Group Discussion . Listening to any recorded or live material and asking oral questions for listening comprehension.

Books Recommended:

1. Soft skills Training - A workbook to develop skills for employment by Fredrick H. Wentz
2. Personality Development and Soft skills , Oxford University Press by Barun K. Mitra

Objective: Keeping in view the modern status of environment, the course primarily aims at providing various awareness programs required for the welfare of the environment apart from the emphasis on the general and conventional issues surrounding the environment.

UNIT I- Multidisciplinary nature of environmental studies - Definition, scope and importance, need for public Awareness, Natural Resources: Renewable and non - renewable resources, Natural resources and associated problems, Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles, Ecosystems: Concept, Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.

UNIT II- Biodiversity and its conservation, Bio - geographically classification of India, Value of biodiversity, Biodiversity at global, National and local levels. India as a mega diversity Nation, Hot - spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man - wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In - situ and Ex - situ conservation of biodiversity.

UNIT III- Environmental Pollution: Definition , Cause, effects and control measures of : Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides . Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and Rehabilitation of people; its problems and concerns. Case Studies.

UNIT IV- Environmental ethics: Issues and possible solutions. Climate global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution)Act. Wildlife Protection Act Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment. Population growth, variation among nations. Population explosion - Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and Human health. Case Studies.

Books Recommended:

1. M.P. Poonia & S.C. Sharma, Environmental Studies, Khanna Publishing House
2. Mike Hulme, Climates and Cultures.
3. Mark Garrett, Encyclopaedia of Transportation Social Science and Policy.
4. Steel, Science An A - to - Z Guide to Issues and Controversies.
5. John A Matthews, Encyclopaedia of Environmental Change.
6. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House

Paper Title: BMLT – 203:	MICROBIOLOGY - II
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Objectives: The structure of the course comprises the instrumental use, study of microscopes, micro organisms, sterilization and the other related concepts.

UNIT I - Basic principles and usage of Instruments, General Instruments and Distillation plant, Centrifuge machine, Analytical Balance, Hotplate, Magnetic Stirrer, Water Bath, Automatic dispenser and diluters, Deionizer, Microbiological Instruments : pH - meter, Autoclave, Incubator, Hot air oven, Laminar Air flow, Colony counter, Muffle furnace, Refrigerator, Inoculator, McIntosh and Flides anaerobic jar.

UNIT II - Microscopy :Study of compound microscope – magnification numerical aperture, resolution and components of microscope, Dark ground illumination, care of microscope and common difficulties. Study of phase contrast, interference, fluorescent, polarizing and electron microscope. Calibration of ocular micrometer and measurement of microorganisms.

UNIT III - Microbiology & Medicine :Introduction to Medical Microbiology, Discovery of microorganisms. Contribution of Robert Koch, Antonie Van Leeuwenhoek, Louis Pasteur, Bordet, Paul Ehrlich, Alexander Flemming, Elie Metchnikoff, Needham, Tyndall Janssen, Joseph Lister, Karl Landsteiner etc. Scope & relevance and safety measurers of Medical Microbiology. Role of medical microbiology in identification and management of various infectious diseases.

UNIT IV - Sterilization and Disinfection : Definition, mode of action and use of various physical methods of sterilization - heat, UV radiation, ionizing radiation, character affecting sterilization, autoclave control and sterilization indicators. Chemical disinfectants - phenol and its compounds, alcohol, halogen, heavy metals and quaternary ammonium compounds, aldehyde, gaseous compounds. Use and abuse of disinfectants. Disinfectants, antiseptics, chemotherapeutic agents, chemotherapeutic index, development of chemotherapy, antibiotics and effect of antibiotics on protein and nucleic acid synthesis and cytoplasmic membrane. Future development of chemo - therapy.

Books Recommended:

1. Clinical Microbiology; J. Stokes and G. L. Ridgeway; William &Wilkins
2. Manual of Practical Medical Microbiology and Parasitology; T. R. Oberhofer Churchill and Livingston
3. Introduction in Medical Microbiology; Anant - Narainyan Indian

4. Practical Medical - Microbiology; Mackie and MC Cathey
5. Laboratory Manual and work book for Microbiology in Health and Disease; Robert Fuerst W. B. Sunderu

Paper Title: BMLT – 204:	ADVANCED LABORATORY SCIENCE TECHNIQUES & TESTING PROCESS
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Objectives: The course is designed to enable the students on the use and application of the advanced laboratory techniques and the process of testing as well.

UNIT I -Broad understanding of different types of samples to be taken in medical laboratory, Sample Handling, Various equipments useful for blood sample collection, broad understanding of correct method of blood sample collection, broad understanding on collection method of samples other than blood samples, broad understanding of correct procedure of sample transportation.

UNIT II -Understanding about Laboratory planning, develop understanding about laboratory operations, gain broad understanding of care of laboratory glassware, equipment and instruments, understanding about Specimen Handling, Techniques of Disinfection & Sterilization of rubber goods, laboratory equipment & other instruments

UNIT III -Importance and method of Observing and reporting while dealing with patients during sample and report collection, Method of Observing and reporting while assisting the pathologists and other members of the team, Understanding the importance of verbally informing the person in authority,

UNIT IV -Understanding of chemicals/reagents useful in sample analysis, understanding of maintaining record of inventory , test results, etc. , Able to inspect the availability of medical supplies or diagnostic kits To develop understanding about laboratory safety

Books Recommended:

1. Crocker J, Burnett D. The science of laboratory diagnosis, 2nd ed, Chichester: Wiley, 2006
2. Turgeon M. L, Linné and Ringsrud's Clinical laboratory science: the basic and routine techniques, 5th ed, St. Louis, Mo: Mosby Elsevier, 2007

Objectives: The course is designed to encapsulate the fundamentals of chemistry, the laboratory application and the current scenario of the subject.

UNIT I - Introduction to Medical Lab Technology, Role of Medical Laboratory technologists - ethics, responsibility, safety measures and hazards in clinical biochemistry, first aid (accidents), Units of measurements, S. I. Units, measurement of volume, various volumetric apparatus (cylinders, flasks, pipettes), calibration of volumetric apparatus, Cleaning and caring of general laboratory glassware and equipment, preparation and storage of distilled water, preparation of reagents and standard solutions, storage of chemicals and reagents, use of analytical balance, dry and moist heat radiation, filtration, autoclaving and chemical disinfection for sterilization.

UNIT II - Introduction, aim and scope of Biochemistry. Elementary knowledge of inorganic chemistry: atomic weight, molecular weight, equivalent weight, acid, bases. Elementary knowledge of organic chemistry : Organic compounds, Aliphatic and aromatic compounds, Alcohols, Aldehydes, Ketones, Amines, Esters, Phenol etc.

UNIT III - Viscosity - principles and applications; sedimentation – Principles and applications; Radio - isotopes and their use in Biochemistry, mole, molar, molal and normal solutions, pH measurement, buffer solutions, percent solutions, osmosis, dialysis, surface tension. ANALYTICAL BIOCHEMISTRY AND METABOLISM: Colorimetry / Spectrophotometry, Flame photometry, Atomic absorption spectroscopy, electrophoretic determination of Na⁺ and k⁺, chromatography

UNIT IV - Introduction, properties and simple metabolism of carbohydrates proteins and fat, Nucleic acids and Enzymes introduction, general properties. Digestion and absorption, Nutrition (Vitamins, Calories) Radioimmunoassay (RIA) and ELISA. (Hepatitis A, B)

Books Recommended:

1. Varley's Practical Clinical Biochemistry; A. HGowehlock; Heineman Medical Books Ltd. , London
2. Lab Manual in Biochemistry; E. A. Storey; V. G. Makarova; MIR Publishers; 2PerbyRizky1 - 110 GSP Moscow
3. Harper's Biochemistry; A. K. Murray Prentice Hall of India Ltd. , New Delhi
4. Introduction to Practical Biochemistry; Plummer D. T. Tata McGraw Publishing co, New Delhi

Objectives: The course is designed to encapsulate the fundamentals of chemistry, the laboratory application and the current scenario of the subject.

Unit-I Bioinstrumentation

1. Photometry-Definition, laws of photometry, absorbance, transmittance, absorption maxima, instruments, parts of photometer, types of photometry–colorimetry, spectrophotometry, flame photometry, fluorometry, choice of appropriate filter, measurements of solution, calculation of formula, applications.

2. Electrophoresis - Principle, Types & Applications.

3. Autoanalysers - Principle & Applications

Unit-II

A) Water and Mineral Metabolism-

Distribution of fluids in the body, ECF & ICF, water metabolism, dehydration, mineral metabolism, macronutrients (principal mineral elements) & trace elements.

B) Vitamins- Fat & water soluble vitamins, sources, requirement, deficiency disorders & biochemical functions.

C) Liver Functions & their Assessment- Based on:

Carbohydrate metabolism; Protein metabolism; Lipid metabolism. Measurements of serum enzyme levels Bile pigment metabolism, Jaundice, its types and their biochemical findings.

D) Renal Function Tests- Various Tests, GFR & Clearance

Unit-III

A) Cardiac Profile - In brief Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases

B) Different methods of Glucose Estimation - Principle advantage and disadvantage of different methods

C) Different methods of Cholesterol Estimation - Principle, advantage and disadvantage of different methods.

Unit-IV

A) Basic Hematological Techniques

Preparation of blood collection –

Basic steps for drawing blood by vein, capillary and artery puncture; Complications during and after blood collection

Specimen rejection criteria for blood

Anticoagulants- types and concentration Transport of blood sample Effect of storage on blood cell morphology Universal precautions

Books Recommended:

1. Biophysical Chemistry by Upahyay, Upadhyay, Nath; Himalaya Publishing house
2. Text book of medical laboratory technology by Praful Godkar; Bhalani
3. Essential haematology by A.V.Hoffbrand; Black well
4. De Gruchy's Clinical Haematology in medical practice by Frank Firkin, C Chester man; Black well
5. Principles of haematology Peter Haen WCB 17
6. Haematology by Emmanuel Besa; Harwal
7. Text Book of Microbiology by Ananthnarayan and Paniker
8. Clinical diagnosis and management by laboratory methods by Bernard Henry; W B Saunders
9. Text book of biochemistry for medical students by D M Vasudevan; Jaypee
10. TB of biochemistry and human biology by G P Talwar; Prentice Hall
11. Biophysical Chemistry by Dr. Nath, Avinash Upadyay and Kakoli Upadyay; Himalaya Publishing house
12. Clinical Biochemistry by G.Guru

Paper Title: BMLT – 207:	LAB 1: ADVANCED LABORATORY SCIENCE TECHNIQUES & TESTING PROCESS
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List of Experiments: (Based on BMLT – 204)

1. Blood collection process
2. Use of different instruments used for collection of blood
3. Identification of different instruments used for collection of blood
4. Identification and use of a Tourniquet
5. Identification of body areas for Venepuncture
6. SOP on the use of Vacutainers
7. Sterilization of areas used for where from blood is collected
8. Identification and use of anticoagulants for prevention of clotting of sample blood
9. Restoration of a venepunctured wound
10. Demonstration of the use of a lab request form
11. Demonstration of the morphology of red blood cell
12. Demonstration of the minimum safety requirements to be maintained in a lab for purpose of preventing contamination of slides

List of Experiments: (Based on BMLT – 205)

1. Introduction – Aim, basis, interpretation, safety in clinical biochemistry laboratory
2. Laboratory organization: instruments, glassware, sample collection & specimen labeling
3. Routine test & the identification of equipment & supply
4. Identification of supplies of a biochemistry lab
5. Preparation of different solutions used in the biochemistry lab
6. Standardization of methods commonly used in biochemistry lab
7. Detection of carbohydrates in a given sample
8. Detection of proteins in a given sample
9. Interpretation of results obtained from the routine tests
10. Study the general properties of enzyme (urease)
11. Achromatic time of salivary amylase
12. Estimation of glucose in a given sample
13. Centrifugation : principle, type and application
14. Chromatography: description of paper chromatography and methodology of their application

List of Experiments: (Based on BMLT – 206)

1. Blood urea estimation
2. Serum creatinine estimation
3. Serum uric acid estimation
4. Serum total protein estimation
5. Serum albumin estimation
6. Serum globulin estimation
7. Serum glucose estimation
8. Total cholesterol estimation
9. HDL and LDL cholesterol (direct) estimation.
10. Triglyceride estimation
11. Serum Bilirubin total estimation
12. Serum Bilirubin direct estimation
13. Serum amylase estimation
14. Serum GOT (AST) estimation
15. Serum GPT (ALT) estimation
16. Alkaline phosphatase estimation
17. Acid phosphatase estimation
18. Serum sodium estimation
19. Serum potassium estimation
20. Serum chloride estimation
21. CK-NAC estimation



॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

स्वामी रामानंद तीर्थ
मराठवाडा विद्यापीठ, नांदेड

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accr-edited with 'B++' grade

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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या बी. ब्लोक (ब्लोकेशनल कोर्सेसचे) पदवी तृतीय वर्षाचे अभ्यासक्रमाचे (Syllabus) शैक्षणिक वर्ष २०२२-२३ पासून लागू करणे बाबत.

परिपत्रक

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विज्ञान व तंत्रज्ञान विद्याशाखेतील विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०-२१ पासून मान्यता दिलेल्या बी. ब्लोक (ब्लोकेशनल कोर्सेसचे) पदवी अभ्यासक्रमाचे तृतीय वर्षाचे Syllabus शैक्षणिक वर्ष २०२२-२३ पासून लागू करण्यास मा. कुलगुरू महोदयांनी मा. विद्यापरिपदेच्या मान्यतेच्या अधीन राहून मान्यता दिलेली आहे. त्यानुसार खालील अभ्यासक्रम लागू करण्यात येत आहेत.

1. B. Voc Software Development III year
2. B. Voc. Bachelor of Medical Laboratory Technology. III year
3. B. Voc. Herbal Medicine III year
4. B. Voc. Agriculture/commercial Aquaculture III year
5. B. Voc. Horticulture and Post Harvest Technology III year
6. B. Voc. Food Processing /Food Processing Technology III year
7. B. Voc. Chemical & Petrochemical Applied Analytical Chemistry III year
8. B. Voc. Life Science/Skill Based Zoology III year

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या www.srtmun.ac.in या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

जा.क्र.:शैक्षणिक-१/परिपत्रक/ब्लोकेशनल अभ्यासक्रम/N-

२०२२-२३/६२५

दिनांक : २९.०९.२०२२

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठाच्या संकेतस्थळावर प्रसिध्द करण्यात यावे.

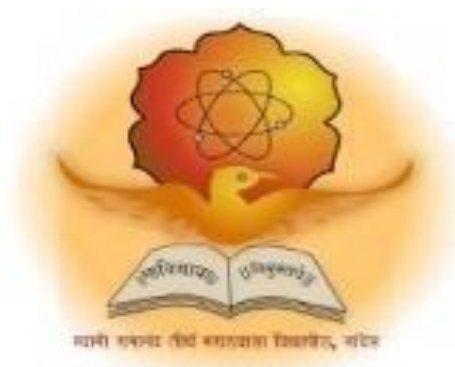
C. J. J.

सहाकुलसचिव

शैक्षणिक (१-अभ्यासमंडळ) विभाग



**Swami Ramanand Teerth Marathwada University,
Nanded (Maharashtra)
(NAAC Re-accredited with 'A' Grade)**



**Syllabus of
B. Voc. Medical Laboratory Technology (Third Year)
(3 years Degree Course)**

B. Voc. Medical Laboratory Technology

1. Preamble:

Skills and knowledge are the driving forces of economic growth and social development for any country. Presently, the country faces a demand – supply mismatch, as the economy needs more ‘skilled’ workforce than that is available. In the higher education sphere, knowledge and skills are required for diverse forms of employment in the sectors of education, health care, manufacturing and other services.

Government of India, taking note of the requirement for skill development among students, launched National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

In view of this our University initiated to start skill based courses which are in demand of industries to be carry responsibilities of society. The programme is highly relevant for all those who want to pursue a professional career in software development.

2. Aim:

3. Objective:

4. Eligibility and Fees

5. Program outcome:

First Exit Point (Diploma) and Outcome of First Year

Second Exit Point (Advance Diploma) and Outcome of Second Year

• Third Exit Point (B. Voc. Degree) and Outcome of Third Year

Students will be awarded:

Certificate	Student shall be required to appear in examinations of all courses. However, to award the Certificate (Medical Laboratory Technology) a student shall study the minimum of 30 credits course and opt minimum passing credits as per university rule.
Diploma:	Student shall be required to appear in examinations of all courses. However, to award the Diploma (Medical Laboratory Technology) a student shall study the minimum of 60 credits course and opt minimum passing credits as per university rule.
Advanced Diploma	Student shall be required to appear in examinations of all courses. However, to award the Advanced Diploma (Medical Laboratory Technology) a student shall be required to study minimum of 120 credits course and opt minimum passing credits as per university rule.
B.Voc Degree	Student shall be required to appear in examinations of all courses. However, to award the degree a student shall be required to study minimum of 180 credits course and opt minimum passing credits as per university rule..

6. Assessment:

The Skill component of the course will be generally assessed by the respective Sector Skill Councils. In case, there is no Sector Skill Council for a specific trade, the assessment may be done by an allied Sector Council or the Industry partner. Further if Sector Skill Council in concerned / relevant trade has no approved QP which can be mapped progressively or due to any other reason, if the SSC expresses its inability to conduct the assessment or cannot conduct the skill assessment in stipulated time frames as per academic calendar, the institutions may conduct skill assessment through a Skill Assessment Board by 'Certified Assessors' as per the provisions enumerated in MHRD Skill Assessment Matrix for Vocational Advancement of Youth (SAMVAY). The Skill Assessment Board may have Vice-Chancellor/Principal/Director/Nodal officer/Coordinator of the programme / Centre, representatives of the partner industry(s),

one nominee of the Controller of Examination or his/her Nominee of affiliating University / Autonomous College and at least one external expert. The affiliating university may nominate additional experts on the Skill Assessment Board, if required.

The certifying bodies may comply with / obtain accreditation from the National Accreditation Board for Certification Bodies (NABCB) set up under Quality Council of India (QCI). Wherever the university/college may deem fit, it may issue a joint certificate for the course(s) with the respective Sector Skill Council(s).

The general education component will be assessed by the concerned university as per the prevailing standards and procedures. General Education credit refers to a unit by which the course work is measured. It determines the number of hours of instructions required per week.

One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week. Accordingly, one Credit would mean equivalent of 14-15 periods of 60 minutes each or 28 – 30 hrs of workshops/ labs. For internship / field work, the credit weightage for equivalent hours shall be 50% of that for lectures /tutorials. For self-learning, based on e-content or otherwise, the credit weightage for equivalent hours of study shall be 50% of that for lectures / tutorials.

The institutions offering B.Voc degree programme should adopt and integrate the guidelines and recommendations of the respective Sector Skill Councils (SSCs) for the assessment and evaluation of the vocational component, wherever available.

Letter Grades and Grade Points: it is recommended to adopt 10- point grading system with the Letter grades as given below:

Grades and Grade Points

Letter Grade	Grade Point
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B+ (Good)	7
B (Above Average)	6
C (Average)	5
P (Pass)	4
F(Fail)	0
Ab (Absent)	0

Passing percentage for each paper each course is 40%. Separate passing for continuous assessment and end semester examination and/or as per time to time guidelines of the university.

A student obtaining Grade F and Ab shall be considered failed and he/she will be required to reappear in the examination.

Computation of Semester Grade Point Average System (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the course components taken by a student and the sum of the number of credits of all the courses undergone by a student in a semester, i.e

$$SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

where 'C_i' is the number of credits of the ith course component and 'G_i' is the grade point scored by the student in the ith course component.

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where 'S_i' is the SGPA of the ith semester and C_i is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

The skill component would be taken as one of the course components in calculation of SGPA and CGPA with given credit weightage at respective level

Swami Ramanand Teerth Marathwada University, Nanded

B. Voc. Medical Laboratory Technology

Syllabus with effective from 2020-2021

Semester I

Sr. No	Course Code	Course Title	Continuous Assessment Credits(CA)			End Semester Exam Credits (ESE)			Total Credits / Marks	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT101	English language and communicative skills	2	50	20	2	50	20	4	100
2	BMLT102	Computer Fundamentals & IT	2	50	20	2	50	20	4	100
3	BMLT103	Fundamentals of Microbiology-I	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT104	Fundamentals of Anatomy and Physiology	2	50	20	2	50	20	4	100
5	BMLT105	Laboratory Science & Human body	2	50	20	2	50	20	4	100
6	BMLT106	Hematology	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLT 107	LAB1:Fundamentals of anatomy and physiology	1	25	10	1	25	10	2	50
8	BMLT 108	LAB2:Laboratory Science & Human body	1	25	10	1	25	10	2	50
9	BMLT 109	LAB3:Hematology	1	25	10	1	25	10	2	50
Total									30	750

Semester II

Sr. No.	Course Code		Course Title		Continuous Assessment				End Semester Exam Credits (ESE)		Total Credits / Marks	
					Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education												
1	BMLT 201	Soft Skill & Personality Development I	2	50	20	2	50	20	4	100		
2	BMLT 202	Environmental Studies	2	50	20	2	50	20	4	100		
3	BMLT 203	Microbiology-II	2	50	20	2	50	20	4	100		
Skill Courses												
4	BMLT 204	Advanced Laboratory Science Techniques & Testing Process	2	50	20	2	50	20	4	100		
5	BMLT 205	Biochemistry-I	2	50	20	2	50	20	4	100		
6	BMLT 206	Bioinstrumentation, Haematological Techniques	2	50	20	2	50	20	4	100		
Practical Skill Courses												
7	BMLT 207	LAB4:Advanced Laboratory Science Techniques & Testing Process	1	25	10	1	25	10	2	50		
8	BMLT 208	LAB5:Biochemistry-I	1	25	10	1	25	10	2	50		
9	BMLT 209	LAB Bioinstrumentation, Hematological Techniques	6	1	25	10	1	25	10	2	50	
Total									30	750		

B.Voc.Medical Laboratory Technology, Second Year

Semester III

Sr. No.	Course Code	Course Title	Continuous Assessment Credits(CA)			End Semester Exam Credits (ESE)			Total Credits	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT 301	Value Education	2	50	20	2	50	20	4	100
2	BMLT 302	Biostatistics	2	50	20	2	50	20	4	100
3	BMLT 303	Soft Skills & Personality Development - II	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT304	Advanced Virology	2	50	20	2	50	20	4	100
5	BMLT 305	Medical Pathology - I	2	50	20	2	50	20	4	100
6	BMLT 306	Essentials of Immunology	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLT 307	LAB 7- Advanced Virology	1	25	10	1	25	10	2	50
8	BMLT 308	LAB 8 : Medical Pathology - I	1	25	10	1	25	10	2	50
9	BMLT 309	LAB 9 Essentials of Immunology	1	25	10	1	25	10	2	50
Total									30	750

**B.Voc.Medical Laboratory Technology, Second Year
Semester - IV**

Sr. No.	Course Code	Course Title	Continuous Assessment Credits(CA)			End Semester Exam Credits (ESE)			Total Credits	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT 401	Medical Ethics	2	50	20	2	50	20	4	100
2	BMLT402	Biomedical Waste Management	2	50	20	2	50	20	4	100
3	BMLT403	Metabolism - I	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT 404	Bioinstrumentation Techniques - II	2	50	20	2	50	20	4	100
5	BMLT 405	Microbial Physiology	2	50	20	2	50	20	4	100
6	BMLT 406	Diagnostic Microbiology	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLT 407	LAB 10-Bioinstrumentation Techniques - II	1	25	10	1	25	10	2	50
8	BMLT 408	LAB 11:Microbial Physiology	1	25	10	1	25	10	2	50
9	BMLT 409	LAB 12: Diagnostic Microbiology	1	25	10	1	25	10	2	50
Total									30	750

**B.Voc.Medical Laboratory Technology, Third Year
Semester - V**

Sr. No.	Course Code	Course Title	Continuous Assessment Credits(CA)			End Semester Exam Credits (ESE)			Total Credits	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT 501	Human Psychology	2	50	20	2	50	20	4	100
2	BMLT 502	Advanced Biotechnology	2	50	20	2	50	20	4	100
3	BMLT 503	Laboratory Management & Ethics	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT 504	Histopathology & Cytopathology	2	50	20	2	50	20	4	100
5	BMLT 505	Parasitology & Mycology	2	50	20	2	50	20	4	100
6	BMLT 506	Microbiology - III	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLT 507	LAB 13- Histopathology & Cytopathology	1	25	10	1	25	10	2	50
8	BMLT 508	LAB 14: Parasitology & Mycology	1	25	10	1	25	10	2	50
9	BMLT 509	LAB 15: Microbiology - III	1	25	10	1	25	10	2	50
Total									30	750

**B.Voc.Medical Laboratory Technology, Third Year
Semester - VI**

Sr. No	Course Code	Course Title	Continuous Assessment Credits(CA)			End Semester Exam Credits (ESE)			Total Credits	
			Credits	Marks	Min. Marks	Credits	Marks	Min. Marks	Credits	Marks
General Education										
1	BMLT 601	R-DNA Technology	2	50	20	2	50	20	4	100
2	BMLT 602	Entrepreneurship Program	2	50	20	2	50	20	4	100
3	BMLT 603	Research Methodology	2	50	20	2	50	20	4	100
Skill Courses										
4	BMLT 604	Hematology - III	2	50	20	2	50	20	4	100
5	BMLT 605	Pathology - III	2	50	20	2	50	20	4	100
Practical Skill Courses										
7	BMLT 606	LAB 16- Hematology - III	1	25	10	1	25	10	2	50
8	BMLT 607	LAB 17: Pathology - III	1	25	10	1	25	10	2	50
9	BMLT 608	LAB 18 : Project & Seminar on Hospital Training	6	150	60	-	-	-	6	150
Total									30	750

Semester V

Paper Title - BMLT 501	Human Psychology	Credits - 4
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Objective – The classic blend of psychology and human resource will help to deal with the individuals in the corporate sector. The study of proper human mind is to be emphasized before the role of human resource management comes to play.

Unit 1 - Introduction to psychology, Nature of psychology; Basic concepts: Person, States of Consciousness: Sleep and Wakefulness and altered States of Consciousness, Behavior and Experience, II Evolution of the discipline of psychology; Psychology and other disciplines; Linkages across psychological processes

Unit 2 - Methods of psychology, The bases of human behavior, Evolutionary perspective on human behavior; Biological and cultural roots; Nervous system and endocrine system: Structure and relationship of with behavior and experience; Brain and behavior, Socialization, Enculturation and Acculturation; Globalization; Diversity and pluralism in the Indian context.

Unit 3 - Evolution and growth of human resource management (with special reference to Scientific management and Human relations approaches). Role of HR in strategic management. Nature, objectives, scope, and functions of HR management, Challenges of HR (the changing profile of the workforce - knowledge workers, employment opportunities in BPOs, IT and service industries, Flexi options), Workforce diversity (causes, paradox, resolution of diversity by management).

Unit 4 - Concepts of line - staff in the structure of human resource department and the role of human resource manager, Manpower planning, Job analysis, Job evaluation.

Books Recommended –

- 1) General Psychology by S. Dandapani, Neelkamal Publication (2016)
- 2) General Psychology by R. K. Gupta
- 3) Aswathappa K. (2002) Human Resource and Personnel Management, Tata McGraw - Hill, New Delhi.
- 4) Bhattacharyya Kumar Deepak (2006) Human Resource Managing, Excel Books, New Delhi.
- 5) Cascio F. W. (2003) Managing Human Resources, Productivity, Quality of Life, Profits, Tata Mc - Graw - Hill, New York

Paper Title - BMLT 502	Advanced Biotechnology	Credits - 4
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Objective :- The student will understand and be able to explain different branches of Microbiology such as Bacteriology and Virology. The student will be able to explain about various applications of Statistics in the field of Medical, Pathology, Immunological Science.

Unit 1:- Historical Perspective. Biotechnology in pharmaceutical industry. Current Trends in Drug Development. Fermentation products in pharmaceutical industry. Types of antibiotics and synthetic antimicrobial agents. Clinical uses of antimicrobial drugs. Mechanisms of action of antibiotics. Chemical disinfectants and antiseptics Identification and Development of New Antimicrobial Drugs.

Unit 2 :- Biopharmaceuticals & Microbial aspects

Vaccine: Genetically improved vaccines, Synthetic peptide-based vaccines, Nucleic acid vaccines. Technical aspects of vaccine production. Plants as bioreactor for pharmaceutical products. Principles and practice of sterilization. Contamination of non-sterile pharmaceuticals. Sterile pharmaceutical products. Sterility testing.

Unit 3 :- The drug development process

Drug discovery - Regulatory and Intellectual property aspects. Strategies in pharmaceutical products development Delivery of biopharmaceuticals. Pre-clinical trials a. Pharmacokinetics and pharmacodynamics b. Toxicity studies c. Mutagenicity & carcinogenicity. Clinical trials

Unit 4 :- Drug manufacturing process and Biogeneric Drugs

Introduction to Indian and International Pharmacopoeia. Good manufacturing practices (GMP). International regulations of GMP. Good laboratory practices (GLP) in pharmaceutical industry. Advanced Drug Delivery a. Rationale and Basic Principles b. Physiologic and Mechanistic Approaches c. Molecular Approaches Design and layout of sterile pharmaceutical manufacturing unit. Introduction to biogenetic drugs Biogeneric targets

Books Recommended –

- 1) Advances in Applied Biotechnology series Vol.10, Biopharmaceutical in transition. Industrial Biotechnology Association by Paine Webber, Gulf Publishing Company Houston.
- 2) Analytical Microbiology- Edited by Fredrick Kavanagh volume I &II. Academic Press New York.
- 3) Biotechnology – Expanding Horizon by B.D. Singh., First Edition, Kalyani Publication, Delhi.
- 4) Biotechnology- Edited by H.J. Rhem & Reed, vol 4 VCH publications, Federal Republic of Germany.
- 5) Drug carriers in biology & medicine Edited by Gregory Gregoriadis. Academic Press New York.
- 6) Good manufacturing practices for Pharmaceuticals. By Sydney H. Willing, Murray M. Tuckerman, William S. Hitchings IV. Second edition Mercel Dekker NC New York.
- 7) Lippincott's illustrative Reviews: Pharmacology Edition: 02 Maryjnyck by Lippincott's review Publisher Pheladelphia 1997.
- 8) Pharmaceutical Biotechnology by S. P. Vyas & V.K. Dixit. CBS publishers & distributors, New Delhi.
- 9) Pharmaceutical Microbiology- Edited by W. B. Hugo & A.R. Russel Sixth Edition. Blackwell Scientific Publications.
- 10) Pharmacognosy by Gokhle S.D., KoKate C.K. Edition: 18, Nirali Publication.
- 11) Principles of medicinal chemistry Vol. 1 by Kadam S.S., Mahadik K.R., Bothra K.G. Edition: 18, Nirali Publication.

Paper Title - BMLT 503	Laboratory Management & Ethics	Credits - 4
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Objectives :- To acquire the skill of successful Pathological Laboratory management and its ethics

Unit 1 :- Introduction

Role of laboratory in human health and diseases. Human diseases and methods of diagnosis
 Laboratory at different level (National / State / District). Duties and responsibilities of laboratory personnel
 Laboratory services are a backbone of health care delivery system.

Unit 2 :- LABORATORY PLANNING

General principles, Laboratory goals, Operational data –, Market potential, Selection of area, Competition, Laboratory trends, Space requirements, Designing of laboratory sections, Staff and their duties, Work schedule and workload assessment

**Unit 3 :- CARE OF LABORATORY GLASSWARE, CHEMICALS
EQUIPMENT AND INSTRUMENTS**

3.1 General Principles, Care and Cleaning of Glassware, Making Simple Glassware in the Laboratory, Care of equipment and apparatus, Laboratory chemicals – Proper use, care, storage and labeling, Specimen handling
 Appropriate container, Method of collection, Method of transportation, Method of preservation and disposal of laboratory waste. Laboratory Safety- General principles of safety programmes, First aid and safety measures for Mechanical, Electrical, Chemical, Radioactive and Biological hazards, Universal safety precautions.

Unit 4 :- Quality control and quality assurance in following sections of laboratory

- (a) Biochemistry, (b) Microbiology, (c) Hematology and Blood Banking
- (d) Histopathology and Clinical Pathology

Books Recommended :-

- 1) Eleanor M.Travers Clinical Laboratory Management 1st 1997 Williams & Wilkens.
- 2) K. Anand Hospital Management 1st 1996 Vikas Publishing, New Delhi.
- 3) Govt.Publication ‘Hospital Administration Manual’ 1st 1976 Govt. of Maharashtra.
- 4) G. Guru ‘Laboratory Setup & procedures’ 1st 1989 NCERT, New Delhi.

Paper Title - BMLT 504	Histopathology & Cytopathology	Credits - 4
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Objectives :- To study the derangement of tissue due to diseases at cellular level, and to study the exfoliation of cells from surfaces of various passages, organs and viscera.

Unit 1 :- Histopathology

Introduction & importance of histopathology Cell, tissue and their functions.
Methods of specimen collection (biopsies) and examination of tissues and cells.

Unit 2 :- : Tissues Fixative

Simple Fixative and their properties. Simple Fixative and their properties. Micro anatomical fixative
Histochemical fixatives

Unit 3:

Section Cutting

Microtome and microtome knives, sharpening and care. Technique of section cutting Mounting of sections, Frozen sections and Cryostat.

Staining

Dyes and their properties, Theory of staining, Types of staining, Basic staining – Hematoxylin and Eosin (H&E) Mounting of sections Common special stains **PAS, Masson trichrome, Fleugens, Geimsa, PTAH**

Unit 4 : CYTOPATHOLOGY

Introduction – cytology and cytopathology Method of specimen collection and transportation. For gynaecological samples. Method of specimen collection, transportation and preservation of non-gynecological samples. Fixation and fixative. Common fixative. Special purpose fixative. Fluid specimen Preservation prior to processing. Preparation for microscopy

The Papanicolaou stain

Main characteristics and modification, Preparation of stain and solutions, Factors influencing staining reaction, Mounting of cell sample, Other routine and special stains, Stains for histological sections, Stains for hormonal evaluation, Stains for sex chromatin, pigments, microorganism, parasites, carbohydrates, lipids and nucleic acid

Books Recommended :-

- 1) G. Guru Histotechnology 1st 1988 NCERT, New Delhi.
- 2) C. F. A. Culling 'Hand Book of Histotechnological & Histochemical Techniques' 3rd 1974 Butterworth – London.
- 3) G. G. Brown 'An introduction to Histotechnology' 3rd 1974 Century - Croft , New York.
- 4) P.B. Godkar 'Text Book of Medical Laboratory Technology' 2nd 2003 Bhalani Publication.
- 5) L. G. Koss 'Diagnostic Cytology', Vol - I & II 3rd 1979 J. B. Lippincott Co. Philadelphia.

Paper Title - BMLT 505	Parasitology , Mycology & Virology	Credits - 4
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Objectives :- To develop the skill of laboratory diagnosis of various parasites, Pathogenic fungi.

Unit-1 PARASITOLOGY

Morphology, Life-Cycle, Pathogenicity and Laboratory diagnosis of protozoa such as :-

(a) E. histolytica and E. coli, (b) Giardia, (c) Trichomonas, (d) Toxoplasma, (e) Plasmodia and Lishmania

Unit – 2 Morphology,

Life-Cycle, Pathogenicity and Laboratory diagnosis of following helminths and nematodes :-

(a) Hook worm, Round worm, Whip worm, Thread worm, Pinworm.

(b) Tapeworm and Echinococcus

(c) Wucheria bancrofti and B. malayi

Unit- 3 MYCOLOGY

Morphology and classification of pathogenic fungi

Morphology and laboratory diagnosis of fungi causing superficial mycosis

Morphology and laboratory diagnosis of fungi causing deep mycosis.

Morphology and laboratory diagnosis of fungi causing systemic mycosis

Morphology and laboratory diagnosis of fungi causing opportunistic fungal infections

Unit – 4 VIROLOGY

Classification, general properties of viruses

Cultivation and propagation of human viruses

Bacteriophage and its significance

Morphology, pathogenicity and laboratory diagnosis of hepatitis viruses

Morphology, pathogenicity and laboratory diagnosis of HIV / AIDS virus.

Oncogenic viruses

Books Recommended :-

- 1) K. D. Chatterji 'Parasitology' 11th 1976 Chatterji Medical Publisher, Kolkata.
- 2) J. W. Rippon 'Medical Mycology' 3rd 1988 W. B. Saunders Co., London.
- 3) G. M. More & D. M. Jacio Mycology for clinical Laboratory 1st 1979 Reston Publishing co. USA.
- 4) D. O. White & F. Fenner 'Medical Virology' 3rd 1986 New York Academic Press, N. Y.
- 5) R. B. Bleshe, et. al. 'Text book of Human Virology' 2nd 1991 St. Louis Mosby, Year Book,

Paper Title - BMLT 506	Microbiology - III	Credits - 4
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Objectives - The structure of the course comprises the instrumental use, study of microscopes, micro organisms, sterilization and the other related concepts.

Unit- 1 PATHOGENIC FUNGI:

Candida, Cryptococci, Dermatophytes, Sporotrichoums, Histoplasma, Blastomyces, Coccidioides, Para - coccidioides, Dematiaceous fungi, Mycetoma, Actinomyces, Nocardia and common laboratory contaminants. Biochemical tests used for identification of bacteria and fungi. Antimicrobial sensitivity testing and assay methods for body fluids, Antimicrobial susceptibility testing for Mycobacteria. Preparation and standardization of antigens and antisera.

Unit- 2 VIROLOGY: Different staining techniques used in virology, Use of Embryonated eggs in clinical Virology, Principles of animal cell culture and their use in virology, Use of common laboratory animals in viral diagnosis. **PARASITOLOGY:** Morphology and life cycle of - Leishmania, haemoflagellates. - Trypanosomes, Laboratory diagnosis of leishmania, trypanosomes; Morphology and life cycle of tissue - Filaria and blood nematodes - Trichinella – Dracunculus.

Unit – 3 MEDICAL ENTOMOLOGY: Basic concept of medical entomology in relation to medical lab technology. Arthropods of medical importance, arthropods borne diseases and their transmission. Principles of arthropods control, Mosquito- Role of this arthropods in disease transmission, disease types and controlling measures. House flies, Role of disease transmission and controlling measures. Flea: Role of disease transmission and control measures and itch mite. Filarial: Causes, symptoms and controlling measures. Taeniasis: Causes, symptoms and controlling measures. Collection, Presentation and identification of different disease causing arthropods.

Unit- 4 Whole mount preparation of slide of different disease causing arthropods for their detailed anatomical studies. Identification of different phases of life cycle of arthropods, protozoa having medical importance for causing disease. Slide identification of micro filarial, Taenia solium, ascaris and different stages of malaria. Examination of stool for OPV (Ova parasite cyst). **INFECTION CONTROL AND PREVENTION:** Practices to curb infection, Hospital borne infections, Prevention and treatment of needle stick injury, Management of blood and body substance spills in the health care setting

Books Recommended :-

- 1) Diagnostic techniques in medical parasitology; Fleck and Moody John Wright
- 2) Tropical Medicine and Parasitology; Gold Smith and Heynemann; Appleton and Lange.
- 3) Parasites: A guide to Laboratory Procedures and identifications; L. R. Ash and T. C. Orihel Am. Soc. Clinical
- 4) Parasitic Diseases M. Katz Springer – Verlog
- 5) Immunodiagnosis of Parasitic diseases; Walls and Sohanz Academic Press.

Paper Title - BMLT 507	Practical - LAB 13 – Histopathology & Cytology	Credits - 2
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List of Experiments :-

- 1) Estimation of T3, T4 Estimation of LH
- 2) Estimation of FSH
- 3) Measurement of Blood Pressure
- 4) Estimation of TSH

Paper Title - BMLT 508	Practical - LAB 14 : Parasitology, Mycology & Virology	Credits - 2
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List of Experiments

Para cytology:

1. Collection, Preservation and Transportation of fecal material and its Physical, Chemical & Parasitic examination
2. Preparation of stained and unstained slide for detection of larvae / ova or cysts
3. Concentration methods for Ova & Cysts.
4. Demonstration of gross specimen of Hookworm, Roundworm, Whip worm, Thread worm, Pin worm and Tape worm,
5. Demonstration of following parasites / ova / cyst under microscope :
6. G. lamblia, (b) T. vaginalis, (c) Malarial parasites, (d) Lishmania, (e) Roundworm, (f) Whipworm, (g) Threadworm, (h) Pin worm and (i) Tapeworm.

Mycology:

1. Collection and processing of skin scrappings / nail clippings / hair pieces / clinical material for demonstration of fungal elements
2. Microscopy for fungal elements : unstained perpetration : Lactophenol cotton blue.
3. Microscopy for fungal elements : stained perpetration
4. Demonstration of common fungal media with and without growth

Virology:

1. Instruments / Equipments and glassware used in
2. viral diagnostic laboratory
3. Inoculation of chick-embryo and other cell / tissue culture media.

Paper Title - BMLT 509	Practical - LAB 15 Microbiology - III	Credits - 2
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List of Experiments :-

- 1) Identification of different stains used in Virology
- 2) Slide identification of Candida,
- 3) Slide identification of fungi
- 4) Slide identification of Taenia
- 5) Slide identification of trypanosomes

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Model Question paper Pattern (Theory)

B.Voc.MLT Third Year (Semester V /VI) CBCS Pattern

Subject :- Medical Laboratory Technology

Paper – BMLT 501 to BMLT 506, BMLT 601to BMLT 605

Time :- 2 Hrs.

Max.Marks 50 (ESE)

Note :- 1) All Questions are Compulsory.

2) All questions carry equal marks.

3) Draw neat & well labeled diagram whenever necessary.

Q.1 Essay Type Question (On Unit I) 10 Marks

OR

a) Short Question 5 Marks

b) Short Question 5 Marks

Q.2 Essay Type Question (On Unit II) 10 Marks

OR

a) Short Question 5 Marks

b) Short Question 5 Marks

c)

Q.3 Essay Type Question (On Unit III) 10 Marks

OR

a) Short Question 5 Marks

b) Short Question 5 Marks

c)

Q.4 Essay Type Question (On Unit IV) 10 Marks

OR

a) Short Question 5 Marks

b) Short Question 5 Marks

Q.5 Short Notes (Any Two) 10 Marks

a) Short Note

b) Short Note

c) Short Note

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Model Question paper Pattern (Practical)

B.Voc.MLT Third Year (Semester V /VI) CBCS Pattern

Subject :- Medical Laboratory Technology

Practical Paper – BMLT 507 TO 509 and BMLT 606 to 607

Time :- 4 Hrs.

Max.Marks : 25

Q. 1 : Long Experiment	10 Marks
Q. 2 : Short Experiment	05Marks
Q. 3 : Record Book	05 Marks
Q. 4 : Viva Voce	05 Marks

Semester – VI

Paper Title - BMLT 601	R – DNA Technology	Credits - 4
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Objectives :- Students can understand Molecular Biology, Recombinant DNA Technology, and Microbial Genetics, and will be able to execute a short research project incorporating techniques of Basic and Advanced Microbiology under supervision. The student will be equipped to take up a suitable position in academia or industry, and to pursue a career in research if so desired.

Unit 1:- Tools of R – DNA Technology

Enzymes used with their types, mode of activity and examples: Nucleases Exonucleases (BAL 31 nuclease, Exonuclease I, III), Endonucleases Restriction endonucleases type I, II, III, restriction modification system: nomenclature and classification of type II endonucleases (S1 nuclease). DNA polymerase (E. coli DNA pol. I, T7 DNA Pol., Klenow fragments, Thermostable DNA Pol., Terminal Transferase and Reverse Transcriptase). DNA ligation (Linkers and Adaptors). DNA Manipulating enzymes (Polynucleotide kinase, Phosphatase, Methylase, Topoisomerase and Ribonucleases).

Unit 2:- Cloning Vectors

Cloning Vectors (their structure, genealogy and derivatives): Plasmids (pBR 322 and pUC18). Bacteriophage lambda (λ), Cosmids, Phasmids and Phagemids as vectors. Artificial chromosome vectors (YACs, BACs, PACs, and MACs). Animal virus derived vectors, SV40 vaccina/bacculo and retroviral vectors. Expression vectors, Shuttle vectors, Integrative vectors. 3. Gene probes: development and labeling of DNA and RNA probes

Unit 3 :- Polymerase Chain Reaction (PCR) - Primer design, fidelity of thermal enzymes, DNA polymerase, variations in PCR and its applications. PCR in gene recombination, deletion, addition, overlap extension and SOEing, site specific mutagenesis, PCR based mutagenesis, PCR in molecular diagnostics, viral and bacterial detection. 2. Methods of nucleic acid detection, sequencing methods (enzymatic DNA sequencing, chemical DNA sequencing, principles of automated DNA sequencing, RNA sequencing, thermal cycle dideoxy DNA sequencing, and pyrosequencing). 3. Methods of nucleic acid hybridization (Southern blotting, Northern blotting, in situ hybridization). DNA fingerprinting, chromosome walking and jumping.

Unit 4 :- Applications

Molecular Markers- types and applications. Construction of molecular maps (genetic and physical maps). DNA chip Technology and Microarrays (a brief account) Applications of recombinant DNA technology in medicine, agriculture, Forensic and veterinary sciences. 3. Engineering microbes for the production of antibiotics, enzymes, Insulin, growth hormones, monoclonal antibodies etc. Human genetic engineering and Gene therapy- methods of gene therapy, gene therapy in treatment of diseases, Stem cell therapy, Future of stem cell therapy, gene targeting. Gene silencing in bacteria. CRISPR-Cas systems for editing and targeting genome. 4. Science and the constitution- ethical, legal and environmental issues associated with rDNA Technology

Books Recommended :-

1. DNA cloning: A practical approach by D.M. Glover and D.D. Harnes, RL press, Oxford 1995.
2. Essentials of molecular biology vol. I (A Practical Approach) by Brown T.A., IRL press Oxford. 1995.
3. From Gene to Clone by E. L. Winnacker.
4. Genetic engineering, principles and practice, by Sandhya Mitra. Macmillan India Ltd.
5. Genome mapping and sequencing by Ian Dunham. Horizon Scientific press.

6. Manipulation and expression of Recombinant DNA. Robertson.
7. Methods in enzymology gene expression technology by D.A Godgel. Academic press Inc, San Diego.
8. Methods in enzymology guide to molecular cloning techniques, vol. 152 S. L. Berger. Academic press .Inc, san Diegn, 1996.
9. Molecular biotechnology (2nd edition), by S.B. Primrose, Blackwell Scientific publishers, Oxford.
10. Molecular biotechnology: principles and application of Recombinant DNA II by Bernard R. Glick and J. Pastemak, ASM publication.
11. An introduction to genetic engineering (2nd edition) by Nicholl D.S.T., Cambridge University press, Cambridge, U.K.
12. PCR application. Protocol for functional genomics by Michael A. Innis. David H., Gelfand John J. Sninsky, Academic Press.
13. PCR technology- principles and application for DNA amplification by Henry A Erilch (Ed) Stockton Press. 1989.
14. Route maps in gene technol

Paper Title - BMLT 602	Entrepreneurship Program	Credits - 4
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Objectives :- The course aim to give a shape to understand the validity of various entrepreneurship development programs in the field of economics and its related concepts.

Unit 1 :- To make the students understand about entrepreneurs and different classifications. Entrepreneur and entrepreneurship - Definition; traits and features; classification; Entrepreneurs; Women entrepreneurs; Role of entrepreneur in Entrepreneurs in India, Create an awareness about EDP. Entrepreneurial development programme concept; Need for training; phases of EDP; curriculum & contents of Training Programme; Support systems, Target Groups; Institutions conducting EDPs in India and Kerala.

Unit 2:-

General awareness about edeutification of project financing new enterprises; Promotion of a venture; opportunity Analysis Project identification and selection; External environmental analysis economic, social, technological an competitive factors; Legal requirements for establishment of a new unit; loans; Over rum finance; Bridge finance; Venture capital; Providing finance in Approaching financing institutions for loans.

Unit 3:- To identify different Discuss opportunities in small business; Small business Enterprise - Identifying the Business opportunity in various sectors - formalities for setting up of a small business enterprise - Institutions supporting small business enterprise - EDII (Entrepreneurship Development Institute of India), SLDO (Small Industries Development Organization NSIC (National small Industries Corporation Ltd. (CNSIC) NIESBUD (National Institute for Entrepreneurship and small Business Development) Sickness in small business enterprise causes and remedies.

Unit 4 :-

To understand about a project report relating to a small business; Project formulation - Meaning of a project report significance contents formulation planning commissions guidelines for formulating a project report - specimen of a project report, problems of entrepreneurs case studies of entrepreneurs.

Books Recommended :-

- 1) Cliffton, Davis S. and Fylie, David E. , Project Feasibility Analysis, John Wiley, New York, 1977.
- 2) Desai A. N., Entrepreneur and Environment, Ashish, New Delhi, 1990.
- 3) Drucker, Peter, Innovation and Entrepreneurship, Heinemann, London, 1985
- 4) Jain Rajiv, Planning a Small Scale Industry: A guide to Entrepreneurs, S. S. Books, Delhi, 1984
- 5) Kumar S. A. , Entrepreneurship in Small Industry, Discovery, New Delhi, 1990
- 6) McClelland, D. C. and Winter, W. G. , Motivating Economic Achievement, Free Press, New York, 1969

Paper Title - BMLT 603	Research Methodology	Credits - 4
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Objectives :- The course aims to teach the students to read, understand and explore something new from the conventional material before they climb up the ladder for more progressive research works.

UNIT 1: Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method - Understanding the language of research - Concept, Construct, Definition, Variable. Research Process (10%)

UNIT - 2

Problem Identification & Formulation - Research Question - Investigation Question - Measurement Issues - Hypothesis - Qualities of a good Hypothesis - Null Hypothesis & Alternative Hypothesis. Hypothesis Testing - Logic & Importance (10%)

UNIT 3: Research Design: Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

UNIT 4:- Qualitative and Quantitative Research: Qualitative research - Quantitative research - Concept of measurement, causality, generalization, replication. Merging the two approaches.

Books Recommended :-

- 1) Research methodology by P. K. Manoharam
- 2) Research methodology by Dr. C. Rajindra Kumar
- 3) Research methodology methods and techniques by C. R. Kothari

Paper Title - BMLT 604	Hematology - III	Credits - 4
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Objectives - The course is designed to focus on the various studies of blood and its components with help of intense laboratory work.

Unit 1: Definition and classification of anaemias, Laboratory investigation for megaloblastic anaemia, Laboratory investigation for iron deficiency anaemia. , Laboratory investigation for haemolytic anaemia including classification and causes.

Unit 2 : Leukemia: definition and classification, Cytochemical staining procedures in various haemopoietic disorders, Laboratory test for assessing bleeding disorders, Laboratory investigation for disseminated intravascular coagulation (DIC)

Unit 3 : Mechanism of fibrinolysis: tests for fibrinolysis, Platelet function tests and their interpretation, Techniques available for cytogenetic studies.

Unit 4 : Use of Radioisotopes in haematology, Safety measures for handling Radioisotopes.

Books Recommended :-

- 1) Recombinant Human Erythropoietin (rhEPO) in Clinical Oncology, edited by Mohammad Resa Nowrouzian, Springer Science & Business Media.
- 2) A Cancer Source Book for Nurses, By American Cancer Society, Jones & Bartlett Learning.
- 3) Hemostasis and Thrombosis: Practical Guidelines in Clinical Management, edited by Hussain I. Saba, Harold R. Roberts, John Wiley & Sons .
- 4) Radionuclide Tracer Techniques in Haematology, By C. S. Bowring, Butterworth & Co (Publishers) Ltd 1981.

Paper Title - BMLT 605	Pathology - III	Credits - 4
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Objectives :- The course aims at covering the fundamental concepts of biology apart from the primary focus on the study of diseases and the possible remedies.

UNIT I: Preservation of microbes and Lyophilisation methods, Total and viable counts of bacteria, Testing of disinfectants - Rideal - Walker, Chick - Martin and In - use tests, Preparation and standardization of vaccines and immunization schedule.

UNIT II: Bacteriological examination of water, milk, food and air, Nosocomial infections and sterility testing of I/V fluids and processing of various samples for hospital infections, Toxin - Antitoxin assays and pathogenicity tests, Epidemiological markers of microorganisms - Serotyping, Bacteriophage and Bacteriocine typing methods.

UNIT III: Lab, Diagnosis of common bacterial infection viz: Pyogenic infections, Respiratory tract infections, Meningitis, Diphtheria, whooping cough, Gas gangrene, Food - poisoning, Enteric fever, Acute diarrhoeas, diseases, Cholera Urinary tract infection, Tuberculosis, Leprosy, Plague, Anthrax, Typhus fever, Syphilis, Gonorrhoea and other STD's,

UNIT IV : Lab diagnosis of fungal infections viz: Superficial Dermatophyte fungal infections, Candidiasis, Cryptococcosis, pulmonary infections, Mycetoma, other deep mycotic infections, subcutaneous fungal infections - Sporotrichosis, Chromoblastomycosis, Eye and Ear fungi infections, Serological tests for fungal infections and skin tests, Advanced techniques in microbiology - ELISA, RIA, CCIEP, Co-agglutination GLC, HPLC etc. , Rapid diagnostic methods and Automation. in Microbiology.

Books Recommended :-

- 1) Medical Laboratory Science : Theory And Practice, By Ochei Et Al, Tata McGraw-Hill Education
- 2) The Chemistry and Bacteriology of Public Health, By Cuthbert Lindsay Dunn, Butterworth & Company.
- 3) Bartram's Encyclopedia of Herbal Medicine, By Thomas Bartram, Hachette UK
- 4) Diagnosis: A Symptom-based Approach in Internal Medicine, By Madgaonkar CS, Jaypee Brothers Medical Publishers Pvt. Ltd.
- 5) Clinical Anatomy by Regions, By Richard S. Snell, Lippincott Williams & Wilkins

Paper Title - BMLT 606	LAB – 16 Hematology - III	Credits - 4
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List Of Experiments

- 1) Estimation of Haemoglobin
- 2) Identification of Megaloblasts
- 3) Identification of stains used in haemopoetic disorders
- 4) Use of stains to detect haemopoetic disorders
- 5) Measurement of Bleeding time
- 6) Measurement of Clotting time

Paper Title - BMLL 607	Practical – LAB 17 Pathology - III	Credits - 2
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List of Experiments

- 1) Bacteriological examination of water, milk, food and air
- 2) Identification of Vibrio Cholerae
- 3) Identification of Mycobacterium tuberculosis
- 4) Identification of Mycobacterium leprae
- 5) Identification of Syphilis Spirochete
- 6) Identification of Yersinia Pestis

Paper Title - BMLT 608	Practical – LAB 18 Project & Seminar on Hospital Training	Credits - 6
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Objective :-

1. To develop the students from all facets of various domains of skills such as Personal, social, professional & life long learning and make them a perfect human being with awareness of all social responsibilities.
2. To develop confidence as well as to promote the attitude of the students towards self developer and entrepreneur and also to developed the skill of presentation art.

Training Details:

The students are placed in research & development, pathological / clinical departments of various health care industries / hospitals / diagnostic centers / pathological laboratories / organisations for four months duration. During the hospital training tenure, the students are expected to gain actual pathological and clinical experience and try to make them familiar with the hospital environment.

The students have to keep day-to-day record of their actual work done during hospital training and same is to compiled along with the information about the hospital / pathological laboratory (in which they have been placed) in a bound volume which is to be submitted as a project report. The concerned teachers are supposed to guide the students for the preparation and presentation of the project report.

Seminar:

The students are required to deliver seminar on the topic of their pathological laboratory experiences i.e. actual work done by them in that pathological laboratories / pathological department / hospitals / diagnostic centre during their tenure of hospital training of one month duration. The duration or time allotted for students for delivering a seminar is 10 minutes only and in this stipulated time period he/she has to present his/her pathological laboratory experiences about the actual work done by him/her in pathological laboratory during hospital training.

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