

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.



CIRCULAR NO.SU/ Faculty of Science & Technology./B.VOC./ 38 /2022.

It is hereby informed to all concerned that, on the recommendation of Ad-hoc Board in Vocational Studies and Dean, Faculty of Science & Technology the Hon'ble Vice-Chancellor has **accepted the curriculum of following B.Voc. Courses under Choice Based Credit and Grading System** in his emergency powers under Section-12 [7] of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith:

Sr.No.	Course Name	Semester
1.	B.Voc in Medical Laboratory Technology	III & IV
2.	B.Voc in Software Development	III & IV

This is effective from the **Academic Year 2020-21 and 2021-22** and onwards. This curriculum is also available on the University website www.bamu.ac.in.

All concerned are requested to note the contents of the circular and bring notice to the students, teachers and staff for their information and necessary action.

University campus,
Aurangabad-431 004.

Ref. No.SU/B.voc./Curri./2021-22/14099-89

Date: 31.10.2022

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**Deputy Registrar,
Academic [Syllabus]
Section.**

Copy forwarded with compliments to :-

- 1] **The Principal All Affiliated Concerned Colleges, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.**
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload the curriculum along with this Circular on University Website.**

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.BAMU, A'bad
- 2] **The Concerned Section, Examination Branch,**
- 3] The Section Officer, [Eligibility Unit],
- 4] **The Programmer [Computer Unit-1] Examinations, section, Dr. BAMU, A'bad**
- 5] **The Programmer [Computer Unit-2] Examinations, section, Dr. BAMU, A'bad**
- 6] The In-charge, [E- Suvidha Kendra],
- 7] The B.Voc Section, Dr. BAMU, A'bad
- 8] The Public Relation Officer,
- 9] The Record Keeper,

MARATHWADA UNIVERSITY AURANGABAD



SYLLABUS OF
BACHELOR OF VOCATIONAL
IN

B.Voc in Medical Laboratory Technology Sem-III & IV

Choice Based Credit System

Effective form the Academic Year
2020- 21 Onwards



कृष्णाई शिक्षण प्रसारक मंडळ, लातूर संचलित,

जनविकास महाविद्यालय, बनसारोळा

ता. केज, जि. बीड - ४३१५१८ (महाराष्ट्र)
दूरध्वनी (०२४४५) २३७२४९, फॅक्स : ०२४४५ - २३७२४९
संलग्न : डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ, औरंगाबाद
Email : principaljanvikas@rediffmail.com

सौ. आर.ए. तट
अध्यक्ष

डॉ.बी.एम. गोरे
सचिव

डॉ. बाबासाहेब गोरे
प्राचार्य

जमाक्र. : जमब/अभ्यासक्रम/२०२२-२३/८८५

दि. ०५/०९/२०२२
०७/१०/२०२२

प्रति,

मा. उपकुलसचिव,
शैक्षणिक विभाग (बी.व्होक.),
डॉ.बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ,
औरंगाबाद.



विषय:- बी.व्होक. द्वितीय वर्ष (तिसरे व चौथे सत्र) पदवी कोर्सचा अभ्यासक्रम प्रमाणित करुन मिळणे बाबत.

संदर्भ:- १) UGC आदेश क्र. F.No.4-1/2020(NSQF) September, 2020.

२) शैक्ष/संलग्न/वायपीएस/२०२०-२१/३१४७२-८० दि.२४.०५.२०२१.

महोदय,

वरील संदर्भित पत्रान्वये आमच्या महाविद्यालयात संदर्भ क्र. १ नुसार विद्यापीठ अनुदान आयोगाने बी.व्होक. च्या (1) Media & Entertainment (2) Medical Laboratory Technology (3) E-Commerce & Digital Marketing (4) Software Development या चार कोर्सला मान्यता दिली. त्यानुसार शैक्षणिक वर्ष २०२०-२१ मध्ये सदरील पदवी कोर्सच्या प्रथम वर्ष अभ्यासक्रमास मान्यता मिळाली असून शै.वर्ष २०२१-२२ करिता द्वितीय वर्ष (तिसरे व चौथे सत्र) पद्धतीचा अभ्यासक्रम विद्यापीठाच्या विहित फॉर्मेट मध्ये तयार करुन मान्यतेसाठी सादर करत आहोत.

तरी सदरील द्वितीय व तृतीय वर्षाचा अभ्यासक्रम प्रमाणित करुन पुढील कार्यवाही व्हावी ही नम्र विनंती.

आपला विश्वासू

प्राचार्य

जनविकास महाविद्यालय
बनसारोळा, ता. केज, जि. बीड

सोबत :

१) अभ्यासक्रम आराखडा द्वितीय व तृतीय वर्ष (४ कोर्स)

२) अभ्यासक्रम आराखडा सॉफ्ट कॉपी (सी.डी.)

**Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad (MS)**



Syllabus of

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

Introduced from Academic Year 2021-22


Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

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.

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 creditscourse 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

$$SGPA (S_i) = \Sigma(C_i \times G_i) / \Sigma C_i$$

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.

$$CGPA = \Sigma(C_i \times S_i) / \Sigma C_i$$

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

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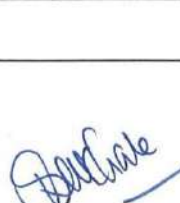
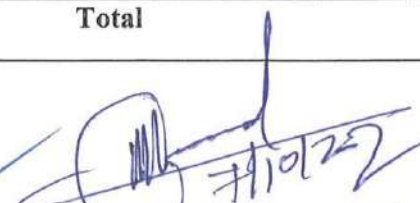
B. Voc. Medical Laboratory Technology

Syllabus with effective from 2021-2022

B.Voc. Medical Laboratory Technology, Second Year

Semester III

Sr. No.	Course Code	Course Title	Contact Hours Per Week		Evaluation Scheme (Marks)		Total Credits
			L	P	CIA	SEE	
	General Education						
1	BMLT 301	Value Education	4	0	20	80	4
2	BMLT 302	Biostatistics	4	0	20	80	4
3	BMLT 303	Soft Skills & Personality Development - II	4	0	20	80	4
	Skill Courses						
4	BMLT304	Advanced Virology	4	0	20	80	4
5	BMLT 305	Medical Pathology - I	4	0	20	80	4
6	BMLT 306	Essentials of Immunology	4	0	20	80	4
	Practical Skill Courses						
7	BMLL 307	LAB 7- Advanced Virology	0	4	25	25	2
8	BMLL 308	LAB 8 : Medical Pathology - I	0	4	25	25	2
9	BMLL 309	LAB 9 Essentials of Immunology	0	4	25	25	2
	Total				195	555	30



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

Sr. No.	Course Code	Course Title	Contact Hours Per Week		Evaluation Scheme (Marks)		Total Credits
			L	P	CIA	SEE	
	General Education						
1	BMLT 401	Medical Ethics	4	0	20	80	4
2	BMLT 402	Biomedical Waste Management	4	0	20	80	4
3	BMLT 403	Metabolism - I	4	0	20	80	4
	Skill Courses						
4	BMLT 404	Bioinstrumentation Techniques - II	4	0	20	80	4
5	BMLT 405	Microbial Physiology	4	0	20	80	4
6	BMLT 406	Diagnostic Microbiology	4	0	20	80	4
	Practical Skill Courses						
7	BMLL 407	LAB 10-Bioinstrumentation Techniques - II	0	4	25	25	2
8	BMLL 408	LAB 11:Microbial Physiology	0	4	25	25	2
9	BMLL 409	LAB 12: Diagnostic Microbiology	0	4	25	25	2
	Total				195	555	30




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Dr. Babasaheb Ambedkar Marathwa
University, Aurangabad

Semester III

Paper Title - BMLT 301	Value Education	Credits – 4 Marks - 100
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Objective – The objective of this paper is to familiarize the students with the basic value of education for mankind purpose.

Outcomes : - Students will gain deeper understanding about the purpose of their life. Students will understand and start applying the essential steps to become good leaders. Students will emerge as responsible citizens with clear conviction to practice values and ethics in life.

(15 Hours)

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.

(15 Hours)

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

(15 Hours)

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.

(15 Hours)

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: Corus 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 Marks - 100
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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.

Outcomes :- restate the principal concepts about biostatistics. collect data relating to variable/variables which will be examined and calculate descriptive statistics from these data. identify data relating to variable/variables. identify convenient sample by using sampling theory.
(15 Hours)

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.
(15 Hours)

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.
(15 Hours)

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)
(15 Hours)

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	Creadits – 4 Marks - 100
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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.

Outcomes :- Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.
(15 Hours)

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.

(15 Hours)

Unit 2 :- Soft Skills

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

(15 Hours)

Unit 3 :- Career Skills

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

(15 Hours)

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	Creadits – 4 Marks - 100
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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.

Outcomes :- 'Firstly, the increasing importance of virology is clearly linked to the fact that we know more and more viruses, understand their links to certain diseases better and that epidemiology looks at certain viral infections in new ways: all of a sudden we recognise viruses where we did not see them before

(15 Hours)

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.

(15 Hours)

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.

(15 Hours)

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.

(15 Hours)

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	Creadits – 4 Marks - 100
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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.

Outcomes :- Delection of potential to develop a disease. diagnosis of disease/condition. identification of cause or severity of disease. monitoring disease progression

(15 Hours)

Unit-1 Bacterial infection

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

- a. Cholera
- b. Typhoid

(15 Hours)

Unit – 2 Bacterial infection

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

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

(15 Hours)

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)

(15 Hours)

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	Creadits – 4 Marks - 100
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Objectives - Students can understand the human body defence mechanism, its role against external pathogens.

Outcomes : - From stopping infections in the lungs, to repairing damage in the liver; to preventing cancer in the skin or keeping the resident gut bacteria in check in the colon. Immunology really is a multidisciplinary science at the centre of much translational research.

(15 Hours)

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.

(15 Hours)

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.

(15 Hours)

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.

(15 Hours)

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. Akta Prakashan. Nadiad.
3. Medical Microbiology. N. C. Dey and T. K. Dey. Allied agency, Culcutta.
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 Marks - 50
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(30 Hours)

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 - LAB 8: Medical Pathology – I	Credits – 2 Marks - 50
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(30 Hours)

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 Marks - 50
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(30 Hours)

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.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS)

Model Question paper Pattern (Theory)

B.Voc.MLT Second Year (Semester III /IV) CBCS Pattern

Subject :- Medical Laboratory

Paper – BMLT 301 TO 306 and BMLT 401 to 406

Time :- 2 Hrs.

Max.Marks 100

- 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)	20 Marks
OR	
a) Short Question	10 Marks
b) Short Question	10 Marks

Q.2 Essay Type Question (On Unit II)	20 Marks
OR	
a) Short Question	10 Marks
b) Short Question	10 Marks
c)	

Q.3 Essay Type Question (On Unit III)	20 Marks
OR	
a) Short Question	10 Marks
b) Short Question	10 Marks
c)	

Q.4 Essay Type Question (On Unit IV)	20 Marks
OR	
a) Short Question	10 Marks
b) Short Question	10 Marks

Q.5 Short Notes (Any Two)	20 Marks
a) Short Note	
b) Short Note	
c) Short Note	

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad (MS)

Model Question paper Pattern (Practical)

B.Voc.MLT Second Year (Semester III /IV) CBCS Pattern

Subject :- Medical Laboratory Technology

Practical Paper – BMLL 307 TO 309 and BMLL 407 to 409

Time :- 4 Hrs.

Max.Marks 50

Q. 1 : Long Experiment	10 Marks
Q. 2 : Long Experiment	10 Marks
Q. 3 : Long Experiment	10 Marks
Q. 4 : Long Experiment	10 Marks
Q. 5 : Record Book	5 Marks

Q. 6 : Viva Voce	5 Marks
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Semester – IV

Paper Title - BMLT 401	Medical Ethics	Credits – 4 Marks - 100
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Objectives :- Students can understand moral values of Humanity.

Outcomes:- Thus they protect not only patients but also care providers and their institutions by setting standards of conduct that ultimately promote the trust of patients, professional colleagues, and the general public. The four cornerstones of medical ethics are respect for autonomy, beneficence, nonmaleficence, and justice.

(15 Hours)

Unit 1:- Definition and scope

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

(15 Hours)

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

(15 Hours)

Unit 3 :- Work in health institutions

Organ transplants
Human reproduction
Genetic testing
Medical research on humans

(15 Hours)

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 Marks - 100
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Objectives :- After studying this subject, students have idea about handling, disposal of biomedical waste. Its effects on environment.

Outcomes:- Inadequate biomedical waste management not only poses significant risk of infection due to pathogens such as HIV and Hepatitis B and C virus but also carries the risk of water, air, and soil pollution thereby adversely affecting the environment and community at large.

(15 Hours)

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

(15 Hours)

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 BMWM 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.

(15 Hours)

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

(15 Hours)

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 Marks - 100
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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.

Outcomes:- Metabolism is the process by which **your body converts what you eat and drink into energy**. During this complex process, calories in food and beverages are combined with oxygen to release the energy your body needs to function.

(15 Hours)

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).

(15 Hours)

UNIT 2: Carbohydrate Catabolism

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

(15 Hours)

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.

(15 Hours)

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. Harper - 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 Marks - 100
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Objectives - Students can understand the knowledge of various bio instruments, its working mechanism & handling.

Outcomes:- Biomedical instrumentation focuses on the development of methods and devices for the treatment of diseases. It is an emerging field of biomedical engineering that bridges the gap between medicine and engineering.

(15 Hours)

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.

(15 Hours)

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.

(15 Hours)

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.

(15 Hours)

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 Marks - 100
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Objectives :- After studying this paper students can understand the Microbial Nutrition, Growth & Reproduction mechanism.

Outcomes:- Microbial physiology has traditionally played a very important role in both fundamental research and in industrial applications of microorganisms. The classical approach in microbial physiology has been to analyze the role of individual components (genes or proteins) in the overall cell function.

(15 Hours)

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.

(15 Hours)

UNIT II: Permeation (in brief) Periods:

Passivediffusion

Facilitateddiffusion

Active transport mechanism

Group translocation

Uptake of amino acids and sugars (as examples)

(15 Hours)

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.

(15 Hours)

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, Crabtree, 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, Gujarat
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 Marks - 100
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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.

Outcomes:- The purpose of diagnostic microbiology is to confirm the suspicion of infectious disease and to identify the etiologic agent, often by bacterial or fungal culture or virus isolation.

(15 Hours)

Unit I Importance of diagnosis of diseases

Common Bacterial, Viral , Fungal and Protozoal diseases

(15 Hours)

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.

(15 Hours)

Unit III Diagnosis of pathogen using culture media

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

(15 Hours)

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 Marks - 50
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(30 Hours)

List of Experiments

1. Efficacy testing of autoclave employing chemical and biological autoclave indicators.
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 Marks - 50
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(30 Hours)

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 Marks - 50
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(30 Hours)

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 Syphilis by RPR.
- 7) Various diagnostic kits (Demonstration)


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