

Date :- 29/06/2019

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc./M. Sc. in Biotechnology (Sem I & II)

Ref. :- Decision of the Academic Council at its meeting held on 28/06/2019.

The Syllabi of B. Sc./M. Sc. in Biotechnology (First and Second Semesters) as per CBCS-UG/~~PG~~ Regulations, 2016 and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2019-20.

Copy of the Syllabi shall be downloaded from the College Website (www.kcesmjcollege.in)

Chairman
Board of Studies



Principal,
M. J. College, Jalgaon

To :

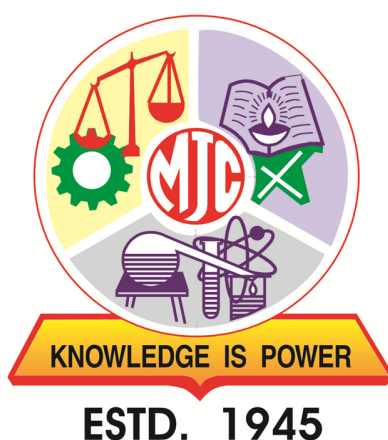
- 1) The Head of the Dept., M. J. College, Jalgaon.
- 2) The Director, School of Life Sciences, M. J. College, Jalgaon.
- 3) The office of the COE, M. J. College, Jalgaon.
- 4) The office of the Registrar, M. J. College, Jalgaon.
- 5) Office File.

Knowledge is Power

Khandesh College Education Society's

Moolji Jaitha College, Jalgaon

An "Autonomous College" Affiliated to
KBC North Maharashtra University, Jalgaon



SYLLABUS STRUCTURE OF

B. Sc. Biotechnology

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2019-20]

Course Structure

F. Y. B. Sc. Biotechnology

Term/ Semester	Course Module	Subject code	Title of paper
I	CC	BT-111	Basic Biotechnology-I
	CC	BT-112	Biochemical Tools
	CC	BT-113	Practical Paper I
II	CC	BT-121	Biomolecules
	CC	BT-122	Basic Biotechnology
	CC	BT-123	Practical Paper II

S. Y. B. Sc. Biotechnology

Term/ Semester	Course Module	Subject code	Title of paper
III	CC	BT-231	Basic Genetics and Immunology
	CC	BT-232	Cell biology and metabolism
	CC	BT-233	Practical Paper III
	SEC	BT-230	Bio inoculant development Techniques
IV	CC	BT-241	Molecular Biology
	CC	BT-242	Industrial biotechnology
	CC	BT-243	Practical Paper IV
	SEC	BT-240	Animal and Plant Tissue Culture Techniques

T. Y. B. Sc. Biotechnology

Term/ Semester	Course Module	Subject code	Title of paper
V	DSE	BT-351	Advanced Genetics
	DSE	BT-352	Plant Biotechnology
	DSE	BT-353	Food Biotechnology
	DSE	BT-354	Advanced Immunology
	DSE	BT-355	Animal Biotechnology
	DSE	BT-356	Environmental Biotechnology
	DSE	BT-357	Practical Course based on BT-351 and BT-352
	DSE	BT-358	Practical Course based on BT-353 and BT-354
	DSE	BT-359	Practical Course based on BT-355 and BT-356
	SEC	BT-350	Waste management Techniques
VI	DSE	BT-361	Genetic Engineering
	DSE	BT-362	Bioprocess technology
	DSE	BT-363	Microbial Biotechnology
	DSE	BT-364	Molecular Diagnostics
	DSE	BT-365	Biophysics
	DSE	BT-366	Biodiversity and Biometry
	DSE	BT-367	Practical Course based on BT-361 and BT-362
	DSE	BT-368	Practical Course based on BT-363 and BT-364
	DSE	BT-369	Practical Course based on BT-365 and BT-366
SEC	BT-360	GLP and GMP techniques	

➤ **Syllabus Pattern for The all Courses (40: 10)**

Nature	Marks
External Marks	40
Internal Marks	10
Total Marks	50

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ESTD. 1945

SYLLABUS

Biotechnology

F.Y.B. Sc.

(Semester I & II)

Under Choice Based Credit System (CBCS)

[w. e. f. Academic Year: 2019-20]

Course Structure

F. Y. B. Sc. Biotechnology

Term/ Semester	Course Module	Subject code	Title of paper
I	CC	BT-111	Basic Biotechnology-I
	CC	BT-112	Biochemical Tools
	CC	BT-113	Practical Paper I
II	CC	BT-121	Biomolecules
	CC	BT-122	Basic Biotechnology
	CC	BT-123	Practical Paper II

BT111: Basic Biotechnology-I (Theory)

Total Hours: 30

Credits:2

Course objective:

To introduce biotechnology and its various applications in various fields of human life and to apprise about scenario of biotechnology in society

Learning outcome:

Students are expected to:

- To introduce the concept and scope of biotechnology
- To impart the knowledge of Food Technology and Fermentation Techniques
- To understand applications of biotechnology in various fields

Unit I: Scope and Introduction to Biotechnology

10 L

- Introduction and History of Biotechnology
- Traditional and Modern Biotechnology
- Scope of Biotechnology: Plant Biotechnology, Animal Biotechnology, Marine Biotechnology, Agriculture, Healthcare, Industrial Biotechnology, Pharmaceutical Biotechnology, Environmental Biotechnology.
- Biotechnology Research in India.
- Biotechnology Institutions in India (Public and Private Sector)
- Biotech success stories
- Biotech Policy Initiatives Biotechnology in context of Developing World
- Commercial opportunities in Biotechnology sector at national and international level

Unit II: Applications of Biotechnology

10L

- Agriculture :
 - GM Food: Papaya, Tomato
 - Resistant Plants: BT Cotton and Brinjal
 - Advantages and disadvantages of genetic engineering in plants
- Modifications in grain Quality :Golden Rice
- Molecular pharming, Plant based vaccines

- Modern Biotechnological Regulatory Aspects in Food Industries
- Biotechnology and Food - Social Appraisal
- Concept and application in Fermentation Technology
- Microbial Fermentations : General production and flow chart for Citric Acid and Ethanol fermentation

Unit III: Biotechnology and Society

10L

- Public Perception of Biotechnology
- Patenting (Intellectual Property Rights—IPR)
- Patents: Types of Patents
- Licenses: After a License Is Granted
- International Patent Laws
- Patenting in Biotechnology
- Varietal Protection
- Ethical Issues in Biotechnology —Agriculture and Health Care

Suggested readings:

1. Nair AJ., (2008) Introduction to Biotechnology and Genetic Engineering, Infinite Science Press, New Delhi
2. Wiley JM, Sherwood LM and Woolverton CJ., (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International, New York
3. Patil UK, Kulkarni JS, Chaudhari AB and Chincholkar SB.,(2016) Foundations in Microbiology 9th edition, Nirali Prakashan, Pune
4. Godbey WT., (2014) An Introduction to Biotechnology: Academic Press, USA ISBN: 978190756828,
5. Smith JE., (2009) Biotechnology, Cambridge University, Cambridge ISBN-13 978-0-521-88494-5
6. Dubey RC., (2018) A Textbook Of Biotechnology Edition: 4th Rev. Edn., S. Chand publication, New Delhi

BT 112: Biochemical Tools (Theory)

Total Hours: 30

Credits:2

Course objective:

To complement the students with routine biochemical tools adopted in biotechnology Studies

Learning outcome:

Students are expected to be able to:

- Demonstrate theory and techniques in staining
- Understand the fundamental biochemical concepts and familiarize with standard solution, buffer and reactions
- Describe the concepts of pH and its biological significance, buffers, Henderson-Hassel balch equation, biological buffer systems and their importance
- Know the terms and terminologies related to basic biochemical aspects

Unit: I Biochemical concept**10L**

- Concept and type of biochemical reactions, mechanism of reactions
- Solution, and type of solutions (homo- and hetero- geneous), standard solutions
- Concept of pH, pOH, buffer system, type of buffer solutions, buffer system for blood, biological buffers, weak acid and weak base, dissociation constant of weak acid and base, pKa, pH and pOH scale, titration curve, Henderson-Hassel batch equation and buffers used in chemical reactions
- Titration, types of titration: acid base titration, precipitation titration, redox titration, complexometric titration
- Enzymes concept, active site, Transition state theory, classification and Coenzymes, applications

Unit II: Microscopy**10L**

- Concept of microscopy: Resolution, magnification, Numerical aperture, and illumination systems in microscope
- Lens aberrations and its correction system
- Light microscope: principle, ray diagram, components, working and applications of Bright field, Dark field and Phase contrast microscope
- Electron microscope: Principle, ray diagram, construction, working and applications of TEM and SEM
- Sample preparation for electron microscope and Ultra microtomy

Unit III: Staining techniques**10L**

- Concept of dyes and Stains, types of stains, Fixative, Mordent,
- Staining techniques: Simple (Monochromatic, and Negative), differential (Gram's and acid fast staining), Lactophenol cotton blue staining for fungi,
- Histochemical techniques: plant and animal cell staining, Haematoxylin staining, Periodate staining(PAS), Thionyl staining and Fluorescence staining

Suggested readings:

1. John E Smith., (2009) Biotechnology 5th edition, Cambridge University Press. <http://www.thanutswu.com/images/BOT101/BiotechnologyBook.pdf>
2. Channarayappa (2006) Molecular Biotechnology: Principles and Practices, Universities Press Pvt. Ltd., Hyderabad
3. Wiley, JM, Sherwood, LM and Woolverton, CJ., (2013) Prescott's Microbiology. 9th Edition. McGraw Hill, International, New York
4. Frobisher M. Hinsdill, Crabtree and Goodheart., (1974). Fundamentals of Microbiology, 9th edition, WB Saunder's Co. USA.
5. Madigan MT, Martinko JM, Dunlap PV and Clark DP., (2014), Brock Biology of Microorganisms, 14th edition, Pearson International Edition, New Delhi

6. Pelczar MJ, Chan ECS and Krieg NR., (1993). Microbiology. 5th edition. McGraw Hill Book Company, New York
7. Tortora, Funke and Case., (2010). Microbiology, 10th edition, Benjamin Cummings Inc, California.
8. Ulhas Patil, JS Kulkarni, AB Chaudhari and SB Chincholkar., (2016) Foundations in Microbiology 9th edition, Nirali Prakashan, Pune
9. Modi, H.A., (2014) Elementary Microbiology, Vol.1 and II, Akshar Prakashan, Ahmedabad

BT113: Practical Paper I (Practical)

Total Hours: 60

Credits: 2

Course objective:

To acquaint students with instruments operation, safety aspects and train the students on the practical components of the theory courses

Learning outcome:

Students are expected to:

- Demonstrate practical skills in microscopy, laboratory equipment and their handling techniques and staining procedures
- Know various stages of cell division and also understand the significance of each event during meiosis and mitosis
- Perform routine tasks safely and effectively

1. First aid, Hazardous Chemicals, Antidotes to hazardous and toxic
2. chemicals, Safety measures in laboratory,
3. Handling of instruments: Autoclave, Laminar air flow, Incubator, Hot air oven, Centrifuges, spectrophotometer, Use and care of compound microscope
4. Calibration of Weighing balance, Micropipettes and pH, Calibration of Laboratory glass wares
5. Principles of Colorimetry: (i) Verification of Beer's law, estimation of protein and (ii) study relation between absorbance and % transmission
6. Study the structure of plant cell through temporary mounts of onion/any plant of choice
7. Study the cell division in onion root tip/ insect gonads (temporary and permanent mounts)
8. Monochrome Staining of bacterial cell
9. Negative Staining of bacterial cell
10. Gram's staining of bacteria
11. Periodate staining
12. Lactophenol Blue staining of Fungi
13. Preparation of standard solution and buffer solution
14. Fermentative production of Alcohol content and Determination of Alcohol
15. Estimation of acetic acid from vinegar

Suggested readings:

1. Atlas, R. M., (1997) Principles of Microbiology, 2nd edition, W.M.T. Brown Publishers,

Dubuque,USA.

2. Cappucino J and Sherman N.,(2010) Microbiology: A Laboratory Manual, 9thedition, Pearson Education Limited, NewDelhi
3. Parija S.C. ,(2005) Text Book of Practical Microbiology, 1stedition, Ahuja Publishing House, NewDelhi.
4. Dubey RC and Maheshwari DK .,(2004) Practical Microbiology, 1stedition, S. Chand and Co.,Delhi.
5. Harley, J. P. and Prescott L. M., (2002) Laboratory Exercises in Microbiology, 5thedition, The McGraw-Hill Co., NewYork
6. Benson H., (2001) Microbiological Applications Lab Manual, 8thedition, The McGraw-Hill Companies, NewYork
7. Aneja K.R. ,(2007) Experiments in Microbiology, 4th edition, WishwaPrakashan, NewDelhi.

SEMESTER II

BT 121: Biomolecules (Theory)

Total Hours: 30

Credits:2

Course Objective:

To complement the students with the basic concept about biomolecules

Learning outcome:

Students are expected to:

- Overview of major biomolecules –carbohydrates, lipids, proteins, amino acids, nucleic acids, classification, structure, function of the above mentioned biomolecules
- Specify the biological significance of biomolecules in metabolism

Unit I: Carbohydrates

10L

- Definition, classification (glyceraldehydes, Simple Aldose, Simple Ketoses, D-glucose, Conformation of D-glucose) and biological functions of carbohydrates. D and L isomers, dextrorotatory and levorotatory, reducing sugar and mutarotation
- Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides, Homo- and Hetero- Polysaccharides, Mucopolysaccharides,
- Structure and biological significance of lactose, sucrose and maltose
- Polysaccharides: Homo- Cellulose, Glycogen and Starch; Plant lignocellulose and Bacterial peptidoglycan, Glycoprotein's and their biological Functions

Unit II: Lipids

08L

- Classification, nomenclature and properties of fatty acids, essential fatty acids.
- Definition, classification and biological functions of simple, compound and derived lipids
- Structure and biological significance of phospholipid and cholesterol, Saturated (palmitic acid), Non-saturated (oleic acid)
- Use as signal, cofactor, pigment

Unit III: Proteins and nucleic acid

12L

- Amino acids: Definition, physical and chemical properties, classification
- Protein : Structure; primary, secondary, tertiary and quaternary, Bonds stabilizing structural conformation, Denaturation and renaturation of proteins, Different types of proteins in the living system, Protein sequencing by Sanger, Edman's method
- Structural Components of Nucleic acids: Nucleosides and Nucleotides, purines and pyrimidines
- DNA: Structure (Watson and Crick Model), Chargaff's Rule, forms of DNA
- RNA: Structure and Significance of: mRNA, tRNA and rRNA, hnRNA.

Suggested readings:

1. Berg, J. M., Tymoczko, J. L. and Stryer, L., (2006) Biochemistry, VI Edition,

W.H Freeman and Co.,

2. Buchanan, B., Gruissem, W. and Jones, R., (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M., (2004) Lehningers' Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A., (2008) Introduction to Plant Physiology, John Wiley and Sons,
5. Salisbury, F.B. and Ross, C.W., (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.,

BT 122: Basic Microbiology (Theory)

Total Hours: 30

Credits: 2

Course objective:

To complement the students with fundamental concepts in Microbiology

Learning outcome:

Students are expected to:

- Understand the basic microbial structure, comparative characteristics of prokaryotes and eukaryotes
- Know various culture media, various physical and chemical means of sterilization
- Know general microbial techniques for isolation of microbial pure cultures
- Learn aseptic techniques and culture handling tasks safely and effectively
- Know the various growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

Unit I: Microbial cells

10 L

- Concept of microorganisms
- Comparative account of prokaryotic and eukaryotic cells,
- Morphology and cell structure of Bacteria, virus, Algae, Fungi, and Protozoa
- Classification of microorganisms: Whittaker's five kingdom system of classification, Microbial taxonomy, Microbial phylogeny and current classification of bacteria.
- Morphological features of Bacteriophage

Unit II: Growth and cultivation of microbes

10 L

- Concept of Culture: Pure culture, axenic culture, mixed culture
- Media and media ingredients (water, peptone, malt extract, meat extract, yeast extract, trace elements, growth factor)
- Types of media: complex, synthetic, natural, selective, differential, enriched media
- Isolation methods: Streak Plate, Spread Plate, Pour Plate, stab inoculation
- Cultivation of fungi: Slide culture technique
- Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, Measurement of growth and factors affecting growth of bacteria

Unit III: Control of microorganisms

10L

- Concept of Sterilization, disinfectant, antiseptic, sanitizer, TDP & TDT.
- Physical methods (Heat, radiation, filtration) and chemical (Ethylene oxide, formaldehyde) methods of sterilization. Biological indicators of sterilization
- Definition of Disinfection, characteristics of ideal disinfectant, Mode of action of alcohol, phenolic compounds, halogen, heavy metals, H₂O₂, detergent

Suggested readings:

1. Alexopoulos, CJ, Mims CW, and Blackwell, M., (1996) Introductory Mycology, 4th edition, John and Sons, Inc.,
2. Jay, JM, Loessner, MJ and Golden, DA., (2005) Modern Food Microbiology, 7th edition, CBS Publishers and Distributors, New Delhi
3. Kumar, HD. (1990) Introductory Phycology, 2nd edition, Affiliated East Western Press,
4. Madigan, MT, Martinko, JM and Parker, J., (2009) Brock Biology of Microorganisms, 12th edition, Pearson/Benjamin Cummings,
5. Pelczar, MJ, Chan ECS and Krieg NR., (1993). Microbiology, 5th edition, McGraw Hill Book Company,
6. Stanier, RY, Ingraham, JL, Wheelis, ML, and Painter PR., (2005) General Microbiology, 5th edition, McMillan,
7. Tortora, GJ, Funke, BR, and Case, CL., (2008) Microbiology: An Introduction, 9th edition, Pearson Education.
8. Willey, JM, Sherwood, LM, and Woolverton, CJ., (2008) Prescott, Harley and Klein's Microbiology, 7th edition, McGraw Hill Higher Education,

BT 123: Practical Paper II (Practical)

Total Hours: 60

Credits: 2

Course objective:

To complement the students with basic biochemistry, cultivation techniques for microbes and familiarize with algae, fungi

Learning outcome:

Students are expected to:

- Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures
 - Understand the basic microbial practices and study the comparative characteristics of prokaryotes and eukaryotes
 - Prepare and view specimens using microscopy (brightfield microscope).
 - Aware and train in aseptic handling of microbial specimens.
 - Practice safe microbiology, using appropriate protective and emergency procedures.
1. Qualitative test for carbohydrates, lipids, amino acids and proteins
 2. Qualitative test for lipids,
 3. Qualitative test for amino acids and proteins

4. Extraction of Starch from Potatoes
5. Extraction of Ovalbumin from Egg
6. Extraction of Lact-albumin from Milk
7. Measurement of bacterial cell size using ocular micrometer and stage Micrometer
8. Preparation of culture media for bacterial cultivation(Nutrient broth and nutrient agar/
MacConkeys broth and MacConkes agar
9. Study of colony morphological characteristics of bacteria
10. Biochemical characteristics: IMVIC, Sugar fermentation test and H₂S test
11. Use of TSI multi test medium for the differentiation of gram negative bacteria
12. Isolation of bacteria by streak plate method from water sample
13. Isolation of bacteria by spread plate method from soil sample
14. Study cultivation of fungi by slide culture technique
15. Study of Algae with temporary mounts and permanent slides (e, g.Spirogyra /Anabena
/Nostoc)

Suggested readings:

1. Atlas, R.M., (1997) Principles of Microbiology, 2nd edition, W.M.T. Brown Publishers,
2. Cappucino, J. and Sherman, N., (2010) Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited,
3. Parija, S.C., (2005) Text Book of Practical Microbiology. 1st edition, Ahuja Publishing House, New Delhi.
4. Dubey, R.C and Maheshwari, D.K., (2004) Practical Microbiology, 1st edition, S. Chand and Co., Delhi.
5. Harley, J. P. and Prescott, L.M., (2002) Laboratory Exercises in Microbiology 5th edition, The McGraw-Hill Companies,
6. Benson, H., (2001) Microbiological Applications Lab Manual, 8th edition, The McGraw-Hill Companies,
7. Aneja, K.R., (1996) Experiments in Microbiology, 3rd edition, Wishwa Prakashan, New Delhi.
8. Erika M. Tóth, Andrea K. Borsodi, Tamás Felföldi, Balázs Vajna, Rita Sipos and Károly Márialigeti., (2013) Practical Microbiology: based on the Hungarian practical notes entitled "Mikrobiológiai Laboratóriumi Gyakorlatok" . XML to PDF by RenderX XEP XSL-FO F ... www.eltereader.hu/media/2014/05/Practical_microbiology_READER.pdf