Syllabus approved en toto to be implemented from the academic year 2016-17 onwards

Chairman (B.o.S) 12/7/16

AP STATE COUNCIL OF HIGHER EDUCATION
CBCS PATTERN FOR MICROBIOLOGY

YEAR	SEMESTER	PAPER	TITLE	MARKS	CREDITS
I	I	I	Introductory Microbiology and Microbial Diversity	100	03
			Practical - I	50	02
	II	II	Microbial Biochemistry and Metabolism	100	03
			Practical - II	50	02
II	III	III	Microbial Genetics and Molecularbiology	100	03
			Practical - III	50	02
	IV	IV	Immunology and Medical Microbiology	100	03
			Practical - IV	50	02
III	V	V	Environmental and Agricultural Microbiology	100	03
			Practical - V	50	02
		VI	Food And Industrial Microbiology	100	03
			Practical - VI	50	02
	* Any one Paper from A, B and C	VII A*	Microbial Biotechnology	100	03
			Practical - VII A	50	02
		VII B*	Advances in Microbiology	100	03
			Practical - VII B	50	02
		VII C*	Instrumentation and Biotechniques	100	03
			Practical - VII C	50	02
	** Any one cluster from I, II and III	VIII (I)**	**Cluster Elective - I**		
			I. Microbial diagnosis in health care	100	03
			II. Management of Human microbial diseases	100	03
			III. Microbial quality control in food and pharmaceutical industry	100	03
			Practical – VIII: 1	50	02
			Practical – VIII: 2	50	02
			Project Work	50	02
	VI	VIII (II)**	**Cluster Elective - II**		
			I. Microbes in sustainable agriculture	100	03
			II. Biofertilizers and Biopesticides	100	03
			III. Mushroom Cultivation	100	03
			Practical – VIII: 1	50	02
			Practical – VIII: 2	50	02
			Project Work	50	02
		VIII (III)**	**Cluster Elective - III**		
			I. Biosafety and intellectual property rights	100	03
			II. Biostatistics	100	03
			III. Bioinformatics	100	03
			Practical – VIII: 1	50	02
			Practical – VIII: 2	50	02
			Project Work	50	02

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B.Sc MICROBIOLOGY (CBCS) SYLLABUS
FIRST YEAR – SEMESTER- I

MBT- 101 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 48 **CREDITS: 4 3**

UNIT-I

No. of hours: 12

History and mile stones in microbiology.
Contributions of Anton von Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Ivanowsky.
Importance and applications of microbiology.
Classification of microorganisms – Haeckel's three Kingdom concept, Whittaker's five kingdom concept, three domain concept of Carl Woese.
Outline classification of bacteria as per the second edition of Bergey's Manual of Systematic Bacteriology.

UNIT – II

No. of hours: 10

General characteristics of Bacteria, Archaea, Mycoplasmas and Cyanobacteria.
Ultra structure of Prokaryotic cell- Variant components and invariant components.
General characteristics of viruses.
Morphology, Structure and replication of TMV and HIV.

UNIT-III

No. of hours: 10

General characteristics and outline classification of Fungi, Algae and Protozoa.
Principles of microscopy - Bright field and Electron microscopy (SEM and TEM).

UNIT-IV

No. of hours: 8

Staining Techniques - Simple and Differential (Gram Staining and Spore Staining).
Sterilization and disinfection techniques - Physical methods – autoclave, hot- air oven, pressure cooker, laminar air flow, filter sterilization, Radiation methods – UV rays, Gamma rays.
Chemical methods – alcohols, aldehydes, fumigants, phenols, halogens and hypochlorites.

UNIT – V

No. of hours: 8

Isolation of Microorganisms from natural habitats.
Pure culture techiques – dilution-plating, Streak-plate, Spread-plate, Pour-Plate and micromanipulator. Enrichment culturing.
Preservation of microbial cultures – subculturing, overlaying cultures with mineral oils, lyophilization, sand cultures, storage at low temperature.

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MBP- 101 INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY

TOTAL HOURS: 48 **CREDITS: 2**

1. Microbiology Good Laboratory Practices and Biosafety.
2. Preparation of culture media for cultivation of bacteria
3. Preparation of culture media for cultivation of fungi
4. Sterilization of medium using Autoclave
5. Sterilization of glassware using Hot Air Oven
6. Light compound microscope and its handling
7. Microscopic observation of bacteria (Gram +ve bacilli and cocci, Gram -ve bacilli), Cyanobacteria, Algae and Fungi.
8. Simple staining
9. Gram's staining
10. Hanging-drop method.
11. Isolation of pure cultures of bacteria by streaking method.
12. Preservation of bacterial cultures by various techniques.
13. Diagramatic or Electron photomicrographic observation of TMV, HIV, T4 phage and Adenovirus

SUGGESTED READING

Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). **Introductory Mycology**. Wiley, New York.

Atlas, R.A. and Bartha, R. (2000). Microbial Ecology . **Fundamentals and Application,** Benjamin Cummings, New York.

Dimmock, N.J., Easton, A.J. and Leppard, K.N. (2001). **Introduction to Modern Virology**, Blackwell Science Ltd, U.K.

Dube, R.C. and Maheswari, D.K. (2000) **General Microbiology**. S Chand, New Delhi. Edition), Himalaya Publishing House, Mumbai.

Frobisher, H., Hinsdil, R.D., Crabtree, K.T. and Goodhert, D.R. (2005). **Fundamentals of Microbiology,** Saunder and Company, London.

Jaya Babu (2006). **Practical Manual on Microbial Metabolisms and General Microbiology**. Kalyani Publishers, New Delhi.

Madigan, M.T., Martinkl, J.M. and Parker, J. (2010). **Brock Biology of Microorganisms,** 9th Edition, MacMillan Press, England.

Moore , Landecker, E. (1996). **Fundamentals of Fungi**, Prentice-Hall, NJ, USA.

Niclin, J. et al. (1999). **Instant Notes in Microbiology.** Viva Books Pvt. Ltd., New Delhi.

Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (1993). **Microbiology.** 5th Edition, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi.

Gopal Reddy et al Laboratory **Experiments in Microbiology**

Power, C.B. and Daginawala, H.F. (1986). **General Microbiology** Vol I & II (2nd

Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). **Microbiology.** 5th Edition, WCB Mc GrawHill, New York.

Ram Reddy, S. and Reddy, S.M. (2007). **Essentials of Virology.** Scientific Publishers India, Jodhpur.

Rao, A.S. (1997). **Introduction to Microbiology**. Prentice-Hall of India Pvt Ltd., Nerw Delhi.Black, J.G. (2005).

Reddy, S.M. (2003). **University Microbiology** .I . Galgotia Publications New Delhi.

Reddy, S.M. and Reddy, S.R. (1998). **Microbiology – Practical Manual**, 3 rd Edition, Sri Padmavathi Publications, Hyderabad.

Singh, R.P. (2007). **General Microbiology**. Kalyani Publishers, New Delhi.

Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed., Prentice Hall of India Pvt. Ltd., New Delhi.

Sullia, S.B. and Shantaram, S. (1998). **General Microbiology**, Oxford & IBH Publishing Pvt. Ltd., New Delhi.

Talaro, K. and Talaro, A. (1996). **Foundations in Microbiology**. 2nd Edition. UMC Brown Publications.

Webster, J. (1980). **Introduction to Fungi,** Cambridge University Press, Cambridge.

Wilson, K. and Walker, J. (1994). **Practical Biochemistry**. 4 th Edition, Cambridge University Press, England.

Zubay, G. (1998). **Biochemistry** WCB. Mc GrawHill, Iowa.

14/7/16

18/7/16
B.O.S. (Botany & Chairman - Microbiology).

ACHARYA NAGARJUNA UNIVERSITY

B.Sc MICROBIOLOGY (CBCS) SYLLABUS

FIRST YEAR – SEMESTER- II

MBT- 201 : MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 48 **CREDITS: 3**

UNIT-I **No. of hours: 10**

Outline classification and general characteristics of carbohydrates (monosaccharides, disaccharides and polysaccharides).
General characteristics of amino acids and proteins.
Structure of nitrogenous bases, nucleotides, nucleic acids.
Fatty acids (saturated and unsaturated)
lipids (spingolipds, sterols and phospholipids).

UNIT-II **No. of hours: 8**

Principle and applications of -
Colorimerty
Chromatography (paper, thin-layer and column),
Spectrophotometry (UV & visible),
Centrifugation and
Gel Electrophoresis.

UNIT-III **No. of hours: 10**

Properties and classification of Enzymes.
Biocatalysis- induced fit and lock and key models.
Coenzymes and Cofactors.
Factors affecting catalytic activity.
Inhibition of enzyme activity- competitive, noncompetitive, uncompetitive and allosteric.

UNIT-IV **No. of hours: 10**

Microbial Nutrition –Nutritional requirements and uptake of nutrients by cells.
Nutritional groups of microcroorganisms- autotrophs, heterotrophs, mixotrophs.
Growth media- synthetic, complex, selective, enrichment and differential media.
Microbial Growth- different phases of growth in batch cultures, Synchronous, continuous, biphasic growth.
Factors influencing microbial growth.
Methods for measuring microbial growth – Direct microscopy, viable count estimates, turbiodometry and biomass.

UNIT-V **No. of hours: 10**

Aerobic respiration -Glycolysis, HMP path way, ED path way, TCA cycle, Electron transport, oxidative and substrate level phosphorylation.
Anaerobic respiration (Nitrate).

Fermentation - Alcohol and lactic acid fermentations.
Outlines of oxygenic and anoxygenic photosynthesis in bacteria.

ACHARYA NAGARJUNA UNIVERSITY

MBP- 201: MICROBIAL BIOCHEMISTRY & METABOLISM

TOTAL HOURS: 48 **CREDITS: 2**

1. Qualitative Analysis of Carbohydrates
2. Qualitative Analysis of Aminoacids
3. Colorimetric estimation DNA by diphenylamine method
4. Colorimetric estimation of proteins by Biuret/Lowry method
5. Paper chromatographic separation of sugars and amino acids
6. Preparation of different media- Synthetic and Complex Media
7. Setting and observation of Winogradsky column.
8. Estimation of CFU count by spread plate method/pour plate method.
9. Bacterial growth curve.
10. Factors affecting bacterial growth – pH.
11. Factors affecting bacterial growth – Temperature.
12. Factors affecting bacterial growth –Salts

SUGGESTED READING

1. Berg JM, Tymoczko JL and Stryer L (2011) **Biochemistry**, W.H.Freeman and Company
2. Caldwell, D.R. (1995). **Microbial Physiology and Metabolism**, W.C. Brown Publications, Iowa, USA.
3. Campbell, PN and Smith AD (2011) **Biochemistry** Illustrated, 4th ed., Published by Churchill Livingstone
4. Elliot, W.H. and Elliot, D.C. (2001). **Biochemistry and Molecular Biology**, 2 nd Edition, Oxford University Press, U.S.A.
5. Gottschalk, G. (1986). **Bacterial Metabolism**, SpringerVerlag, NewYork.
6. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). **Principles of Biochemistry**, 2 nd Edition, CBS Publishers and Distributors, New Delhi.
7. Madigan, M.T., Martinkl, J.M. and Parker, J. (2010). **Brock Biology of Microorganisms**, 9th Edition, MacMillan Press, England.
8. Moat, A.G. and Foster, J.W. (1995). **Microbial Physiology**, JohnWiley, New York.
9. Nelson DL and Cox MM (2008) Lehninger **Principles of Biochemistry**, 5th Edition., W.H. Freeman and Company.
10. Prescott, M.J., Harley, J.P. and Klein, D.A. (2010). **Microbiology.** 5th Edition, WCB Mc GrawHill, New York.
11. Reddy, S.R. and Reddy, S.M. (2004). **Microbial Physiology**, Scientific Publishers, Jodhpur, India.
12. Sashidhara Rao, B. and Deshpande, V. (2007). **Experimental Biochemistry**: A student Companion. I.K. International Pvt. Ltd.
13. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1991). **General Microbiology**, 5th Ed.,Prentice Hall of India Pvt. Ltd., New Delhi.
14. Tymoczko JL, Berg JM and Stryer L (2012) **Biochemistry:** A short course, 2nd ed., W.H.Freeman
15. Voet,D. and Voet J.G (2004) **Biochemistry** 3rd edition, John Wiley and Sons
16. White, D. (1995). **The Physiology and Biochemistry of Prokaryotes**, Oxford University Press, New York.
17. Willey MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's **Microbiology** by. 9th Ed., McGrawHill

B.Sc MICROBIOLOGY (CBCS) SYLLABUS
SECOND YEAR – SEMESTER- III

MBT- 301 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

TOTAL HOURS:48 **CREDITS: 3**

UNIT-I **No. of hours: 10**

DNA and RNA as genetic material.
Structure and organization of prokaryotic DNA.
Extrachromosomal genetic elements – Plasmids and transposons.
Replication of DNA – Semi conservative mechanism, Enzymes involved in replication.

UNIT-II **No. of hours: 10**

Mutations – spontaneous and induced, base pair changes, frame shifts, deletions, inversions, tandem duplications, insertions.
Mutagens - Physical and Chemical mutagens.
Outlines of DNA damage and repair mechanisms.
Genetic recombination in bacteria – Conjugation, Transformation and Transduction.

UNIT-III **No. of hours: 10**

Concept of gene – Muton, Recon and Cistron. One gene one enzyme and one gene one polypeptide hypotheses.
Types of RNA and their functions.
Genetic code.
Structure of ribosomes.

UNIT-IV **No. of hours: 8**

Types of genes – structural, constitutive, regulatory
Protein synthesis – Transcription and translation.
Regulation of gene expression in bacteria – *lac* operon.

UNIT-V **No. of hours: 10**

Basic principles of genetic engineering.
Restriction endonucleases, DNA polymerases and ligases.
Vectors.
Outlines of gene cloning methods.
Polymerase chain reaction. Genomic and cDNA libraries.
General account on application of genetic engineering in industry, agriculture and medicine.

TOTAL HOURS: 48 **CREDITS: 2**

1. Study of different types of DNA and RNA using micrographs and model / schematic representations
2. Study of semi-conservative replication of DNA through micrographs / schematic representations
3. Isolation of genomic DNA from *E. coli*
4. Estimation of DNA using UV spectrophotometer.
5. Resolution and visualization of DNA by Agarose Gel Electrophoresis.
6. Resolution and visualization of proteins by Polyacrylamide Gel Electrophoresis (SDS-PAGE).
7. Problems related to DNA and RNA characteristics, Transcription and Translation.
8. Induction of mutations in bacteria by UV light.
9. Instrumentation in molecular biology – Ultra centrifuge, Transilluminator, PCR

SUGGESTED READING

Crueger, W. and Crueger, A. (2000). **Biotechnology: A Text Book of Industrial Microbiology,** PrenticeHall of India Pvt. Ltd., New Delhi.

Freifelder, D. (1990). **Microbial Genetics**. Narosa Publishing House, New Delhi.

Freifelder, D. (1997). **Essentials of Molecular Biology**. Narosa Publishing House, New Delhi.

Glazer, A.N. and Nikaido, H. (1995). **Microbial Biotechnology – Fundamentals of Applied Microbiology**, W.H. Freeman and company, New York.

Glick, B.P. and Pasternack, J. (1998). **Molecular Biotechnology**, ASM Press, Washington D.C., USA.

Kannan, N. (2003). **Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers**. Panima Publishing Co., New Delhi.

Lewin, B. (2000). **Genes VIII.** Oxford University Press, England

Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). **Microbial Genetics**, Jones and Bartlett Publishers, London.

Nicholl, D.S.T. (2004). **An Introduction to Genetic Engineering.** 2 nd Edition. Cambridge University Press, London.

Old, R.W. and Primrose, S.B. (1994) **Principles of Gene Manipulation**, Blackwell Science Publication, New York.

Ram Reddy, S., Venkateshwarlu, K. and Krishna Reddy, V. (2007) **A text Book of Molecular Biotechnology**. Himalaya Publishers, Hyderabad.

Sinnot E.W., L.C. Dunn and T. Dobzhansky. (1958). **Principles of Genetics**. 5 th Edition. McGraw Hill, New York.

Smith, J.E. (1996). **Biotechnology**, Cambridge University Press.

Snyder, L. and Champness, W. (1997). **Molecular Genetics of Bacteria**. ASM press,
Strickberger, M.W. (1967). **Genetics**. Oxford & IBH, New Delhi.

Turner, P.C., Mclennan, A.G., Bates, A.D. and White, M.R.H. (1998). **Instant Notes in Molecular Biology**, Viva Books Pvt., Ltd., New Delhi.

Twynan, R.M. (2003). **Advanced Molecular Biology**. Viva books Pvt. Ltd. New Delhi.

Verma, P.S. and Agarwal, V.K. (2004). **Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.** S. Chand & Co. Ltd., New Delhi.

Washington, D.C., USA.

ACHARYA NAGARJUNA UNIVERSITY

B.Sc MICROBIOLOGY (CBCS) SYLLABUS
SECOND YEAR – SEMESTER- IV

MBT- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 48 **CREDITS: 3**

UNIT-I **No. of hours: 10**

Types of immunity – innate and acquired; active and passive; humoral and cell-mediated immunity.
Primary and secondary organs of immune system – thymus, bursa fabricus, bone marrow, spleen and lymph nodes.
Cells of immune system.
Identiification and function of B and T lymphocytes, null cells, monocytes, macrophages, neutrophils, basophils and eosinophils.

UNIT-II **No. of hours: 10**

Antigens – types, chemical nature, antigenic determinants, haptens.
Factors affecting antigenicity.
Antibodies – basic structure, types, properties and functions of immunoglobulins.
Types of antigen-antibody reactions - Agglutinations, Precipitation, Neutralization, complement fixation, blood groups.
Labeled antibody based techniques – ELISA, RIA and Immunofluroscence. Polyclonal and monoclonal antibodies – production and applications.
Concept of hypersensitivity and Autoimmunity.

UNIT-III **No. of hours: 10**

Normal flora of human body.
Host pathogen interactions: infection, invasion, pathogen, pathogenicity, virulence and opportunistic infection.
General account on nosocomial infection.
General principles of diagnostic microbiology- collection, transport and processing of clinical samples.
General methods of laboratory diagnosis - cultural, biochemical, serological and molecular methods.

UNIT-IV **No. of hours: 8**

Antibacterial Agents- Penicillin, Streptomycin and Tetracycline.
Antifungal agents – Amphotericin B, Griseofulvin
Antiviral substances - Amantadine and Acyclovir
Tests for antimicrobial susceptibility.
Brief account on antibiotic resistance in bacteria - Methicillin-resistant Staphylococcus aureus (MRSA).
Vaccines – Natural and recombinant.

UNIT-V **No. of hours: 10**

General account on microbial diseases – causal organism, pathogenesis, epidemiology, diagnosis, prevention and control
Bacterial diseases – Tuberculosis and Typhoid
Fungal diseases – Candidiasis.
Protozoal diseases – Malaria.
Viral Diseases - Hepatitis- A and AIDS

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MBP- 401 IMMUNOLOGY AND MEDICAL MICROBIOLOGY

TOTAL HOURS: 48 **CREDITS: 2**

1. Identification of human blood groups.
2. Separate serum from the blood sample (demonstration).
3. Estimation of blood haemoglobin.
4. Total Leukocyte Count of the given blood sample.
5. Differential Leukocyte Count of the given blood sample.
6. Immunodiffusion by Ouchterlony method.
7. Identify bacteria (*E. coli, Pseudomonas, Staphylococcus, Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, urease production and catalase tests
8. Isolation of bacterial flora of skin by swab method.
9. Antibacterial sensitivity by Kirby-Bauer method
10. Study symptoms of the diseases with the help of photographs: Anthrax, Polio, Herpes, chicken pox, HPV warts, Dermatomycoses (ring worms)
11. Study of various stages of malarial parasite in RBCs using permanent mounts.

SUGGESTED READING

Abbas AK, Lichtman AH, Pillai S. (2007). **Cellular and Molecular Immunology.** 6th edition Saunders Publication, Philadelphia.

Ananthanarayan R. and Paniker C.K.J. (2009) **Textbook of Microbiology**. 8th edition, University Press Publication

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

Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's **Essential Immunology**.11th edition Wiley-Blackwell Scientific Publication, Oxford.

Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' **Medical Microbiology.** 4th edition. Elsevier

Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's **Immunology**. 6th edition W.H. Freeman and Company, New York.

Kuby's **Immunology**. 6th edition W.H. Freeman and Company, New York.

Jawetz, Melnick and Adelberg's **Medical Microbiology**. 26th edition. McGraw Hill Microbiology. 4th edition. Elsevier Publication

Richard C and Geiffrey S. (2009). **Immunology**. 6th edition. Wiley Blackwell Publication.

Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's **Microbiology**. 9th edition. McGraw Hill Higher Education