THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U1RMC1**

COURSE TITLE : General Microbiology **QN.NO : 9001**

TIME : 3 Hours **MAX.MARKS :75**

Unit I

Definition and scope of Microbiology- Overview of history of Microbiology-Biogenesis and Abiogenesis, Spontaneous generation, Germ theory of diseases, Contribution of Redi, Spallanzani, Needham, Louis Pasteur, Tyndal, Leewenhoek, Joseph Lister, Robert Koch, Edward Jenner, Winogradsky, Flemming, William Beijernick, Emil Christian Hansen, Elie Metchinikoff and Kary Mullis. Impact of Microbiology on future.

Unit II

Ultra structure and differences of Eukaryotes and Prokaryotes, Archaebacteria and Eubacteria, Mycoplasma with examples. Growth curve, Growth kinetics, Acidophiles, Alkalophiles Neutrophiles, Thermophiles, aerobes and anaerobes, Halophiles, Osmophiles and Basophiles.

Unit III

Bacterial cell size, shape, arrangement, gram positive , negative cell wall , glycocalyx, capsule, flagella, fimbriae, pili, cell membrane, cytoplasm. Endospore : structure, formation, stages of sporulation. Ultra structure of *E.coli, Bacillus subtilis.* Ultra-structure and reproduction of *Saccharomyces cereviseae* and *Penicillum* sp.

Unit IV

Ultra structure of HIV, types of Hepatitis. ultra structure and reproduction of Algae – Spirulina, Chlamydomonas and Protozoans. Structure and reproduction of Amoeba and Plasmodium.

Unit V

General characters of antimicrobial, antiseptics, disinfectants. Antibiotic- Beta lactum and aminoglycosides- mechanism of action. Antiviral, antiparasitic, antifungal antibiotics. Antibiotic sensitivity test & MIC.

Text Book(s):

1. Michael J Pelczar, JR. E.C.S Chan, Noel R. Krieg;(1998). Microbiology, TATA McGraw-Hill publication.
2. Madigah, Martinko, Dunlap; (2010).Brock Biology of Microorganisms; Pearson Publication.
3. P Sharma, (1986).Algae – Series on diversity of Microbes, Tata McGraw Hill Education Private Limited.
4. R.C.Dubey & K.Maheshwari (1999). A Text book of Microbiology, S. Chand & Company.

Reference Books:

1. Prescott, Harley & Klein's,(2008), Microbiology, Mac Graw Hill Higher education.
2. Jacquelyn G.Black, (2008), Microbiology Principles and explorations, JohnWiley& sons Ltd K Rajeshwar Reddy, General Microbiology, New Age Publishers.

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U1RSM1**

COURSE TITLE : Basic Techniques in Microbiology **QN.NO : 9002**

TIME : 3 Hours **MAX.MARKS :75**

Unit I

Microscopy- principles and components of Simple, Compound, Dark field, Phase contrast, fluorescent, Electron microscope (TEM & SEM)-Resolution power of microscope. Stains and Staining techniques- Definition of auxochrome, chromophores, dyes, classification of stains, theories of staining, mechanism of Gram staining, Acid fast staining, Negative staining, Capsule staining, Flagellar staining and Endospore staining.

Unit II

Concept of sterilization and disinfection. Definitions, principles, methods of sterilization- physical methods (heat, filtration), radiation and chemical methods- Pasteurization, Tyndalization, Ultrasonication. Disinfection - sanitization, antisepsis sterilization and fumigation. Determination of phenol co- efficient of disinfectant.

Unit III

Types of culture media: synthetic, complex, enriched, enrichment, selective, differential, dehydrated solid and liquid. Concept & methods of pure culture technique; Methods: enrichment, streak plate, surface spread, pour plate, colony characters and pigmentation.

Unit IV

Principle of pH meter, Colorimeter, Centrifuge and its types, Chromatographic techniques – TLC and Column chromatography, Electrophoresis, Spectroscopy – UV spectrophotometer.

Unit V

Microbiological media, composition and types: Selective and Differential media, growth curve and growth kinetics, influence of environmental factors for microbial growth. Maintenance and preservation of cultures - sub culturing, overlaying cultures with mineral oils, Lyophilization, and culture storage at low temperature.

Text Book(s):

1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). Introductory Mycology. 4th edition. John and Sons, Inc.
2. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
3. Kumar HD. (1990). Introductory Phycology. 2nd edition. Affiliated East Western Press.

Reference Book(s):

1. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/Benjamin Cummings.
2. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education limited.

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U2RMC2**

COURSE TITLE : Microbial Taxonomy **QN.NO : 9003**

TIME : 3 Hours **MAX.MARKS :75**

Unit I

Bacterial Taxonomy and Classification: position of microorganisms in living world, Whittaker's five kingdom concept. Taxonomic groups, species concept, principles of Binomial nomenclature, criteria used for classification of bacteria.

Unit II

Methods of Classification: intuitive methods, numerical taxonomy, genetic approach. Introduction to Bergey's manual - salient features, criteria used for classification, past and present status of bacterial taxonomy.

Unit III

Fungal taxonomy: General criteria for classification, classification by Alexopoulos and Mims, Detail studies on the classes of (a) Slime molds (b) Zygomycetes (c) Deuteromycetes- morphology habitat , reproduction and economic importance of fungi.

Unit IV

Classification of Algae by Fritsch, Myxophyceae – morphology, habitat and reproduction. Economic importance of algae.

Unit- V

Principles of Virus taxonomy, characteristics used in nomenclature & classification of bacterial, plant and animal viruses- their major families with suitable examples.

Text Book (s):

1. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
2. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan.
3. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
4. Vashishta BR and Sinha AK. (2008). Fungi. S. Chand and Company Ltd.

Reference Book(s):

1.Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.
2.Vashishta BR. (2005). Algae. 3rd edition. S. Chand and Company Limited, New Delhi.

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U2RSM2**

COURSE TITLE : Cell and Molecular Biology **QN.NO : 9005**

TIME : 3 Hours **MAX.MARKS :75**

Unit I

Overview of Prokaryotic & Eukaryotic cells, cell size, phages, viriods, mycoplasma. Bacterial cell wall- gram positive and gram negative, structure, chemistry &functions, fluid mosaic model of cell membrane, pili, flagella and endospore- structure and functions.

Unit II

Nucleoid, Nucleus, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Mitochondria and Chloroplast- structure and functions.

Unit III

The replication of DNA (Prokaryotes and eukaryotes), DNA replication- Meselson - Stahl experiment (evidence for semi conservative replication). Mechanism of replication-rolling circle model and theta (θ) mode of replication., enzyme involved in DNA replication-DNA polymerase, ligase, primase & telomerase.

Unit IV

Transcription in prokaryotes – mechanism (initiation, elongation, termination) promoter structure, mechanism of termination, dependent and independent termination.

Unit V

Mutation-spontaneous & induced, mutagens- physical and chemical. Types of mutations-addition, deletion, inversion, substitution, base analog, frame shift. DNA repair mechanisms, SOS-Photoreactivation, dark repair mechanism.

Text Book(s):

1. Lodish, H. Baltimore Daerk . A. Zipsury, S.L. Marsudaisa. P. Darnel. J. (1995) Molecular cell biology.
2. Gardner- Simon Snustad. (2001) Principles of genetics, 8th Edition. John Wiley & sons. Inc. New York.

Reference Book(s):

1.Maloy, S.R. Cronan Jr. J.E, Freifelder D (1994), Microbial genetics. Jones and Barlett publishers.

2.Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. 7th edition. McGraw Hill Higher Education.

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U3RMC3**

COURSE TITLE : Biochemistry **QN.NO : 9006**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To introduce the structure and properties of various biomolecules.
- To learn the concepts involved in the mechanism of enzyme action.

Learning Outcomes:

- Students gathered indepth informations about biomolecules and their mechanisms.
- Students acquire knowledge on role of lipids and vitamins to human population.

Unit I

Carbohydrates – definitions, biological significance - Classification, Structure, chemical and physical properties of Monosaccharides - Glucose, Disaccharides- lactose, Polysaccharides – starch.

Unit II

Amino acids -classification, essential and non – essential amino acids, structure and properties. Proteins – definitions, classification based on composition, solubility. structural levels of organization – primary, secondary, tertiary and quaternary structure and functions.

Unit III

Enzymes – definitions, IUB classification with example, Structure, mechanism of enzyme action-lock and key model. Enzyme inhibition-competitive and non competitive, factors affecting enzymes activity.

Unit IV

Lipids - classifications , physical and chemical properties, saturated and unsaturated fatty acids. Lipid metabolism - β-oxidation, biosynthesis of saturated fatty acid eg. Palmitic acid.

Unit V

Vitamins- classification, occurrence, deficiency, symptoms and importance of vitamins-water soluble vitamins (Vitamin B and C). Fat soluble vitamins (Vitamin A, D, E and K).

Text Book :

1. Jain, J. L. (2000). Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi

Reference Book(s):

1.Nelson, D.L., and M.M.Cox., (2000). Lehninger, Principles of Biochemistry, Third edition, Macmillan Worth publishers

2.David, B.D., Delbecco,. R., Eisen, H.N and Ginsburg, H.S (1990). "Microbiology" 5th Edition. Harper & Row, New York.

3.Stryer. L. (1995). Biochemistry, 4th Edn , W.H. Freeman &Co. NY.

4.Rober K. Murray, Daryl K. Grammer, (1990) -Harper's Biochemistry- McGraw Hill, Lange Medical Books. 25th edition.
5.Satyanarayana, U (2005). Essentials of Biochemistry, Books and Allied (P) Ltd., Kolkata.
6.Veerakumari, L (2004). Biochemistry. MJP Pubilshers, A Unit of Tamil Nadu Book House, Chennai.

Web reference(s):

1.www.biochemistry.org/
2. www. bookboon.com/en/biology-biochemistry
3.www.ncbi.nlm.nih.gov/books/NBK21154

You tube reference(s):

1. www. Biochemistry Introductory Lecture for Kevin Ahern's BB 450/550 youtube.com
2. www .Biochemistry Lecture (Introduction) from Kevin Ahern's BB 350 youtube.com

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PROGRAMME : B.Sc., **COURSE CODE : 18U3RAC3 / 17U3RAC1**

COURSE TITLE : Environmental Microbiology **QN.NO : 9001**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To understand the role of microbes in different spheres of life.
- Make them to learn analytical techniques of quality control sector in microbiological industry.

Learning Outcomes:

- Students are able to isolate and observe the soil micro flora. They will be able to measure bacterial content of air and identify the airborne diseases.
- Students gather knowledge to analyze the nature of microorganisms and potability of water.
- Students familiarize with specific test for water analysis and sewage water treatment.
- Students are able to analyze the role of microbes in the field of biodegradation.

Unit I

Microbiology of soil – Rhizosphere, soil microflora, significance of soil microbes. Role of microbes in Biogeochemical cycle- Carbon , Nitrogen and Phosphorus .

Unit II

Microbiology of air – Enumeration of bacteria from air – Air sampling devices – Air sanitation- Air borne diseases –Tuberculosis , Influenza.

Unit III

Microbiology of water – Potability of water quality -MPN test – Indicator organisms -IMVIC test – water purification – waterborne diseases and their control measures – Amoebic dysentery, Cholera & Typhoid.

Unit IV

Microbiology of sewage – chemical and biochemical characteristics of sewage – Sewage treatment – Physical, chemical and biological methods -trickling filter, activated sludge, Lagoon and sewage farming.

Unit V

Role of microbes in biodegradation – Xenobiotics –Biomining eg. (copper). Biodegradation of paper, oil, pesticide, dyes and heavy metals. Phytoremediation.

Text Book :

1. Vijaya Ramesh K (2004). Environmental Microbiology. 1st Edition, MJP Publishers (A unit of Tamil Nadu Book house), Chennai.

Reference Book(s):

1.Mithell R (1974). Introduction to Environmental Microbiology. Prantice Hall. Inc., Englewood Cliffs, New Jersey.

2.Atlas, RN and Bartha R (1992). Microbial Ecology: Fundamentals and applications. 3rd Edition, Redwood city, Benjamin/Cummings.

3.Joseph C Daniel (1999). Environment Aspects of Microbiology. 1st Edition, Bright sun Publications, Chennai.

4.Subba Rao, N.S., (2000). Advances in Agricultural Microbiology, Oxford & IBH Publ. Co. Pvt. Ltd., New Delhi.

5.Metting, Jr. F.B., (1993). Soil Microbial Ecology, Harcel Dekker Inc., New York.

6.Atlas, M., (2000).Microbiology-Fundamentals and Applications, Collier MacMillan Publication, London

Web reference(s):

1.www.highveld.com/microbiology/environmental-microbiology.

2.www.sfam.org.uk/en/journals/environmental-microbiology.cfm

3.www.sciencedirect.com/science

You tube reference(s):

1.www.Environmental Microbiology youtube.com

2.www .BI280 Chapter 26 Environmental Microbiology - Part 1 of 2youtube.com

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PROGRAMME : UG NME- Microbiology **COURSE CODE : 17U3RNM1**

COURSE TITLE : Microbes in Human Welfare **QN.NO : 9008**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To get a fundamental knowledge about microbial world for other major students.
- To motivate the non microbiology students to appreciate the role and importance of microbes in day today life.

Learning Outcomes:

- This paper gives a basic and elementary aspects of microbiology to non major / non microbiology students.
- Students acquire knowledge on history and development of microbiological world.
- The students have a clear idea about the beneficial and harmful aspects of microbes in a lucid manner.

Unit I

History and scope of Microbiology- Spontaneous generation of organism. Contributions of Louis Pasteur, Robert Koch and Edward Jenner.

Unit II

Role and applications of microorganisms - in food and dairy industries- *Saccharomyces* - *Lactobacillus*, *Agaricus* and *Spirulina* .

Unit III

Role of microbes in Pharma field- Industrial production of Insulin. Antibiotics – industrial production of Penicillin. Immunization- Vaccines, immunization schedule for children, role of vaccines for Small pox, Rabies and Polio.

Unit IV

Role of microbes in Agriculture- Soil microflora, Rhizosphere, organic manure. Biofertilizer - *Blue green algae*. Bioinsecticides – *Bacillus thuringiensis*,.

Unit V

Role of microbes in sewage treatment -Trickling filter, activated sludge, oxidation pond, oxidation ditch. Microbes in the production of biogas. Industrial production of alcohol.

Text Book :

1. Dubey RC and Maheswari DK (2005). A Text book of Microbiology. S.Chand &Company Ltd., New Delhi.

Reference Book(s):

1. Adams, M.R.and Moss. M.O. (1995) .Food Microbiology. New International (P) Ltd. Publishers.

2. Frazies ,W.C. and Westhoff, D.C. (1988) .Food microbiology. 4th Edition. McGraw Hill NY.

3. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons. N.Y.

4. Subba Rao, N.S. (1995) .Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd.

5. Sundara Rajan S (2003). College Microbiology. Volume 1 & 2. Revised Edition, Vardhana Publications, Bangalore.

6. Powar CB and Daginawala HF (2005). General Microbiology, Volume I & II, 8th Edition, Himalaya Publishing House, Mumbai.

Web reference(s):

1.www.periobasics.com/basic-microbiology.

2.www.microbiologynutsandbolts.co.basic-concepts.

3.www.microbiologyinfo.com/category/basic-microbiology

You tube reference(s):

1.www. Microbiology - Overview -youtube.com

2.www. Introduction to microbiology youtube.com

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PATTERN OF QUESTION PAPER

TIME: 3 Hours **MAXIMUM MARKS: 75**

SECTION – A (10 x 1 =10)

Answer All the Questions (Multiple Choice Questions)

Question No. 1, 2 from	**Unit – I**
Question No. 3, 4 from	**Unit - II**
Question No. 5, 6 from	**Unit - III**
Question No. 7, 8 from	**Unit – IV**
Question No. 9, 10 from	**Unit - V**

SECTION – B (5 x 7 = 35)

Answer All the Questions (Either OR Pattern) each answer not exceeding 3 pages

Question No. 11(a) **(OR)** **Question No. 11(b)**	**From Unit -I**
Question No. 12(a) **(OR)** **Question No. 12(b)**	**From Unit -II**
Question No. 13(a) **(OR)** **Question No. 13(b)**	**From Unit -III**
Question No. 14(a) **(OR)** **Question No. 14(b)**	**From Unit -IV**
Question No. 15(a) **(OR)** **Question No. 15(b)**	**From Unit -V**

SECTION – C (3 x 10 = 30)

Answer 3 out of 5 Questions (Open choice) each answer not exceeding 4 pages.

Question No. 16 from Unit - I
Question No. 17 from Unit - II
Question No. 18 from Unit - III
Question No. 19 from Unit - IV
Question No. 20 from Unit - V

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PROGRAMME : B.Sc., **COURSE CODE : 18U1RAC1**

COURSE TITLE : Basic Microbiology **QN.NO : 9009**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To learn the fundamentals of microbiology.
- To understand the morphology, structural organization of microbes.

Learning Outcomes:

- This paper introduce the foundation of Microbiology. Students traced the history and contribution of various microbiologists. This is a motivation to the students in the field of Microbiology.
- Students are able to isolate the microbes in the lab and note their morphology and staining of bacteria of various types.
- Students properly understood the techniques, types and importance of sterilization in the field of microbiology.
- Students get the information about various antibiotics, biofertilizers and their significance.

Unit I

Introduction and History of Microbiology – History and recent developments – Spontaneous generation – Biogenesis Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchinkoff and Fleming.

Unit II

Morphology and structure of bacteria – types of bacteria based on morphology and flagella, Ultrastructure of bacteria eg. *E.coli* , flagella, fimbriae and Pili. Endospore – Structure, formation and significance.

Unit III

Cell wall structure and staining of bacteria – Gram positive and Gram negative bacteria. Staining techniques – Simple, differential and special staining. Fungal staining.

Unit IV

Sterilization and its methods – Principles – dry heat – moist heat – Radiation – Filtration. Disinfection- sanitization , antisepsis and fumigation..

Unit V

Antibiotics and Biofertilizer - Antibiotics – mode of actions – antimicrobial resistance – Tests for sensitivity to antimicrobial agents. Biofertilizers -*Mycorrhizae* , Biopesticides- *Bacillus thuringiensis*.

Text Book :

1. Dubey RC & Maheswari DK (2005). A text book of Microbiology, Revised Multicolour Edition, Published by S. Chand & Company Limited, New Delhi.

Reference Book(s):

1. Prescott M (2005). Microbiology. 6th Edition, Tata McGraw – Hill, New Delhi.
2. Albert G Moat & John W Foster (2004). Microbial Physiology. 4th Edition, John Wiley & Sons, New York.
3. Robert F Boyd (1984). General Microbiology. Times Mirror / Mosby College Publishers.
4. Purohit SS (2005). Microbiology – Fundamentals and Applications. Reprinted & Published by Student Edition, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
5. Pelczar TR, Chan ECS & Kreig NR (2006) Microbiology. 5th Edition, Tata McGraw – Hill, New Delhi.
6.Schlegel, H.G., (1993).General Microbiology, Seventh edition, Cambridge University Press.

Web reference(s):

1.www.periobasics.com/basic-microbiology.
2.www.microbiologynutsandbolts.co.basic-concepts.
3.www.microbiologyinfo.com/category/basic-microbiology

You tube reference(s):

1.www. Microbiology - Overview -youtube.com
2.www. Introduction to microbiology. youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U4RMC4**

COURSE TITLE : Microbial Physiology **QN.NO : 9010**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To study the various physiological phenomena involved within microbes.
- To study different types of extremophilic organisms.

Learning Outcomes:

- The learners acquire knowledge about various physiological activities of the microbes and their survival under extreme atmospheric conditions.
- Students learn the concepts of physiological cycles mainly the importance of gluconeogenesis.

Unit I

Nutritional requirements of microorganisms -autotrophs, heterotrophs, phototrophs and chemotrophs. Energy production- Phosphorylation - types. Structure of ATP and its significance.

Unit II

Metabolism- Types, Aerobic, anaerobic respiration and fermentation. Catabolism – Glycolysis, Kreb cycle and ED pathway. Fermentation – alcoholic and lactic acid .Homo and heterolactic fermentation.

Unit III

Anabolism - Photosynthesis- Classification and properties of prokaryotic photosynthetic microbes. Light reaction of Cyanobacteria, Purple and green bacteria. Dark reaction - C3 cycle and reductive TCA cycle.

Unit IV

Biosynthetic Pathway of Aminoacids – leucine, valine, isoleucine, methionine, lysine. Biosynthesis of Peptidoglycan.

Unit V

Biosynthetic Pathway - Purine and Pyrimidine pathways. Glyoxylate Pathway and Gluconeogenesis and their significance.

Text Book :

1. Moat G, John E. Foster and Michael P.Spector (2002). Microbial physiology. Fourth edition, A John Wiley sons, Inc publication. New Delhi.

Reference Book(s):

1.Dall, D.O and Rao, K.K (1995). "Photosynthesis" –Cambridge University press.

2.Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (1986). "General Microbiology" -Mac Milan Education Ltd. London.

3.Dubey, R.C. and Maheswari, D.K. (2005). A Text book of microbiology. S. Chand & Company Ltd. New Delhi.

4.Sale, A.J (1992). "Fundamentals Principles of Bacteriology", 7th Edition. McGraw Hill Publishing Co. Ltd., New York.
5.Stanier, R.Y., J.L.Ingraham, M.L.Whellis and P.R.Painter, (1986). The Microbial World, Fifth edition, Prentice Hall of India, New Delhi.
6.Sundara Rajan ,S. (2003). Microbial Physiology, Anmol Publication ,NewDelhi

Web reference(s):

1.www.omicsonline.org/microbial-physiology/..
2.www.omicsonline.org/scholarly/microbial..
3. www mib.uga.edu/research/content/microbial-physiology

You tube reference(s):

1. www Microbial Physiology youtube.com.
2. www .Dr. S. R. Dave's lecture on Microbial Physiology and Growth youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U4RSM3**

COURSE TITLE : Biostatistics **QN.NO : 9011**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To train the students to collect, organize and analyze data.
- Learn to apply different statistical tools in presenting biological data.

Learning Outcomes:

- The students obtain analytical knowledge to apply various statistical tools in their higher studies.
- Students have the methods of sampling, collection of data.
- Students know the methods of data presentation.

Unit I

Biostatistics - definitions , types of data, sources of data in life science – Limitations and uses of statistics – collection of data – Primary data – Secondary data – classification of data – Tabulation and presentation of data.

Unit II

Theory of sampling – Introduction, types of sampling- random and non random sampling methods.

Unit III

Measures of central tendency – Mean, Median and Mode – Measures of dispersion – range, quartile deviation, standard deviation.

Unit IV

Data presentation - introduction, presentation of three forms - textual form, tabular form and graphical form. Frequency – types of diagram – bar, pie, histogram and line diagram.

Unit V

Chi square distribution - F and T test. Analysis of Variance - One way and two way classifications.

Text Book :

1.Gurumani, N. (2004). An Introduction to Biostatistics. MJP publishers, Chennai.

Reference Book(s):

1. Arora, P.N and P.K.Malhan (2008). Biostatistics. Himalaya Publications, Mumbai.

2. Daniel, W.W (2006) Biostatistics-A foundation for analysis in health sciences, John Wiley (Asia) & sons, Singapore.

3. Gupta S.P. (1987). Statistical Methods. Sultan Chand & Sons Publishers, New Delhi

4. Sokal, R.R. and Rohif, F.J. (1987). Introduction to Biostatistics. W.H. Freeman and company, New York.

5. Sundar Rao, P.S.S. and Righard, J. (2002). An Introduction to Biostatistics. III edn. Prentice Hall of India, New Delhi.

6.Misra, B.N. and Misra, B. K. (1998). Introductory Practical Biostatistics. Naya Prakash, Calcutta.

Web reference(s):

1.www.researchgate.net/publication/2

2.www.stat.ufl.edu/~winner/sta6934/st4170

3.www.sanfoundry.com/-biostatistics

You tube reference(s):

1. www Biostatistics introduction youtube.com.

2. www Biostatistics SUMMARY STEP 1 - The Basics USMLE youtube.com

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PROGRAMME : UG NME - Microbiology **COURSE CODE : 17U4RNM2**

COURSE TITLE : Microbes in Human Welfare **QN.NO : 9013**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To get a fundamental knowledge about microbial world for other major students.
- To motivate the non microbiology students to appreciate the role and importance of microbes in day today life.

Learning Outcomes:

- This paper gives a basic and elementary aspects of microbiology to non major / non microbiology students.
- Students acquire knowledge on history and development of microbiological world.
- The students have a clear idea about the beneficial and harmful aspects of microbes in a lucid manner.

Unit I

History and scope of Microbiology- Spontaneous generation of organism. Contributions of Louis Pasteur, Robert Koch and Edward Jenner.

Unit II

Role and applications of microorganisms - in food and dairy industries- *Saccharomyces* - *Lactobacillus*, *Agaricus* and *Spirulina* .

Unit III

Role of microbes in Pharma field- Industrial production of Insulin. Antibiotics – industrial production of Penicillin. Immunization- Vaccines, immunization schedule for children, role of vaccines for Small pox, Rabies and Polio.

Unit IV

Role of microbes in Agriculture- Soil microflora, Rhizosphere, organic manure. Biofertilizer - *Blue green algae*. Bioinsecticides – *Bacillus thuringiensis*,.

Unit V

Role of microbes in sewage treatment -Trickling filter, activated sludge, oxidation pond, oxidation ditch. Microbes in the production of biogas. Industrial production of alcohol.

Text Book :

1. Dubey RC and Maheswari DK (2005). A Text book of Microbiology. S.Chand &Company Ltd., New Delhi.

Reference Book(s):

1. Adams, M.R.and Moss. M.O. (1995) .Food Microbiology. New International (P) Ltd. Publishers.

2. Frazies ,W.C. and Westhoff, D.C. (1988) .Food microbiology. 4th Edition. McGraw Hill NY.

3. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons. N.Y.

4. Subba Rao, N.S. (1995) .Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd.

5. Sundara Rajan S (2003). College Microbiology. Volume 1 & 2. Revised Edition, Vardhana Publications, Bangalore.

6. Powar CB and Daginawala HF (2005). General Microbiology, Volume I & II, 8th Edition, Himalaya Publishing House, Mumbai.

Web reference(s):

1.www.periobasics.com/basic-microbiology.

2.www.microbiologynutsandbolts.co.basic-concepts.

3.www.microbiologyinfo.com/category/basic-microbiology

You tube reference(s):

1.www. Microbiology - Overview -youtube.com

2.www. Introduction to microbiology youtube.com

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : B.Sc., **COURSE CODE : 18U2RAC2**

COURSE TITLE : Medical Microbiology **QN.NO : 9015**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To know about morphology and pathogenesis of different bacteria, fungi & parasites.
- To understand the pathogenesis mechanism.
- To learn the technique of prevention, control and therapy.

Learning Outcomes:

- This field emphasize in response to dreadful disease such as Cholera, Typhoid, Tuberculosis, Pneumonia, Smallpox.
- This paper helps the students to classify various types of diseases i.e., bacterial, fungal, protozoan, viral etc.
- Students able to know the method of transmission, prevention and control of diseases.

Unit – I Micro flora of human body

General features of normal flora. Microflora of human body, germ theory of diseases, Contribution of Robert Koch and his postulates and Edward Jenner. Non specific defense mechanisms- general factors- physical, mechanical and chemical barriers.

Unit – II Bacterial disease

Morphology, Culture, biochemical, pathogenicity, Lab diagnosis and prevention of bacterial diseases – *Staphylococcus aureus, Streptococcus pyogenes, Salmonella typhi, Vibrio cholera* and *Escherichia coli.*

Unit – III Fungal disease

Superficial Mycosis – black and white piedra, Cutaneous mycosis – Trichophyton, Subcutaneous mycosis – sporothrix, Systemic mycosis – Histoplasmosis, Opportunistic mycosis-Aspergillosis, Candidiasis.

Unit – IV Parasitology

Life cycle of *Entamoeba histolytica, Giardia intestinalis, Plasmodium vivax, Toxoplasma gondii, & Wuchereria bancrofti.*

Unit - V Viral Disease

DNA viruses – Pox, Adeno, Herpes, Hepatitis. RNA viruses – Picorna, Rhabdo, Retero, Orthomyxo .

Text Book :

1.Ananthanarayan R & Jayaram Paniker CK (2005). Text Book of Microbiology. 7th Edition, Orient Longman Private Limited.

Reference Book(s):

1.Baron EJ, Peterson LR and Finegold SM (1994). Bailey and Scott's – Diagnostic Microbiology. 9th Edition, Mosby Publications.

2. Morag C 7 MC Timbury (1994). Medical virology. 10th Edition, Churchill Livingstone, London.

3. Patric R Murray (1990). Medical Microbiology. Mosby Publications.

4. Satish Gupte (2006). The Short Text books of Medical Microbiology. 9th Edition, Jaype Brothers, Medical Publishers (P) Ltd., New Delhi.

5.Chakraborty P. (1995). A Text Book of Microbiology, New Central Book Agency (P) Ltd., Kolkata.

6.Rajan, S. (2009). Medical Microbiology, MJP Publishers, Chennai.

Web reference(s):

1.www.microbiologynutsandbolts.co.uk/medical-students.html

2.www.takealot.com/lecture-notes-medical-microbiology-

3.www.microbiologybytes.wordpress.com/.../instant-notes-in-medical-microbiology

You tube reference(s):

1.www. Introduction to Medical Microbiology - youtube.com

2.www. Staphylococcus - Medical Microbiology- youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U5RME1**

COURSE TITLE : Microbial Genetics **QN.NO : 9017**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To learn the fundamentals of Microbial genetics.
- To expose the students to the structure and functions of genetic material and gene transfer methods.

Learning Outcomes:

- Enables the students to understand the relevance of microbial genetics with day today life.
- Students gathered the information regarding the structure and chemistry of genetic molecule.
- They learn the types and functions of various forms of DNA and RNA.
- Students can understand the gene transfer mechanisms and gene regulation.

Unit I

Cell cycle –G_1 phase, S phase (synthesis), G_2 phase (interphase), mitosis, amitosis and meiosis - significance.

Unit II

DNA - structure, types and chemical composition , replication- semiconservative- Meselson stahl experiment. Replication of double strand DNA, synthesis of Okazaki fragment and enzymes involved. RNA – types and significance.

Unit III

Translation in prokaryotes- Genetic Code, wobble hypothesis, Ribosome. tRNA, Initiation, Elongation and Termination of polypeptide biosynthesis. Post transcriptional and post translational modifications of proteins.

Unit IV

Prokaryotic gene transfer mechanism - Bacterial conjugation –F Factor, Hfr Transfer. Gene mapping. Bacterial Transformation- *E.coli* Transduction- Generalized and specialized transduction.

Unit V

Gene Regulation – introduction, Operon concept , types – positive and negative regulations, Lac operon and Trp operon concept.

Text Book :

1.David Frifielder (2005). Molecular Biology. 2nd Edition. Narosa Publishers, New Delhi.

Reference Book(s):

1.Maloy, S.R. Cronan Jr. J.E, Freifelder D (1994), Microbial genetics. Jones and Barlett publishers.

2.Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.

3.Lodish, H. Baltimore Daerk . A. Zipsury, S.L. Marsudaisa. P. Darnel. J. (1995). Molecular cell biology.

4.Gardner- Simon Snustad. (2008). Principles of genetics, 8th Edition. John Wiley & sons. Inc. New York.

5.Hayes.W. (1968). Genetics of Bacteria and their viruses, Black Well Publication, London.

6. Allison, L.A., (2007). Fundamental Molecular Biology, Blackwell Publishing, USA.

Web reference(s):

1.www.omicsonline.org/scholarly/microbial-genetics.

2.www.lamission.edu/lifesciences/Steven/Micro20

3.www.indiabix.com Microbiology

You tube reference(s):

1. www Microbial Genetics youtube.com

2. www Microbial Genetics Part 2 youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U5RMC5**

COURSE TITLE : Environmental Microbiology **QN.NO : 9018**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To understand the role of microbes in different spheres of life.
- Make them to learn analytical techniques of Quality control sector in microbiological industry.

Learning Outcomes:

- Students acquire the concept of omnipotence of microorganisms.
- Students will be able to know the role and interaction of microbes in biogeochemical cycle.
- They are able to analyze the role of microbes in the air and their sampling.
- They will know the various biochemical characteristics and treatment of sewage.

Unit I

Introduction to soil Microbiology – Types and significance of soil microbes – Bacteria, fungi, actinomycetes and algae . Factors affecting microbial population.

Unit II

Biochemical cycle – carbon, phosphorus, nitrogen – Biological nitrogen fixation. Biofertilizer – *Rhizobium* and *Azotobacter*, Cyanobacteria – Mass multiplication.

Unit III

Microbial interaction – neutralism, comensalism, synergism, mutualism, ammensalism, competition, parasitism and predation. Interaction of microbes with plants – Rhizosphere.

Unit IV

Microbiology of air – Aeromicrobial pathways – Enumeration of bacteria from air – Air sampling devices – Air sanitation. Microbiology of water- Potability of water quality – Indicator organisms – Water purification – Waterborne diseases – Typhoid and Amoebic dysentery and their control measures.

Unit V

Microbiology of sewage – chemical and biochemical characteristics of sewage. Sewage treatment – physical, chemical and biological treatment -trickling filter, activated sludge and oxidation pond.

Text Book :

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

Reference Book(s):

1. Rangasami G & Bagyaraj D.J(1993). Agricultural Microbiology , Prentice-Hall publications.

2. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons. N.Y.

3. Subba Rao, N.S. (1995) .Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd.

4. Prescott L.M, Harley J.P. & Klein D.A.,(2006). Microbiology , McGraw Hill Publishers.

5. Madigan M.T., Martinko J.M. & Brock P.J.(1997). Biology of Microorganisms , Prentice-Hall Inc.

6. Kanika Sharma, (2011). Textbook of Microbiology – Tools and Techniques. 1st Edition, Ane Books Pvt. Ltd., New Delhi.

Web reference(s):

1.www.highveld.com/microbiology/environmental-microbiology.

2.www.sfam.org.uk/en/journals/environmental-microbiology.cfm

3.www.sciencedirect.com/science

You tube reference(s):

1.www.Environmental Microbiology youtube.com

2.www .BI280 Chapter 26 Environmental Microbiology - Part 1 of 2youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U5RMC6**

COURSE TITLE : Medical Microbiology **QN.NO : 9019**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

To recognize the significance of immune system and vaccines for maintaining human health.

To understand the pathogenesis mechanism of different pathogens.

Learning Outcomes:

- Students acquire various basic concepts of medical microbiology.
- The paper presents an overview of the organization and function of clinical microbiology laboratory
- The students have analyzed the mechanism of pathogenicity and vaccines.

Unit I

History of Immunology – Host-parasite relationship – Immunity – Innate and acquired immunity – Humoral and Cell-mediated immunity.

Unit II

Cells and organs of immune system - Structure and functions of Cells and organs involved in immune system. Primary and secondary lymphoid organs. Antigens – Types, properties – Immunoglobulins – Structure, types and properties . Monoclonal antibodies – production and applications.

Unit III

Antigen – Antibody reactions – Agglutination – Precipitation – Complement fixation – Immunofluorescence – ELISA-RIA. Hypersensitivity reactions – Type I and Type II.

Unit IV

Mechanism of microbial Pathogenicity -Morphology, cultural characteristics, biochemical, pathogenicity, lab diagnosis and prevention of bacterial diseases - *Mycobacterium tuberculosis, Salmonella typhi* and *Escherichia coli.* Viral diseases- *Pox, Herpes, Hepatitis* and *HIV.* Fungal diseases -systemic mycoses- Histoplasmosis. Protozoan diseases- *Plasmodium.*

Unit V

Vaccines – Historical background, types of vaccine- live , inactivated vaccines , recombinant vaccines and edible vaccines . Immunization schedule for infants, children and teens.

Text Book :

1.Ananthanarayanan R. and Jayaram Panicker C.K. (1994). Text book of Microbiology. Orient Longman.

Reference Book(s):

1.Baron, E.J. and Finegold S.M. (1995). Scientific Company. Diagnostic Microbiology. Blackwell Scientific Company.

2.Salle, A.J. (1992). Fundamental Principles of Bacteriology. 7th Edition, Mc. Graw Hill Publishing Co. Ltd., New York.

3.Rajesh Bhatia & Rattan Lal Ichhpujani (2004). Essentials of Medical Microbiology. 3rd Edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi

4.Roitt, I.M (1998) Essential Immunology Blackwell Scientific Publishers.

5.Kuby, J. (1994). Immunology, 2nd edition, W.H. Freeman and Company. New York.

6.Rajan, S. 2009. Medical Microbiology, MJP Publishers, Chennai.

Web reference(s):

1.www.immunology.org/.

2.www.omicsonline.org/clinical-cellular-immunology.php

3.www.omicsonline.org/medical-microbiology

You tube reference(s):

1.www immunology 101: The Basics and Introduction to our Patient- youtube.com

2.www .immunology and medical microbiology Lecture Mini. youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U5RMC7**

COURSE TITLE : Bioinformatics **QN.NO : 9020**

TIME : 3 Hours **MAX.MARKS :75**

Course Objective

- Learn "from sequence to structure prediction" –concept.
- To familiarize students in applying bioinformatic tools in biomedical research.

Learning Outcomes:

- Students acquire knowledge on computers and various programmes.
- Students have collection of biological database and know how to use it.
- Students get familiarize with sequence analysis and information retrieval systems.

Unit I

Introduction to Computers - Characteristics and Classification of Computers – Input and Output Devices, Storage devices. Operating system : MS,DOS & Windows . Intranet , Internet, World Wide Web, Browsers, Search Engines – Google, Yahoo. Information access, LAN, WAN.

Unit II

Introduction to Bioinformatics- History and scope of Bioinformatics. Bioinformatics in India- the flourishing future.. General Introduction of Biological data bases- Nucleic acid databases -Gen Bank, DDBJ and EMBL.

Unit III

Biological Sequence Databases- Protein data bases- eg. SWISS PROT, primary, composite and secondary. Applications of Bioinformatics

Unit IV

Sequence analysis- Sequence alignment, pairwise and multiple sequence alignment, local and global alignment, BLAST, FASTA.

Unit V

Information retrieval systems- Medline, NCBI, Pubmed, OMIM. Genomics and proteomics (Basic concepts), Data mining, ENTREZ and SRS.

Text Book :

1.Ignacimuthu, S.J., (2001). Basic bioinformatics, Phoenix Publishing House Pvt., Ltd., New Delhi.

Reference Book(s):

1. Murthy, C.S.V, (2003).Bioinformatics, Himalaya publishing house.

2. Rastogi, S.C Mendiratta,N and Rastogi,P(2003). Bioinformatics – Concepts, Skills & Applications, CBS Publishers & Distributors.

3. Arthur M. Lesk,(2003). Introduction to Bioinformatics, Oxford University Press, New Delhi.

4. Higgins,D and Taylor, W (Eds), (2000)Bioinformatics- Sequence, structure and databanks, Oxford University Press, New Delhi .
5. Attwood, T.K and Parry-Smith, D.J (2004)Introduction to Bioinformatics, Pearson Education Ltd., New Delhi.
6 Lesk, M.A. (2008). Introduction to Bioinformatics. Oxford Univ. Publishers Ltd., New Delhi.

Web reference(s):

1.www.bioinformatics.org/wiki/...to_Bioinformatics.
2.www.goodreads.com/shelf/show/bioinformatics.
3.www.biostars.org/

You tube reference(s):

1.Introduction to Bioinformatics - Week 1 - Lecture 1 youtube.com
2.Bioinformatics part 3 Sequence alignment introduction youtube.com

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PROGRAMME : B.Sc., **COURSE CODE : 17U5RAC3**

COURSE TITLE : Applied Microbiology **QN.NO : 9021**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To learn the role of microbes in food preparation, preservation, spoilage and control.
- To learn the process involved in the industrial production of microbial products.

Learning Outcomes:

- Students know the applications of microbes in various fields i.e., microbes in food industry and they have gathered more information regarding prevention of food borne disease.
- Students familiarize with prevention and control of food spoilage.
- Students get information regarding biofertilizers and their significance.

Unit I

Microorganisms in food –Food preservation – Principles, Asepsis-anaerobic condition, high temperature, low temperature & drying, Food additives, Canning.

Unit II

Fermented foods – Dairy products –(Cheese, Bread) Vegetable –Sauerkraut. Food borne disease – Bacterial disease -*Bacillus, Clostridium* and fungal disease- *Candida* and *Aspergillus*.

Unit III

Contamination & spoilage – Meat & meat products, milk & milk products. Spoilage of canned foods. Detection of spoilage, Characterization, prevention and control.

Unit IV

Biofertilizer –Introduction and significance- Bacterial biofertilizer - *Rhizobium* – Algal biofertilizer- *Azolla* - *Cyanobacteria* and its Mass multiplication.

Unit V

Microbial production - Organic acid – (Citric acid), Antibiotics – (Penicillin), Enzyme – (α amylase), Alcohol- (Wine).

Text Book :

1.Pelczar, M.J., E.C.S. Chan and N.R. Kreig. (2009). Microbiology, fifth edition. McGrawHill. Book Co. Singapore

Reference Book(s):

1. Adams MR & MO Moss (2005). Food Microbiology. 1st Edition. Reprinted, Published by New Age International (P) Limited. Publishers, New Delhi.

2. James M Jay (2004). Modern Food Microbiology. 4th Edition, CBS Publishers & Distributors, New Delhi.

3.Singh DP & SK Dwivedi (2005). Environmental Microbiology and Biotechnology. 1st Edition, New Age International (P) Ltd., Publishers, New Delhi.

4.Vijaya Ramesh K (2004). Environmental Microbiology. 1st Edition, MJP Publishers (A Unit of Tamil Nadu Book House) Chennai.

5. Patel A.H . (1996). Industrial microbiology .2nd edition ,Macillan India Ltd.

6. Kulshreshtha, S.K. 1994, Food Preservation, Vikas Publishing House Pvt. Ltd.,New Delhi

Web reference(s):

1.www.highveld.com/microbiology

2.www.sciencedirect.com/food-microbiology

3.www.omicsonline.org/scholarly/food-microbiology.

You tube reference(s):

1.www.Food Microbiology youtube.com

2.www. introduction to food microbiology-youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 18U3RSA1/ 17U5RSA2**

COURSE TITLE : Mushroom Cultivation **QN.NO : 9022**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To acquire the basic knowledge and develop suitable skills involved in mushroom cultivation.
- To study the common cultivation methods for mushrooms and to realize the nutritive and medicinal value of mushrooms.

Learning Outcomes:

- This paper aims to develop students to acquire skills in mushroom cultivation.
- Students are able to develop their mushroom cultivation farm as a self employment.
- Students learn to differentiate edible from poisonous mushroom.
- Students acquire knowledge on storage, marketing of mushroom and trained themselves to prepare various mushroom recipes.
- This paper mainly makes the students to acquire self employment.

Unit I

Introduction- History- Scope and importance of mushroom cultivation. Present status of mushroom industry in India.

Unit II

Breeding conditions of mushroom strains -Pure Culture- Media- Preparation and maintenance of mother culture in test tube slants -Petriplates- saline bottle - poly propylene bags.

Unit III

Cultivation Technology - Infrastructure - culture rack - thatched house - substrates - vessels- inoculation methods. Mushroom bed preparation. Mother spawn and commercial spawn preparation- types , methods of storage. Preservation technology- long term storage - short term storage.

Unit IV

Cultivation and importance of edible mushroom in India. *Pleurotus species & Volvariella species* . Mushroom contamination - disease caused by viruses and fungi. Poisonous Mushrooms.

Unit V

Significance and applications - Nutritional and Medicinal values of Mushroom - protein - carbohydrates - vitamins - minerals - fibre content. Preparation of mushroom recipes – Pickles and soup.

P.T.O.

Text Book :

1.Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.

Reference Books(s):

1.Aneja, K.R. (1993). Experiments in Microbiology, Plant pathology, Tissue culture and mushroom cultivation, Wishwa Prakashan, New Age International (P) Ltd., New Delhi.
2.Chang,S. and Miles, P.G. (2004). Mushrooms: Cultivation, Nutritional Value, Medicinal Effect, and Environmental Impact, CRC Press online.
3. Swaminathan, M. (1990) .Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore.
4.Nita Bahl. (1996). Hand Book on Mushrooms. Oxford and IBH Publishing Company Ltd., New Delhi. 2.
5. Kapoor, J.N. (1989). Mushroom Cultivation, ICAR, New Delhi.
6.Banwari George, J. (1998). Basic food microbiology, 2nd Edition. CBS publishers and distributors, New Delhi.

Web reference(s):

1.www.mushroomcouncil.com/...mushrooms/six-steps-to-mushroom-farming
2.www.krishisewa.com/articles/.../46-technology-for-mushroom-cultivation.
3.www.indiamart.com › Vocational Education and Training

You tube reference(s):

1.www. Mushroom Production Technology -youtube.com
2.www. .mushroom cultivation- youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U6RME2**

COURSE TITLE : Food Microbiology **QN.NO : 9023**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives :

- To learn the role of microbes in food preparation, preservation and spoilage
- To understand the quality of food and dairy products.

Learning Outcomes:

- Students understand the role of microbes in food microbiology.
- They get adequate information regarding food preservation and food spoilage.
- Students have gathered information regarding dairy technology.
- Students are able to classify the food borne diseases and food sanitation.

Unit I

Food as a substrate for microbes – Microbes involved in food microbiology – Mould, Yeast, Bacteria – Factors affecting the growth of Microorganisms in food.

Unit II

Food preservation – Asepsis – Removal of microorganisms, anaerobic conditions – high and low temperatures – drying – radiation – chemical preservatives – food additives.

Unit III

Food spoilage – General principles – underlying food spoilage and contamination – Cereals, vegetables, fruits, and poultry products, meat, fish and sea foods.

Unit IV

Microorganisms in milk and milk products – Yoghurt, butter milk, butter and cheese – Quality control of Milk – Methylene blue reductase test , Standard plate count and Phosphatase tests.

Unit V

Food-borne diseases – Food poisoning – infective and toxic bacterial food borne diseases- *Staphylococcus aureus* -Staphylococcal food poisoning , *Clostridium botulinum* - Botulism and their diagnosis – Food sanitation and its control measures eg Hazard analysis & critical control points (HACCP).

P.T.O.

Text Book :

1. Frazier WC and Westhoff DC (1988). Food Microbiology, 4th Edition, Mc Graw Hill, New York.

Reference Book(s):

1.Garbutt,J., (1997). Essentials of Food Microbiology, Arnold-International Students' edition, London.
2.Atlas,R.M., (1997). Principles of Microbiology, Second edition, WCB/McGraw Hill, U.S.A.,
3.Deak, T, and L.R.Beuchat, (1996). Hand Book of Food Spoilage Yeasts, CRC Press, New York.
4.Adams MR & MO Moss (2005). Food Microbiology. 1st Edition. Reprinted, Published by New Age International (P) Limited. Publishers, New Delhi
5.James M Jay (2004). Modern Food Microbiology. 4th Edition, CBS Publishers & Distributors, New Delhi.
6.Banwart,G.J., (1987). Basic Food Microbiology, CBS Publishers & Distributors, New Delhi.

Web reference(s):

1.www.highveld.com/microbiology
2.www.sciencedirect.com/food-microbiology
3.www.omicsonline.org/scholarly/food-microbiology.

You tube reference(s):

1.www.Food Microbiology youtube.com
2.www. introduction to food microbiology-youtube.com

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U6RME3**

COURSE TITLE : Biotechnology **QN.NO : 9024**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- To introduce the basic principles of genetic engineering.
- To learn various methods of gene transfer and manipulation.

Learning Outcomes:

- Students are able to trace the development of biotechnological field.
- They are able to classify the plasmids.
- Students gain knowledge about GATT, IPR and patenting of biological material.
- They get information regarding transgenic plants and animals.

Unit I - History and Scope of Biotechnology

Biotechnological organizations in India. Significance, types of cloning vectors. Plasmids - pBR322, pUC18, Ti plasmids , Lamba phage, cosmids & their applications.

Unit II - Gene manipulation techniques

Restriction enzymes - Types & properties -*E*coRI, *Hind*III, *Alu*I, *Sca*I . DNA ligation-methods of gene transfer- gene gun method, electroporation and microinjection methods . Ti plasmids- *Agrobacterium* mediated gene transfer.

Unit III -Microbial production of recombinant protein

Expression vectors–Constitutive and inducible promoters - Production of recombinant DNA proteins using microbial hosts – Production of Insulin.

Unit IV - Intellectual property rights

GATT & IPR, different forms of IPR, IPR in India, patent co operation treaty, forms of patent, process of patenting, patenting of biological material – A case study of turmeric and basmati rice.

Unit V – Applications of Biotechnology

Transgenic plant- Bt cotton, Bt brinjal,Basmati rice. Transgenic animals- Dolly, Mice, Fishes. Biosafety aspects.

Text Book :

1.Gupta, P.K., (2004). Biotechnology and Genomics, Rastogi & Co., Meerut

Reference Book(s):

1.Winnacker E.L.(1987). From Genes to Clones: Introduction to Gene Technology, VCH Publications, Germany.
2.Glick B.R. & Pasternak, J.J., (2006).Molecular Biotechnology- Principles and Applications of Recombinant DNA technology, ASM press, Washington.
3.Ratledge C & Kristiansen B.,(2008). Basic Biotechnology 3/e, Cambridge University Press.
4.Old, R.W. and S.B. Primrose, (2003). Principles of Gene Manipulation, Blackwell Scientific, London.
5.Mitra S., (2001). Genetic Engineering, Macmillan, India Limited, New Delhi.
6.Satyanarayana V. (2010). Biotechnology, Books and Allied (P) Ltd. Kolkata, India

Web reference(s):

1.www.bio.org/what-biotechnology
2.www.nature.com › subjects
3.www.khanacademy.org/science/biology/biotech-dna-technology

You tube reference(s):

1.www. Applications of Biotechnology -youtube.com/watch
2.www. Introduction to Biotechnology youtube.com/watch

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PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U6RMC8**

COURSE TITLE : Pharmaceutical & Forensic Microbiology **QN.NO : 9025**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

- Students achieve a detailed knowledge and understanding of the sciences underpinning the forensic, pharmaceutical and analytical fields.
- Experience in pharmaceutical and forensic science combined with a range of analytical techniques.

Learning Outcomes:

- After completing the students get placement in Pharma industry and in forensic department.
- They obtain information regarding discovery and designing of drugs.
- They are able to identify microbial contamination of drugs.
- Students will gather information regarding the role of microbes in forensic study and gather various case study.
- They get information regarding bioterrorism i.e., biological warfare.

Unit I

Aim and Scope of Microbial Pharmacology- Definitions, Pharmacology, Pharmocognosy, Pharmacodynamic and Pharmacogenomics. Microbial drugs and edible vaccines. Biopharmaceuticals- source, production methods, cytokines, haemopoetic growth factors, hormones and therapeutic enzymes.

Unit II

Drug discovery and developments – Role of molecular recognition in drug design, enzymes and receptors as drug targets, pro drug design and applications.

Unit III

Microbial contamination of drugs - preventive measures and practices. Concepts of quality control in Biopharmaceuticals, testing the quality of drug, validation and certification of drugs- ISO, WHO and USFDA.

Unit IV

Microbes in forensic –Principles, characteristics, opportunities and challenges. Guidelines to legal proceeding of forensic biology and sub-disciplines. Microbial ethics, superbug- strain escape, case studies and examples.

Unit V

Bioterrorism- biological warfare, Biocrime, Bioweapons, new disease outbreak, national and international dimensions, diagnostic methods, sampling methods, sample preservations and analysis. Tools for forensic microbiology. Scientific working group in forensic microbiology.

Text Book :

1. Parikh C. K. (1999). Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology. Sixth Ed., CBS Publishers & Distributors Pvt. Ltd., India.

Reference Book(s):

1. Hugo, W.B., Russell, A.D,(1999). Pharmaceutical Microbiology 4th edition. Blackwell scientific publications / Oxford.
2. Russell and Ayliffe, G.A.J(1982) Principles and practice of Disinfection, preservation and sterilization Oxford:
3. Ashutosh Kar, (2008).Pharmaceutical Microbiology, New Age International Publishers, New Delhi.
4. Microbiology in Pharmaceutical Manufacturing – II edition – Richard Prince.
5. The United States Pharmacopoeia (USP 32) NF 27 – Volume 1 (General Chapters)
6. Nanda, B.B. and Tewari, R.K. (2001): Forensic Science in India: A vision for the twenty first century Select Publisher, New Delhi.

Web reference(s):

1.www.pharmacy.umich.edu/pharmsci
2.www.scientiaricerca.com/cops.php
3.www.crimesceneinvestigatoredu.org/what-is-forensic-science/

You tube reference(s):

1.www. The Real Science of Forensics - YouTube.com
2.www. The Pharmaceutical world - youtube.com

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : B.Sc., Microbiology **COURSE CODE : 17U6RSM4**

COURSE TITLE : Fermentation Technology **QN.NO : 9028**

TIME : 3 Hours **MAX.MARKS :75**

Course objectives:

- To learn the process involved in the industrial production of microbial products
- To learn processing and recovery of the product.

Learning Outcomes:

- Students understand the concepts of fermentation and role of microbes.
- They get idea regarding media formulation and fermentors.
- Students acquire knowledge on industrial production of various products like Wine , Citric acid, Penicillin, Vitamin B12 and α amylase.
- Students can develop small scale industries with self employment.

Unit I

Industrially important microorganisms – screening techniques – primary and secondary. Preservation of cultures – Strain improvement .

Unit II

Aerobic respiration-sulphur, nitrogenous compounds and CO_2 as a final electron acceptor. Fermentation – Alcoholic fermentation.

Unit III

Media for industrial fermentation – Submerged and solid state fermentation – Down stream processing – Recovery and purification of intracellular and extracellular products

Unit IV

Fermentors –Components of fermentor – Types of bioreactors – Heat production – heat transfer – Oxygen transfer – Stirring and mixing – Scale up – control of temperature – p^H , Foam pressure – computer applications in fermentation technology.

Unit V

Industrial production methods - wine, organic acids – citric acid, Antibiotics – penicillin, vitamin – B12, Enzyme - α amylase.

P.T.O.

Text Book :

1. Patel, A.H., (1996). Text Book of Industrial Microbiology, MacMillan India Ltd., New Delhi

Reference Book(s):

1. Atlas, R.M., (2000). Microbiology Fundamentals and Applications, MacMillan Pub. Co., New York.
2. Crueger, W. and Crueger, A. (2000). Biotechnology: A Test Book of Industrial Microbiology, Second Edition, Panima Publishing corporation, New Delhi.
3. Demain A.L. and Davies, J.E. (1999). Manual of Industrial Microbiology & Biotechnology. ASM press.
4.Kalaichelvan, P.T. and Arul Pandi, I. (2007). Bioprocess Technology, MJP publishers, Chennai.
5.Casida, J.F. (2010). Industrial Microbiology, New Age International India Pvt. Ltd., New Delhi.
6.Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G. (2001). Industrial Microbiology: An Introduction, Blackwell Science, London.

Web reference(s):

1.www.sciencedirect.com/topics/agricultural-and.../industrial-microbiology
2.www.contentextra.com/lifesciences/unit2/unit2home.aspx
3.www.crcpress.com/Modern-Industrial-Microbiology

You tube reference(s):

1.www. Industrial Microbiology introduction youtube.com
2.www. Industrial Microbiology youtube.com

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DEPARTMENT OF MICROBIOLOGY				*CLASS: I B.Sc. Microbiology*		
Semester	**Course Type**	**Course Code**	**Course Title**	**Time**	**Maximum**	**Question Number**
I	**Major Core**	**20U1RMC1**	**General Microbiology**	**3 hrs**	**75 marks**	**11401**

Course Objectives:

1. To understand history of microbiology towards modern microbiology
2. To understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes
3. To know the pathogenesis and treatment for different microbial diseases
4. To gain knowledge about the structure of bacteria, fungi, algae, protozoa and viruses
5. To know about different classes of antibiotics and their mode of actions, treatment strategies and detection of resistant forms of bacteria from clinical settings.

Unit-I: History and Scope of Microbiology

Biogenesis and Abiogenesis, Spontaneous generation, Germ theory of diseases, Contribution of Redi, Spallanzani, Needham, Louis Pasteur, Tyndal, Leewenhoek, Joseph Lister, Robert Koch, Edward Jenner, Winogradsky, Flemming, William Beijernick, Emil Christian Hansen, Elie Metchinikoff and Kary Mullis. Scope and applications of Microbiology.

Unit-II: Microbial Diversity and Extremophiles

Prokaryotes, Eukaryotes and their differences. Archaebacteria and Eubacteria, Mycoplasma with examples. Acidophiles, AlkalophilesNeutrophiles, Psychrophiles, Mesophiles, Thermophiles, Aerobes and Anaerobes, Halophiles, Osmophiles, Barophiles with examples and their adaptations.

Unit-III: Morphology and fine Structure of Bacteria

Bacterial cell size, shape, arrangement – gram positive , negative cell wall , glycocalyx, capsule, flagella, fimbriae, pili, cell membrane, cytoplasm, growth curve. Endospore: structure, formation, stages of sporulation. Ultra structure and significance of *Pseudomonas putida,* and *Bacillus subtilis.*

Unit-IV: Ultra Structure and Significance of different Microbes

General characteristics of Fungi, Algae, Protozoa and Viruses. Ultra structure and significance of *Saccharomyces* sp. And *Penicillium* sp., *Spirulina*, *Chlamydomonas*, *Amoeba*, *Plasmodium*, HIV and T4 bacteriophage and λ (Lambda) phage.

Unit-V:Antimicrobial Agents

General characteristics of antimicrobial agents-antiseptics, disinfectants. Antibiotics-mechanism of action of beta lactum and aminoglycosides-. Antiviral, antiparasitic, antifungal agents with examples. Antibiotic sensitivity test-Kirby Bauer test and Minimum Inhibitory Concentration test.

Contd.,

Books for Study

1. Michael J Pelczar, JR. E.C.S Chan, Noel R. Krieg;(1998). Microbiology, Tata McGraw-Hill publication, New Delhi.
2. Dubey, R.C& Maheshwari, D.K, (1999). A Text book of Microbiology, S. Chand & Company, New Delhi.

Books for Reference

1. Prescott, Harley and Klein's Microbiology (2008), Mac Graw Hill Higher Education, New York.
2. Jacquelyn G.Black, (2008), Microbiology Principles and Explorations, JohnWiley& Sons Ltd, New York.
3. Rajeshwar Reddy, K. (2009). General Microbiology, New Age Publishers, New York.
4. Sharma P, (1986). Algae – Series on diversity of Microbes, Tata McGraw Hill Education Private Limited, New Delhi.
5. Madigan, Martinko, Dunlap, (2010). Brock Biology of Microorganisms; Pearson Publication, New York.

Web Resources

1. https://www.periobasics.com/basic-microbiology.
2. https://www.microbiologynutsandbolts.co.basic-concepts.
3. https://www.microbiologyinfo.com/category/basic-microbiology
4. https://www.microbiology -overview-youtube.com
5. https://www.introduction to microbiology. youtube.com

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Contd.,

Course Learning Outcomes (CLO):

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Outline the contribution of different scientists in the development of microbiology.	Up to K3
CLO2	Define the basic concept in the field of microbiology	Up to K3
CLO3	Predict the different physiological adaptations during sporulation	Up to K3
CLO4	Interpret the structure & reproduction of bacteria , fungi, algae, protozoa	Up to K2
CLO5	Specify general characters and determine mode of action of various antimicrobial agents	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	2	1	2	1	3	1	2
CLO2	1	1	1	2	2	1	1
CLO3	1	2	1	1	3	1	1
CLO4	2	2	1	1	2	3	1
CLO5	1	1	2	3	2	1	2

Advance application–3; Intermediate level –2; Basic level –1

Mapping of Course Outcome with Programme Outcome:

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	2	1	1	1	1
CLO3	2	2	1	1	1
CLO4	2	2	1	2	2
CLO5	3	2	2	2	2

Advance application–3; Intermediate level –2; Basic level –1

Contd.,

Learning Outcome Based Education & Assessment (LOBE)
Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**58%**
K2	5	6	20	20	**51**	42.5	
K3	-	-	10	20	**30**	25	**25%**
K4	-	-	10	10	**20**	16.67	**17%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

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DEPARTMENT OF MICROBIOLOGY				*CLASS: I B.Sc. Microbiology*		
Semester	**Course Type**	**Course Code**	**Course Title**	**Time**	**Maximum**	**Question number**
I	**Major Core**	**20U1RMC2**	**Basic Techniques In Microbiology**	**3 hrs**	**75 marks**	**11402**

Course Objectives:

1. To learn the basic principles and techniques involved in microbiology and related disciplines
2. To demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures
3. To know various Culture media and their applications and also understand various physical and chemical means of sterilization and cultivation of microbes
4. To know microbial culture media and pure culture techniques for aerobic and anaerobic cultivation methods for bacteria
5. To gain knowledge on principle and working of various laboratory equipments and can able to use them with theoretical knowledge

Unit-I: Bacteriological Techniques

Microscopy-working mechanism and applications of Light microscope, Bright field, Dark field, Phase Contrast, Fluorescent, Electron microscope (TEM and SEM). Confocal microscope. Staining techniques - Smear preparation, Simple staining, Gram's staining, Acid fast staining, Spore staining, Capsule staining and Metachromatic granule staining.

Unit-II: Sterilization and Disinfection

Sepsis, asepsis and contamination. Sterilization - principle and methods – moist heat, dry heat, filtration, radiation, pasteurization, tyndallization, ultrasonication and disinfection. Phenol co-efficient test.

Unit-III: Microbial Culture Media and Cultivation of Microbes

Culture media definition and types - basal, complex, enriched, enrichment, selective, indicator, differential, sugar and transport media. Pure culture techniques- Streak plate, Pour plate, Spread plate. Colony morphology of bacteria and fungi. Cultivation of bacteria, fungi algae and viruses.

Unit-IV: Microbial Growth

Methods of culturing anaerobes – Prereduced media and anaerobic jar. Measurement of microbial growth - cell number and cell mass. Batch culture, continuous culture, diauxic growth and synchronous culture. Factors affecting growth of microorganisms.

Contd.,

Unit-V: Instrumentation

Principle, working mechanism and applications of pH meter, Colorimeter, Ultra centrifuge-Chromatographic techniques – Paper, TLC and Column chromatography, Agarose gel Electrophoresis, UV Spectroscopy, Blotting techniques– Southern blotting, PCR.

Books for Study

1. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). Microbiology- 5th Edition, Mc Graw Hill Inc. New York.
2. Dubey, R.C. and Maheswari, D.K. (2010). A Text Book of Microbiology. 3rd edition, S. Chand, New Delhi.
3. Veerakumari, L. (2009). Bioinstrumentation. MJP Publishers, Chennai.
4. Palanivel, P. (2000). Laboratory manual for analytical biochemistry and separation techniques, Twenty first Century Publications, Chennai.

Books for Reference

1. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/Benjamin Cummings, New York.
2. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education limited, New York.
3. Desai, JD. and Desai, AJ. (1995). Methods in Microbiology Microscopy and Staining, Emkay Publications, New Delhi.
4. Bensen, JR.(1996). Microbiological Applications: A Lab Manual in General Microbiology, Sixth Edition, WMC Brown Publication, U.S.A.
5. Gunasekaran, P. (2008). Laboratory Manual in Microbiology, New Age International (P) Ltd. Publishers, New Delhi.
6. Jeyaraman, J. (1985) Lab. Manual in Biochemistry, Wiley Eastern Ltd, New Delhi.

Web Resources

1. https://www.periobasics.com/basic-microbiology.
2. https://www.microbiologynutsandbolts.co.basic-concepts.
3. https://www.microbiologyinfo.com/category/basic-microbiology
4. https://www. Microbiology - Overview -youtube.com
5. https://www. Introduction to microbiology. youtube.com

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Contd.,

Course Learning Outcomes (CLO):

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Explain the principles and types of microscopes and staining techniques	Up to K2
CLO2	Elaborate various physical and chemical means of sterilization	Up to K2
CLO3	Prepare various culture media and microbial techniques for isolation of pure cultures of microorganisms	K1, K3
CLO4	Determine the different growth phases, growth kinetics and physiological adaptations of bacteria	Up to K3
CLO5	Categorize the principles and applications of the various instruments used in biology	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course LearningOutcome with Programme Specific Outcome:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	1	2	2	1	3	1	2
CLO2	1	1	1	2	2	1	1
CLO3	2	1	1	1	3	1	1
CLO4	2	2	1	1	2	3	1
CLO5	1	1	2	3	2	1	2

Advance application–3; Intermediate level –2; Basic level –1

Mapping of Course Outcome with Programme Outcome:

	PO1	PO2	PO3	PO4	PO5
CLO1	2	1	1	2	1
CLO2	1	2	1	1	2
CLO3	2	2	1	1	1
CLO4	3	2	2	1	1
CLO5	3	2	2	2	1

Advance application–3; Intermediate level –2; Basic level –1

Contd.,

Learning Outcome Based Education & Assessment (LOBE)
Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 2	2	K1 & K2	1	K1	2 (K2&K2)	1(K2)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**50%**
K2	5	6	10	20	**41**	34.16	
K3	-	-	20	20	**40**	33.33	**34%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

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DEPARTMENT OF MICROBIOLOGY				*CLASS: I B.Sc. Microbiology*		
Semester	**Course Type**	**Course Code**	**Course Title**	**Time**	**Maximum**	**Question Number**
II	Major Core	20U2RMC3	Microbial Taxonomy	3 hrs	75 marks	**11405**

Course Objectives:

1. To impart basic knowledge on microbial diversity and classification.
2. To enable the students to explore the structural variation among the microbes.
3. To relate the structure of a microbe to its uses
4. To classify microbes based on its characteristic features
5. To emphasize the significance of these microbes in day to-day life.

Unit-I: History and Criteria of Classification

Position of microorganisms in living world, Principles of binomial nomenclature. Woese's three kingdom classification, Whittaker's five kingdom concept. Criteria used for classification, taxonomic groups, species concept. Criteria used for classification of bacteria, fungi ,algae and viruses.

Unit-II: Taxonomy of Bacteria

Bacterial nomenclature and taxonomy- Methods of Classification: intuitive methods, numerical taxonomy, genetic approach. Introduction to Bergey's system of classification. Economic importance of bacteria. General characteristics, morphology, ultra structure and reproduction of *Staphylococcus aureus* and *Escherchia coli*.

Unit-III: Taxonomy of Fungi

General criteria for classification of fungi by Alexopoulos and Mims. General characteristics, morphology, ultra structure and reproduction of *Aspergillus niger*and *Candida.* Economic importance of fungi.

Unit-IV: Taxonomy of Algae

Classification of Algae by Bloom, Fritsch. General characteristics, morphology, ultra structure and reproduction of algae – *Spirogyra* and *Anabaena.* Economic importance of algae.

Unit-V: Taxonomy of Viruses

Principles of Virus taxonomy, characteristics used in nomenclature & classification of animal, plant viruses and bacteriophage – Influenza, TMV and M13 viruses. Virions and Prions.

Books for Study

1. Prescott M. (2005). Microbiology. 6th Edition, Tata McGraw – Hill, New Delhi.
2. Dubey RC and Maheswari DK (2005). A text book of Microbiology, Revised Multicolour Edition, Published by S. Chand & Company Limited, New Delhi.
3. Dube, H.C. (2007). A textbook of fungi, bacteria and viruses. Agrobios India.
4. Atlas and Bartha (1997). Microbial ecology. 4th edition. Pearson education, New York.
5. Saravanan. P. (2017). Virology. MJP Publishers, Chennai.

P.T.O.

Books for Reference

1. Albert G Moat and John W Foster (2004). Microbial Physiology. 4th Edition, John Wiley & Sons, New York.
2. Robert F Boyd (1984). General Microbiology. Times Mirror / Mosby College Publishers, St. Louis.
3. Garrity, G.M., Boone, D.R. and Castenholz, R.W. (2001). Bergey's Manual of Systematic Bacteriology, 2nd ed., vol. 1, Springer-Verlag, New York.
4. Alexopoulos, C.J. Charles W. Mims, Introductory Mycology, 3rd Edition, John Wiley & Sons, US.
5. Purohit SS (2005). Microbiology – Fundamentals and Applications. Reprinted & Published by Student Edition, Behind Nasrani Cinema, Chopasani Road, Jodhpur.
6. Pelczar TR, Chan ECS &Kreig NR (2006) Microbiology. 5th Edition, Tata McGraw – Hill, New Delhi.
7. Schlegel, H.G., (1993).General Microbiology, Seventh edition, Cambridge University Press, UK.

Web Resources

1. https://www.periobasics.com/basic-microbiology.
2. https://www.microbiologynutsandbolts.co.basic-concepts.
3. https://www.microbiologyinfo.com/category/basic-microbiology
4. https://www. Microbiology - Overview -youtube.com
5. https://www. Introduction to microbiology. youtube.com

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO):

On completion of this course the students will be able to

	Course Learning Outcome	Knowledge Level
CLO-1	Define the criteria used for classification of bacteria, fungi, algae and viruses.	Up to K2
CLO-2	Discuss the pros and cons of various classification methods and Classify bacteria	Up to K3
CLO-3	Discuss the characteristics used in nomenclature and classification of fungi with suitable examples.	Up to K2
CLO-4	Compare and contrast the methods of classification of algae, structural organization and economic importance of algae.	Up to K3
CLO-5	Analyse the various characteristics used in nomenclature and classification of animal, plant viruses and bacteriophage.	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

P.T.O.

Mapping of Course Learning Outcome with Programme Specific Outcome:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	1	2	2	1	3	1	2
CLO2	1	1	1	2	2	1	1
CLO3	2	1	1	1	3	1	1
CLO4	2	2	1	1	2	3	1
CLO5	1	1	2	3	2	1	2

Advance application–3; Intermediate level –2; Basic level –1

Mapping of Course Outcome with Programme Outcome:

	PO1	PO2	PO3	PO4	PO5
CLO1	1	2	2	1	3
CLO2	1	2	1	2	2
CLO3	2	1	3	1	3
CLO4	2	1	3	1	3
CLO5	1	1	3	3	3

Advance application–3; Intermediate level –2; Basic level –1

Learning Outcome Based Education & Assessment (LOBE)

Blue Print

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A MCQs		Section B Short Answers		Section C (Either / or Choice)	Section D (Open Choice)
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**58%**
K2	5	6	20	20	**51**	42.5	
K3	-	-	10	20	**30**	25	**25%**
K4	-	-	10	10	**20**	16.67	**17%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

DEPARTMENT OF MICROBIOLOGY				*CLASS: I B.Sc. Microbiology*		
Semester	**Course Type**	**Course Code**	**Course Title**	**Time**	**Maximum**	**Question Number**
II	Major Core	20U2RMC4	Cell And Molecular Biology	3 hrs	75 marks	**11406**

Course Objectives:

1. To understand the basic structure and functions of various cell organelles
2. To comprehend the central dogma of life
3. Appreciate the various cellular mechanisms involved in the control of transcription
4. Gain insights into the various processes involved in the replication of DNA.
5. To explore mechanism of translation.

Unit-I: Cell and Cell Organelles

Overview of prokaryotic and eukaryotic cell. Structure and Functions- Nucleoid, Nucleus, Endoplasmic Reticulum, Golgi apparatus, Lysosomes, Ribosomes, Peroxisome, Mitochondria and Chloroplast. Structure and forms of DNA, Types of RNA.

Unit-II: Cell cycle and Cell division

Cell cycle - cell division types-mitosis and meiosis and their significance. Molecular and biochemical characteristics of cancer cells. Cell ageing, Cell death and its regulation Apoptosis and Necrosis.

Unit-III: DNA Replication

Types of DNA replication – conservative, dispersive, semi conservative mode, Messelson - Stahl experiment. Mechanism of replication- rolling circle and theta mode. Enzymes involved in DNA replication-DNA polymerase, topoisomerase, helicase, primase and gyrase.

Unit-IV: Transcription

Transcription in Prokaryotes and eukaryotes- Initiation - promoters, sigma and transcription factors. Elongation - RNA polymerase, sub units. Termination - Rho dependent and Rho independent.

Post-transcriptional modifications in eukaryotes.

Unit-V: Translation

Genetic code: Deciphering genetic code, Characteristics of genetic code. Translation in prokaryotes – Initiation, Elongation and Termination. Translation in eukaryotes. Post-translational modifications.

Books for Study

1. Powar, C.B. (2009). Cell Biology. Himalayan Publishing House, New Delhi.
2. Paul, A. (2009). Cell and Molecular Biology. Books and Allied (P) ltd, India.
3. Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. (2008). Molecular Cell Biology. 6th Ed., W.H. Freeman & Co., New York.

Books for Reference

1. Alberts, B. Bray, D, Lewis, J, Raff, M, Roberts, K and Watson JD. (1994). Molecular Biology of the Cell (3rd edition). Garland Publishing, Inc., New York
2. Cooper, GM and Hawman RE. (2013). Cell - A Molecular Approach (6th Edition). Sinauer Associates Inc. US.
3. De Roberties E.D.P and E.M.F.DeRoberties. (2011). Cell and Molecular Biology. 8th edition. B.I. PublicatonsPvt. Ltd., India
4. Karp G. (2013). Cell and Molecular Biology - Concepts and Experiments. John Wiley & Sons Inc. New Jersey.
5. Stephen R. B, Jeremy S. H, *et.al*., Cell Biology - A short course, 2nd Edition, John wiley& Sons Inc. New Jersey.

Web Resources

1. https://www.omicsonline.org/scholarly/microbial-genetics.
2. https://www.lamission.edu/lifesciences/Steven/Micro20
3. https://www.indiabix.com Microbiology
4. https://www Microbial Genetics youtube.com

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO):

On the completion of the course the student will be able to

	Course Learning Outcome	Knowledge Level
CLO1	Explain the structure and functions of cell, cell organelles, biological membranes and intercellular communication	Up to K3
CLO2	Appraise the concepts of cells in terms of growth, division and gather an extempore knowledge on different phases of cell cycle	Up to K3
CLO3	Analyse the molecular basis of DNA replication and modes	Up to K4
CLO4	Interpret the transcription process of prokaryotic genomes	Up to K2
CLO5	Elaborate the process of translation in prokaryotes and eukaryotes.	Up to K2

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CLO1	1	2	2	1	3	1	2
CLO2	1	1	1	2	2	1	1
CLO3	2	1	1	3	1	1	1
CLO4	2	2	1	1	2	3	1
CLO5	1	1	2	3	2	2	1

Advance application–3; Intermediate level –2; Basic level –1

Mapping of course outcome with Programme outcome:

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	1	2
CLO2	1	3	1	1	2
CLO3	1	2	3	2	2
CLO4	2	3	1	1	2
CLO5	1	2	3	3	2

Advance application–3; Intermediate level –2; Basic level –1

Learning Outcome Based Education & Assessment (LOBE)

Blue Print

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
5.	CLO 5	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**75%**
K2	5	6	30	30	**71**	59.16	
K3	-	-	-	10	**10**	8.33	**8%**
K4	-	-	10	10	**20**	16.67	**17%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : B.Sc., Microbiology **COURSE CODE : 20U3RMC5**

COURSE TITLE : Biochemistry **QN.NO : 11408**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

1. To understand the basic building blocks of living organisms
2. To introduce the structure and properties of various biomolecules
3. To emphasis on the association between structure and function of various biomolecules
4. To learn the concepts involved in the mechanism of enzyme action
5. To understand the significance of vitamins as vital ingredient of life

Course Learning Outcome:

On successful completion of the programme, the students will be able to

1. Acquaint with chemical and molecular foundations of life and appreciate the role of water in biological systems
2. Comprehend the structure, function and properties of carbohydrates, amino acids and lipids
3. Introduce the significance of carbohydrates, proteins and lipids in biological systems
4. Aware of the importance of vitamins in biological systems
5. Elaborate the mechanism of enzyme action

Unit	Description	Hours	K-level	CLO
I	**Unit - I: Water and Carbohydrates** Water: The solvent of life - physical properties and structure of water molecule. pH and Buffers.Carbohydrates–definition, structure and classification. Physical andchemical properties of Monosaccharides-Glucose, Disaccharides- lactose, Polysaccharides – starch. Biological significance of carbohydrates.	15Hrs	Up to K2	1
II	**Unit - II: Amino acids and Proteins** Amino acids – Structure and classification. Properties – physical andchemical.Uncommon amino acidsand their functions. Proteins – definition, classification based on composition and solubility. Structural levels of organization – primary, secondary, tertiary and quaternary structure and their functions.	15Hrs	Up to K3	2
III	**Unit - III: Enzymes** Enzymes –definition and nomenclature.IUB classification with examples. Mechanism of enzymeaction-lock and key model. Enzyme inhibition-competitive and non-competitive. Factors affecting enzymes activity.	15Hrs	Up to K3	3
IV	**Unit - IV: Lipids** Lipids – definition ,classification and physical and chemical properties. Saturated and unsaturated fatty acids. Plant steroids. Biological significance of lipids. Lipid metabolism - β-oxidation, biosynthesis of saturated fatty acid eg. Palmitic acid.	15Hrs	Up to K3	4

V	**Unit - V: Vitamins and Hormones** Vitamins- Source and importance of vitamins. Classification - water soluble vitamins (Vitamin B and C).Fat soluble vitamins (Vitamin A, D, E and K). Vitamin deficiency diseases and symptoms. Hormones: Definition, Chemical classification of hormones. Functions of hormones and their regulation	15Hrs	Up to K4	5

Total 75 Hours

Books for Study

1. Jain, J. L. (2000). Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi

Books for Reference

1. Nelson, D.L., and Cox,M.M., (2000). LehningerPrinciples of Biochemistry, Third edition, Macmillan Worth publishers. London
2. David, B.D., Delbecco,. R., Eisen, H.N and Ginsburg, H.S (1990). "Microbiology" 5th Edition. Harper & Row, New York.
3. Stryer. L. (1995). Biochemistry, 4th edition , W.H. Freeman &Co. NY.
4. RoberMurray,K., Daryl Grammer, K., (1990).Harper's Biochemistry, 25th edition, McGraw Hill, Lange Medical Books,New York.
5. Satyanarayana, U (2005). Essentials of Biochemistry, Books and Allied (P) Ltd., Kolkata.
6. Veerakumari, L (2004). Biochemistry. MJP Pubilshers, A Unit of Tamil Nadu Book House, Chennai.

Web Resources

1. https://bio.libretexts.org/Bookshelves/Biochemistry
2. https://www.edx.org/course/principles-of-biochemistry
3. https://online-learning.harvard.edu/course/principles-biochemistry
4. https://courses.lumenlearning.com/introchem/chapter/protein-structure
5. https://www.medicalnewstoday.com/articles/319704

Rationale for Nature of the course

The goal of this course is to understand the basic building blocks of living organisms, its structure and propertiesand to emphasize on the association between structure and function of various biomolecules. This course highlights on the concepts involved in the mechanism of enzyme action and to understand the significance of vitamins as a vital ingredient of life.

Activities having direct bearing on skill development/ employability/entrepreneurship

- Providing knowledge on biomolecules, and their significance in the metabolism
- Exploring the structure of biomolecules found in cells and to determine their structures.
- Inculcatingthe formulation of biomolecules such as enzymes, hormones and vitamins in drug designing.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO)

CLOs	Course Learning Outcome On successful completion of the programme, the students will be able to	Knowledge Level
CLO1	Acquaint with chemical and molecular foundations of life and appreciate the role of water in biological systems.	Up to K2
CLO2	Comprehend the structure, function and properties of carbohydrates, amino acids and lipids.	Up to K3
CLO3	Introduce the significance of carbohydrates, proteins and lipids in biological systems.	Up to K3
CLO4	Aware of the importance of vitamins in biological systems.	Up to K3
CLO5	Elaborate the mechanism of enzyme action.	Up to K4

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	2	2	3
CLO2	2	2	2	2	2
CLO3	2	2	3	2	3
CLO4	3	2	2	2	2
CLO5	2	2	2	3	2

Advance application–3 Intermediate level –2 Basic level –1

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	2	2	3
CLO2	2	2	2	2	3
CLO3	3	2	2	2	2
CLO4	2	2	3	2	2
CLO5	3	2	2	2	2

Advance application–3 Intermediate level –2 Basic level –1

Learning Outcome Based Education & Assessment (LOBE) - Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.8	**41.6%**
K2	5	6	10	10	**31**	25.8	
K3	-	-	20	30	**50**	41.7	**41.7%**
K4	-	-	10	10	**20**	16.7	**16.7%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

UNITS	DESCRIPTION	STAFF	HOURS	MODE
I Water and Carbohydrates	a) Water: The solvent of life - physical properties and structure of water molecule		1	PPT
	b) pH and Buffers		3	
	c) Carbohydrates- definitions, classification, structure		2	
	d) Physical and chemical properties of Carbohydrates		3	
	e) Physical and chemical properties of - Monosaccharides – Glucose. Disaccharides- lactose		3	
	f) Polysaccharides – starch. Biological significance of carbohydrates		3	
II Amino acids andProteins	a) Amino acids – Structure and classification.		3	PPT
	b) Properties – physical and chemical		3	
	c) Uncommon amino acids and their functions		2	
	d) Proteins – definitions, classification based on composition, solubility		3	
	e) Structural levels of organization – primary, secondary, tertiary and quaternary structure and functions		4	
III Enzymes	a) Enzymes –definitions, nomenclature,IUB classification with examples		5	PPT
	b) Mechanism of enzyme action-lock and key model		2	
	c) Enzyme inhibition-competitive and non-competitive		4	
	d) Factors affecting enzymes activity.		4	
IV Lipids	a) Lipids - classifications, physical and chemical properties, saturated and unsaturated fatty acids.		5	PPT
	b) Plant steroids. Biological significance of lipids		3	
	c) Lipid metabolism - β-oxidation,		2	
	d) biosynthesis of saturated fatty acid eg. Palmiticacid.		5	
V Vitamins and Hormones	a) Vitamins- Source and importance of vitamins		2	PPT
	b) Classification– water soluble vitamins (Vitamin B and C).		3	
	c) Fat soluble vitamins (Vitamin A, D, E and K).		3	
	d) Vitamin deficiency diseases and symptoms.		2	
	e) Hormones: Definition, Chemical classification of hormones		3	
	f) Functions of hormones and their regulation.		2	
Total			**75 Hrs**	

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : B.Sc., **COURSE CODE : 20U3RAC1**

COURSE TITLE : Allied Microbiology **QN.NO : 11410**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

1. To impart basic knowledge on history of microbiology
2. To learn and relate the structural variation among the micro-organisms.
3. To emphasize the significance of beneficial microbes
4. To enable the students to explore the methods for the control of pathogenic microbes.
5. To understand various aspects of classical Microbiology and fundamental concepts in practical microbiological techniques that forms the basis for any biotechnology application.

Course Learning Outcomes:

On successful completion of the programme, the students will be able to

1. Explain the fundamental concepts; describe the history and development of microbiology.
2. Apply various staining techniques to differentiate and identify the microorganisms.
3. Identify the basic growth requirements of bacteria and demonstrate the practical skills in isolation, cultivation and preservation of microorganisms.
4. Apply suitable methodologies to control the growth of microbes by various sterilization techniques and by the use of other chemical agents
5. Compare and contrast the structural organization and economic importance of fungi, algae, viruses and protozoa.

Unit	Description	Hours	K-level	CLO
I	**Unit I: Introduction and History of Microbiology** Discovery of microorganisms- Contributions of Leeuwenhoek, Louis Pasteur, Edward Jenner, Robert Koch, Elie Metchnikoff and Fleming.Classification based on Carl Woese (The three domains) and Robert H. Whittaker (Five Kingdom system).	12 hrs	Up to K2	1
II	**Unit - II: Structural organization and Staining of Microbes** Types of bacteria based on morphology and flagella. Ultrastructure of bacteria (eg.*E. coli*)- cell wall, cell membrane, flagella, fimbriae, capsule, pili, endospore and cysts. Staining techniques – Simple, differential and special staining; Fungal staining. Microscopy – parts, principle and working mechanism of Bright field and Dark field microscope.	12 hrs	Up to K3	2
III	**Unit - III: Growth and Culturing Techniques** Nutritional requirements –factors affecting growth - determination of growth, growth curve - media and its types (natural, synthetic, selective, differential and enrichment media). Culture techniques – pure culture methods (direct plating, serial dilution technique, streak plate, spread plate, pour plate, stab culture, slant culture), anaerobic culture - preservation of cultures.	12 hrs	Up to K3	3
IV	**Unit - IV: Control of microbes** Sterilization, disinfection, sanitization, antisepsis. Physical methods-dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Tyndallisation, Pasteurization. Chemical methods-Mode of action and uses of: halogen and halogen compounds, compounds of heavy metals, phenols and its derivatives, alcohol, detergents. Chemosterilant gases (formaldehyde, ethylene oxide, beta propiolactone).	12 hrs	Up to K3	4

V	**Unit - V: Types of Microbes and their Economic Importance** General characteristics, morphology, ultra structure and economic importance of Algae – *Chlamydomonas* and *Anabaena.* Fungi- *Aspergillus niger*and *Saccharomyces cerevisiae.* Virus- HIV and T4 bacteriophage, Virions and Prions. Protozoa- *Amoeba*, *Plasmodium*.	12 hrs	Up to K4	5

Total 60 Hours

Books for Study

1. Dubey, R.C. and Maheswari, D.K. (2005). A text book of Microbiology. Revised Multicolour Edition. S. Chand & Company Limited, New Delhi.
2. Pelczar, T.R., Chan, E.C.S. and Kreig, N.R. (2006). Microbiology. 5th Edition. Tata McGraw – Hill, New Delhi.

Books for Reference

1. Prescott, L.M., Harley, J.P. and Klein, D.A. (2005). Microbiology. 6th Edition. Tata McGraw – Hill, New Delhi.
2. Moat, A.G. and Foster, J.W. (2002). Microbial Physiology. 3rd Edition. John Wiley & Sons, New York.
3. Boyd, R.F. (1984). General Microbiology. Times Mirror / Mosby College Publishers, UK.
4. Purohit, S.S. (2005). Microbiology – Fundamentals and Applications. Student Edition Publishers, Jodhpur.
5. Schlegel, H.G. (1993).General Microbiology. 7th Edition. Cambridge University Press, UK.

Web Resources

1. https://microbiologyinfo.com/category/basic-microbiology/
2. https://www.britannica.com/science/microbiology
3. https://www.youtube.com/watch?v=oEvUbWPWVqw
4. https://www.youtube.com/watch?v=gKA_VLC4-jQ&list=PLzju0_wImbUfJsCfSHyeB1iZ95PsTp85v

Rationale for nature of the course

Microorganisms play indispensable role in the field of biotechnology as they act as a main carrier for all biotechnological techniques. For any biotechnological application, understanding theoretical and practical aspects in microbiology becomes essential. It helps to realize the significance of beneficial microbes in various life processes.

Activities having direct bearing on skill development/ employability/entrepreneurship

Applying technical skills to differentiate and identify microorganisms

Exploring theoretical and practical aspects for isolation, cultivation, preservation and control of microorganisms

Imparting knowledge on economic importance of various microorganisms

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO)

On completion of this course the students will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO-1	Explain the fundamental concepts; describe the history and development of microbiology.	Up to K2
CLO-2	Apply various staining techniques to differentiate and identify the microorganisms.	Up to K3
CLO-3	Identify the basic growth requirements of bacteria and demonstrate the practical skills in isolation, cultivation and preservation of microorganisms.	Up to K3
CLO-4	Apply suitable methodologies to control the growth of microbes by various sterilization techniques and by the use of other chemical agents	Up to K3
CLO-5	Compare and contrast the structural organization and economic importance of fungi, algae, viruses and protozoa.	Up to K4

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	1	1	1	1
CLO2	3	2	1	3	3
CLO3	3	3	2	3	3
CLO4	3	3	2	3	3
CLO5	3	3	2	3	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	1	1	1	1
CLO2	3	2	1	2	3
CLO3	3	3	3	3	3
CLO4	3	3	2	3	2
CLO5	3	3	2	3	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

Learning Outcome Based Education & Assessment (LOBE) - Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction and History of Microbiology	Introduction, History of Microbiology, Discovery of microorganisms		2	Chalk and talk
	Contributions of Leeuwenhoek, Louis Pasteur, Edward Jenner , Robert Koch, Elie Metchnikoff and Fleming		6	Screening of educational videos
	Classification based on Carl Woese (The three domains) and Robert H. Whittaker (Five Kingdom system)		4	Chalk and talk
II Structural organization and Staining of Microbes	Bacteria, types of bacteria based on morphology and flagella		2	PPT
	Ultrastructure of bacteria (eg.*E.coli*)- cell wall, cell membrane, flagella, fimbriae, capsule, pili, endospore and cysts		3	Screening of educational videos
	Staining techniques – Simple, differential and special staining; Fungal staining		4	Screening of educational videos
	Microscopy – parts, principle and working mechanism of simple and compound microscope		3	PPT
III Growth and Culturing Techniques	Growth of bacteria– nutritional requirements –factors affecting growth - determination of growth, growth curve		3	Chalk and talk
	Media and its types (natural, synthetic, selective, differential and enrichment media)		3	Quiz
	Culture techniques –pure culture methods (direct plating, serial dilution technique, streak plate, spread plate, pour plate, stab culture, slant culture)		4	Screening of educational videos
	Anaerobic culture, preservation of cultures		2	
IV Control of microbes	Sterilization, Disinfection, sanitization, antisepsis.		3	PPT
	Physical methods- dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Tyndallisation, Pasteurization.		4	Chalk and talk
	Chemical methods-Mode of action and uses of: halogen and halogen compounds, compounds of heavy metals, phenols and its derivatives, alcohol, detergents. Chemosterilant gases (formaldehyde, ethylene oxide, beta propiolactone)		5	Chalk and talk
V Types of Microbes and their Economic Importance	General characteristics, morphology, ultra structure and economic importance of Algae – *Chlamydomonas* & *Anabaena*		3	Seminar, Group discussion
	General characteristics, morphology, ultra structure and economic importance of Fungi- *Aspergillus niger*and *Saccharomyces cerevisiae.*		3	Seminar, Group discussion
	General characteristics, morphology, ultra structure and economic importance of Virus- HIV and T4 bacteriophage, Brief study on Virions and Prions		3	Seminar, Group discussion
	General characteristics, morphology, ultra structure and economic importance of Protozoa- *Amoeba, Plasmodium*		3	Seminar, Group discussion
Total			**60 Hrs**	

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : B.Sc., Microbiology **COURSE CODE : 20U3RSM1**

COURSE TITLE : Cosmetic Microbiology **QN.NO : 11413**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

To understand the history of cosmetic microbiology

1. To understand the Fundamental concepts and manufacturing of cosmetics
2. To gain knowledge regarding cosmetics and microbiological testing of cosmetics
3. To know about the mechanism of preservation of cosmetic products
4. To gain knowledge of antimicrobial properties of natural cosmetic products

Course Learning Outcome:

On successful completion of the programme, the students will be able to

1. Outline the history, need and scope of microbiology, microbial limits on cosmetic products
2. Describe to make cosmetics on HACCP
3. Determine microorganisms in cosmetics using various testing methods
4. Apply precautions that prevent growth of microorganisms
5. Specify general characters and determine mode of action of various antimicrobial natural cosmetic microbiology

Unit	Description	Hours	K-level	CLO
I	**Unit - I: History and Scope of Cosmetic Microbiology** History and Scope of Cosmetic Microbiology- definition of Cosmetics– Need for cosmetic microbiology - Role of microbes in cosmetics preparation - Significance of Cosmetic Microbiology - Microbial limits for Cosmetic Products.	6Hrs	Up to K2	1
II	**Unit- II : Manufacturing Control of Cosmetics** Sanitary practices in cosmetic manufacturing - Microbial environment of the manufacturing plant - Hazard analysis and critical control point (HACCP) protocols in cosmetic microbiology - Microbiological Quality Controls of Cosmetic Products.	6Hrs	Up to K3	2
III	**Unit- III: Testing Methods of Cosmetics** Cosmetic microbiology test methods - Antimicrobial preservative efficacy and microbial content testing - Validation of methods. – Validation in Microbiology Laboratory – Media, microbial Content Test, Identification, Sterilizers, Decontamination.	6 Hrs	Up to K3	3
IV	**Unit- IV: Mechanism of Preservation of Cosmetics** Overview of biocide mechanism and suitability for use in cosmetic Preservation- Preservation of cosmetics - Preservation strategies - Mechanisms of action of Cosmetic preservatives -Preservative resistance - Global regulatory and toxicological aspects of cosmetic preservation- Consumer safety considerations of cosmetic preservation.	6 Hrs	Up to K3	4
V	**Unit- V: Antimicrobial Properties** Antimicrobial properties of natural cosmetic products – Garlic, Neem, Turmeric, Aloe vera and Tulsi. Antimicrobial Care Products – Dental Products, Consumer Hand and Body Washes - Hand Sanitizers and Wipes - Antiseptic Products used in healthcare Settings - Factors affecting effectiveness of antimicrobial preservative.	6 Hrs	Up to K4	5

Total 30 Hours

Books for Study

1. Philip, A.G. (2006). Cosmetic Microbiology. A Practical approach. 2nd Edition. Taylor & Francis group, New York.
2. Daniel K. Brannan. (1997). Cosmetic Microbiology: A practical handbook. CRC Press, Florida.

Books for Reference

1. Wilkinson, J.B., and Moore, R.J. (1982). Harry's Cosmeticology. 7th Edition. Chemical Publishing Company, New York.
2. Sharma, P.P. (1998). Cosmetics – Formulation, Manufacturing and Quality Control. 4th Edition. Vandana Publications Pvt. Ltd., New Delhi.
3. Hilda Butler and Poucher. W.A. (2000). Poucher's Perfumes, Cosmetics and Soaps. 10th Edition. Kluwer Academic Publishers, Boston.
4. André O. Barel, Marc Paye, Howard I. Maibach. (2009). Handbook of Cosmetic Science and Technology. 3rd Edition. Marianne Mahieu Informa Healthcare, USA.
5. Leon Lachmann and Herbert A Lienermann. (2013). Theory and Practice of Industrial Pharmacy. CBS Publishers & Distributors Pvt. Ltd.,New Delhi.
6. Rawlins, E.A. (1997) Bentley's Text book on pharmaceutics, 8th Edition. Bailliere Tindall Ltd., London.

Web Resources

1. https://www.fda.gov/cosmetics/resources-you-cosmetics/resources-industry-cosmetics
2. http://www.simbhq.org/docs/simbnews/SNND2013.pdf
3. https://www.criver.com/resources/webinar-pi-ms-importance-cosmetic-microbiology
4. https://www.fda.gov/cosmetics/potential-contaminants-cosmetics/microbiological-safety-and-cosmetics
5. https://www.sigmaaldrich.com/analytical-chromatography/microbiology.html
6. https://firstthingsfirst966.files.wordpress.com/2018/01/microbiology1.pdf
7. https://www.tentamus.com/microbiology-chemistry-cosmetics/
8. https://www.youtube.com/watch?v=Bpe2ROWKsZU

Rationale for Nature of the course

The purpose of this course is to share the unique knowledge of a small group of cosmetic microbiologists and cover all aspects that are critical to providing consumers with microbiologically safe products in a focused discussion that allows immediate application. The course will emphasize current trends in the selection of cosmetic ingredients.

Activities having direct impact on Skill development/Employability / Entrepreneurship

- Understanding all aspects that are critical for providing consumers with microbiologically safe products.
- Providing in depth learning in cosmetic science, which will serve as a focus for research into the field of cosmetic science.
- Applying knowledge on cosmetics in the field of related sciences, cosmeceuticals, personal care and hygiene products.

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO)

CLOs	Course Learning Outcome *On successful completion of the programme, the students will be able to*	Knowledge Level
CLO1	Outline the history, need and scope of microbiology and microbial limits on cosmetic products.	Up to K2
CLO2	Explain the need of HACCP protocol in manufacturing cosmetics	Up to K3
CLO3	Determine Microorganisms in Cosmetics using various testing methods	Up to K3
CLO4	Apply precautions that prevent growth of Microorganisms	Up to K3
CLO5	Specify general characters and determine mode of action of various antimicrobial natural cosmetics.	Up to K4

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	2	2	2	3
CLO2	2	2	2	3	2
CLO3	2	2	2	2	3
CLO4	3	2	2	2	2
CLO5	3	3	3	3	2

Advance application–3 Intermediate level –2 Basic level –1

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	2	2	3	2	2
CLO2	2	2	3	2	2
CLO3	2	3	2	2	3
CLO4	2	2	2	2	2
CLO5	3	2	2	2	2

Advance application–3 Intermediate level –2 Basic level –1

Learning Outcome Based Education & Assessment (LOBE)
Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.8	**41.6%**
K2	5	6	10	10	**31**	25.8	
K3	-	-	20	30	**50**	41.7	**41.7%**
K4	-	-	10	10	**20**	16.7	**16.7%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

LESSON PLAN

Units	Description	Staff	Hours	Mode
I History of Cosmetic Microbiology	a)History and Scope of Cosmetic Microbiology.		1	Chalk and Talk
	b)Definition of Cosmetics, Need for cosmetic microbiology,		2	
	c) Role of microbes in cosmetics preparation		1	
	d)Significance of Cosmetic Microbiology		1	
	e) Microbial limits for Cosmetic Products.		1	
II Manufacturing of Cosmetics	a) Sanitary practices in cosmetic manufacturing,.		2	Chalk and Talk
	b)Microbial environment of the manufacturing plant		1	
	c)Hazard analysis and critical control point (HACCP) protocols in cosmetic microbiology		2	
	d)Microbiological Quality Controls of Cosmetic Products		1	
III Testing Methods of Cosmetics	a)Cosmetic microbiology test methods		1	Chalk and Talk & PPT
	b)Antimicrobial preservative efficacy and microbial content testing		1	
	c)Validation of methods. Validation in Microbiology Laboratory – Media		2	
	d) microbial Content Test Identification, Sterilizers, Decontamination.		2	
IV Mechanism of Preservation of Cosmetics	a)Overview of biocide mechanism and suitability for use in cosmetic Preservation		2	PPT & Chalk and Talk
	b)Preservation of cosmetics - Preservation strategies - Mechanisms of action of Cosmetic preservatives. - Preservative resistance.		2	
	c)Global regulatory and toxicologic aspects of cosmetic preservation-		1	
	d)Consumer safety considerations of cosmetic preservation.		1	
V Antimicrobial Properties	a)Antimicrobial properties of natural cosmetic products – Garlic, Neem, Turmeric, Aloe vera and Tulsi		2	PPT
	b)Antimicrobial Care Products – Dental Products, Consumer Hand and Body Washes ,Hand Sanitizers and Wipes		2	
	c)Antiseptic Products used in healthcare Settings.		1	
	d)Factors affecting effectiveness of antimicrobial preservative.		1	
Total			**30 Hours**	

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : B.Sc., Microbiology **COURSE CODE : 20U3RNM1**

COURSE TITLE : Nutrition and Health **QN.NO : 11414**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

1. To understand the fundamental concepts of food, nutrition and health
2. To understand the relationship among food, nutrition and health
3. To gain knowledge regarding nutritional contribution of various food groups
4. To know about the importance of food safety and food quality
5. To gain knowledge regarding nutritional disorders ranging from nutritional deficiencies to life style disorders

Course Learning Outcomes:

On successful completion of the programme, the students will be able to

1. Understand basic concepts in food, nutrition and health
2. Summarize nutritional contribution of various food groups
3. Elaborate the functions and dietary sources of Macronutrients and Micronutrients
4. Explain food laws, regulations and standards
5. Identify the causes, symptoms of Nutritional deficiency diseases

Unit	Description	Hours	K-level	CLO
I	**Unit - I: Basic concepts in food and nutrition** Basic terms used in study of food and nutrition. Understanding relationship among food, nutrition and health. Functions of food- Physiological, Psychological and Social.	6 hrs	Up to K2	1
II	**Unit- II: Major Food Groups** Nutritional contribution of the food groups: cereals, pulses, fruits and vegetables, milk and milk products, egg, meat, poultry and fish, fats and oils. Role of fibres in nutrition.	6 hrs	Up to K2	2
III	**Unit- III: Nutrients** Functions, dietary sources of the following nutrients: Macronutrients- carbohydrates, lipids and proteins. Micronutrients- Fat soluble vitamins-A, D, E and K, Water soluble vitamins – thiamine, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C, Minerals – calcium, iron and iodine.	6 hrs	Up to K2	3
IV	**Unit- IV: Food Adulteration** Prevention of Food Adulteration (PFA) - Definition of food adulteration. Adulterants in commonly consumed food items. Accidental contamination: botulism, staphylococcal and aflatoxin intoxication. Importance of food labels in processed foods and nutritional labelling. Food laws, regulations and standards - Codex Alimentarius - Prevention of Food Adulteration (PFA) Act - Agmark - Fruit Products Order (FPO) - Meat Products Order (MPO) - Bureau of Indian Standards (BIS) - MMPO – FSSAI.	6 hrs	Up to K2	4

V	**Unit-V: Nutritional deficiency diseases** Introduction to Nutritional deficiency diseases - causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM),Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Fluorosis	6 hrs	Up to K2	5

Total 30 Hours

Books for Study

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed. New Age International Publishers, Chennai.
2. Wadhwa, A. and Sharma, S. (2003). Nutrition in the Community-A Textbook. Elite Publishing House Pvt. Ltd., New Delhi.
3. Srilakshmi. (2010). Food Science, 4th Edition. New Age International Ltd., Chennai.

Books for Reference

1. Virag Gupta. (2011). The Food Safety and Standards Act along with Rules and Regulations. Commercial Law Publishers (India) Pvt Ltd, New Delhi.
2. Mahan, L. K. and Escott Stump, S. (2013). Krause's Food & Nutrition Therapy, 13th ed. Saunders-Elsevier,Philadelphia.
3. Stacy Nix. (2009). William's Basic Nutrition and Diet Therapy, 13th Edition. Elsevier Mosby,Philadelphia.
4. Bamji, M.S., Krishnaswamy, K, Brahmam, G.N.V. (2009). Textbook of Human Nutrition, 3rd edition. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Park, K. (2011). Park's Textbook of Preventive and Social Medicine, 21st Edition. M/s BanarasidasBhanot Publishers, Jabalpur, India.

Web Resources

1. https://egyankosh.ac.in/bitstream/123456789/41571/1/CNCC-01-E-B1-U1.pdf
2. https://www.brainkart.com/article/Physiological,-Social,-Psychological-functions-of-food_2499/
3. https://www.healthychildren.org/English/healthy-living/nutrition/Pages/The-5-Food-Groups-Sample-Choices.aspx
4. https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=315&printable=1
5. https://www.medlife.com/blog/nutritional-deficiency-anemia-causes-symptoms-treatment/

Rationale for Nature of the course

Proper nutrition practices enable the achievement and maintenance of optimal physical and mental health. The paper focuses on the raising standards in food science, food safety practices, and food standards. The beneficiaries will be imbibed with knowledge and skills that would help them to secure good health and well being for themselves and their family, which leads to a healthy society.

Activities having direct impact on Skill development/Employability / Entrepreneurship

- Developing skills in preparing diet charts for nutritional deficiency diseases.
- Would apply knowledge gained through this paper in meal planning safety
- Safety quality of good would be assessed

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO)

	Course Learning Outcome *On successful completion of the programme, the students will be able to*	**Knowledge Level**
CLO1	Understands basic concepts in food, nutrition and health.	Up to K2
CLO2	Summarizes nutritional contribution of various food groups.	Up to K2
CLO3	Elaborates the functions and dietary sources of Macronutrients and Micronutrients	Up to K2
CLO4	Explains food laws, regulations and standards	Up to K2
CLO5	Identifies the causes, symptoms of Nutritional deficiency diseases	Up to K2

K1 –Remembering and recalling facts with specific answers
K2 – Basic understanding of facts and stating main ideas with general answers
K3 – Application oriented – Solving Problems
K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	1	2	1	1
CLO2	1	1	1	2	2
CLO3	1	2	1	1	2
CLO4	2	2	1	1	2
CLO5	1	1	2	3	2

Advance application–3 Intermediate level –2 Basic level –1

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	1	1	1	1	1
CLO2	2	1	1	1	1
CLO3	2	2	1	1	1
CLO4	2	2	1	2	2
CLO5	3	2	2	2	2

Advance application–3 Intermediate level –2 Basic level –1

Learning Outcome Based Education & Assessment (LOBE)
Formative Exam – Blue Print (CIA I & II)
Articulation Mapping - K Levels with Courses Learning Outcomes (CLOs)

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO x	Up to K2	1	K1	1	K2/K2	1	K1
CLO y	Up to K2	2	K1	1	K2/K2	2	K1
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		**6**		**14**		**20**	

- *CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.*

Distribution of Section-wise Marks with K Levels (CIA I & II)

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	**Total Marks**	% of Marks without choice	Consolidated %
K1	6	-	30	-	**36**	56.25	**100**
K2	-	28	-	-	**28**	43.75	
K3	-	-	-	-	**-**	-	**-**
K4	-	-	-	-	**-**	-	**-**

Total Marks	**6**	**14**	**30**	**-**	**64**	**100.00**	**100%**

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K-Level	Section – A		Section – B		Section – C	
			Short Answers		(Either / or Choice)		(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level	No. of Questions	K-Level
1	CLO 1	Up to K2	1	K1	1	K2/K2	1	K1
2	CLO 2	Up to K2	1	K1	1	K2/K2	1	K1
3	CLO 3	Up to K2	1	K1	1	K2/K2	1	K1
4	CLO 4	Up to K2	1	K1	1	K2/K2	1	K1
5	CLO 5	Up to K2	1	K1	1	K2/K2	1	K1
No. of Questions to be asked			5		5		5	
No. of Questions to be answered			5		5		3	
Marks for each question			2		7		10	
Total Marks for each section			**10**		**35**		**30**	

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Section D (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-	50	-	60	46.15	100
K2	-	70	-	-	70	53.85	
K3	-	-	-	-	-	-	-
K4	-	-	-	-	-	-	-
Total Marks	**10**	**35**	**50**	**-**	**130**	**100.00**	**100**

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Basic concepts in food and nutrition	Basic terms used in study of food and nutrition		1	Chalk and Talk
	Understanding relationship among food, nutrition and health.		2	
	Functions of food- Physiological, Psychological		2	
	Functions of food- Social.		1	
II Major Food Groups:	Nutritional contribution of the food groups - cereals, pulses.		2	Chalk and Talk
	Nutritional contribution of fruits and vegetables,		1	
	Nutritional contribution of milk and milk products,		1	
	Nutritional contribution of egg, meat, poultry and fish, fats and oils. Role of fibres in nutrition		2	
III Morphology and fine Structure of Bacteria	Functions, dietary sources of the following nutrients: Macronutrients- Carbohydrates, lipids and proteins.		2	Chalk and Talk & PPT
	Micronutrients- Fat soluble vitamins-A, D, E and K		2	
	Water soluble vitamins – thiamine, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C, Minerals – calcium, iron and iodine		2	

IV Food Adulteration	Prevention of Food Adulteration (PFA) - Definition of food adulteration. Adulterants in commonly consumed food items.		2	PPT & Chalk and Talk
	Accidental contamination: botulism, staphylococcal and aflatoxin intoxication. Importance of food labels in processed foods and nutritional labelling.		2	
	Food laws, regulations and standards - Codex Alimentarius - Prevention of Food Adulteration (PFA) Act - Agmark - Fruit Products Order (FPO) - Meat Products Order (MPO) - Bureau of Indian Standards (BIS) - MMPO - FSSAI		2	
V Nutritional deficiency diseases:	Introduction to Nutritional deficiency diseases - causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM)		2	PPT
	Causes, symptoms, treatment, prevention of Vitamin A Deficiency (VAD), Iron Deficiency Anaemia (IDA)		2	
	Causes, symptoms, treatment, prevention of Iodine Deficiency Disorders (IDD), Zinc Deficiency, Fluorosis		2	
	Total		**30 Hrs**	

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