

**Title of the Course: DSC-2: Subject code: 21BSC2C2BT2L**

**Paper: Microbiological Methods**

Number of Theory Credits	Number of lecture hrs/semester	Number of practical Credits	Number of practical hrs/ sem
<b>4</b>	56	<b>2</b>	<b>56</b>

Unit No.	Course Content	Hours
Unit I	<p><b>Instruments used in Biotechnology</b>  Microscopy: Principles of Microscopy- resolving power, numerical aperture, working principle and applications of Compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence Microscope, confocal microscope, Electron Microscopes- TEM and SEM.</p> <p><b>Analytical techniques:</b> Working principles and applications: Centrifuge, Ultracentrifuge, Spectrophotometer, Chromatography: Paper and TLC</p>	14
Unit II	<p><b>Sterilization techniques</b>  Definition of terms-sterilization, disinfectant, antiseptic, sanitizer, germicide, microbicidal agents, microbiostatic agent and antimicrobial agent.</p> <p><b>Physical methods of control:</b> Principle, construction and applications of moist heat sterilization Boiling, Pasteurization, Fractional sterilization-Tyndallization and autoclave. Dry heat sterilization-Incineration and hot air oven. Filtration – Diatomaceous earth filter, seitz filter, membrane filter and HEPA ; Radiation : Ionizing radiation-<math>\gamma</math> rays and non-ionizing radiation-UV rays</p> <p><b>Chemical methods:</b> Alcohol, aldehydes, phenols, halogen, metallic salts, Quaternary ammonium compounds and sterilizing gases as antimicrobial agents;</p>	14
Unit III	<p><b>Microbiological techniques</b>  <b>Culture Media:</b> Components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media  <b>Pure culture methods:</b> Serial dilution and plating methods (pour, spread, streak); cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria  <b>Stains and staining techniques:</b> Principles of staining, Types of stains-simple stains, structural stains and differential stains.</p>	14
Unit IV	<p><b>Antimicrobial agents</b>  Five modes of action with one example each: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism</p>	14

	Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine Antibiotic resistance, MDR, XDR, MRSA, NDM-1 Antibiotic sensitivity testing methods: Disc and Agar well diffusion techniques	
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## **Course : Practicals**

### **Paper : Microbiological Methods; Paper Code: 21BSC2C2BT2P**

1. To study the principle and applications of important instruments (biological safety cabinets, autoclave, incubator, BOD incubator, hot air oven, light microscope, pH meter) used in the microbiology and Biotechnology laboratory.
2. Sterilization of medium using Autoclave and assessment for sterility
3. Sterilization of glassware using Hot Air Oven and assessment for sterility
4. Sterilization of heat sensitive material by membrane filtration and assessment for sterility
5. Preparation of culture media for bacteria, fungi and their cultivation.
6. Plating techniques: Spread plate, pour plate and streak plate.
7. Isolation of bacteria and fungi from soil, water and air
8. Study of Rhizopus, Penicillium, Aspergillus using temporary mounts
9. Colony characteristics study of bacteria from air exposure plate
10. Staining techniques: Bacteria– Gram, Negative, Capsule, Endospore staining  
Fungi – Lactophenol cotton blue staining
11. Water analysis - MPN test
12. Biochemical Tests – IMViC, Starch hydrolysis, Catalase test, Gelatin hydrolysis
13. Bacterial cell motility - hanging drop technique

**\*\* Any two experiments given carrying 20 and 15 marks each experiment.**

### **Text Books / References**

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. W.M.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.
5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht
6. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.

10. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
11. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications
12. Fundamentals of Microbiology –Frobisher, Saunders & Toppan Publications
13. Introductory Biotechnology-R.B Singh C.B.D. India (1990)
14. Fundamentals of Bacteriology - Salley
15. Frontiers in Microbial technology-P.S. Bison, CBS Publishers.
16. Biotechnology, International Trends of perspectives A. T. Bull, G.
17. General Microbiology –C.B. Powar

## OPEN-ELECTIVE SYLLABUS

**Title of the Course: OEC-2: Subject code: 21BSC2O2BT2**

**Paper: Applications of Biotechnology in Agriculture**

**B.Sc. Semester – II**

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	2	40	60	100

Unit No.	Course Content	Hours
Unit I	<b>Agricultural Biotechnology</b> Concepts and scope of biotechnology in Agriculture. Plant tissue culture, micro propagation, entrepreneurship in commercial plant tissue culture. Banana tissue culture - primary and secondary commercial setups, Small scale bioenterprises: Mushroom cultivation	14
Unit II	<b>Transgenic plants</b> The GM crop debate – safety, ethics, perception and acceptance of GM crops GM crops case study :Bt cotton, Bt brinjal Plants as biofactories for molecular pharming : edible vaccines, plantibodies, nutraceuticals.	14
Unit III	<b>Bt based pesticides</b> Baculovirus pesticides, Mycopesticides, Post-harvest Protection : Antisense RNA technology for extending shelf life of fruits and shelf life of flowers. Genetic Engineering for quality improvement: Seed storage proteins, Flavours–capsaicin, vanillin	14

### Text Books / References

1. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
3. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
4. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
7. Microbiology- Concepts and Applications, PelczarJr,Chan, Krieg, International ed, McGraw Hill.

8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
9. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
10. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
11. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudbury, 835 pp.
12. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
13. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9<sup>th</sup> ed. Pearson Education Pte. Ltd., San Francisco. 958pp.