KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/1155 Date: 29 OCT 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1),ಬೆಂಗಳೂರು ದಿ. 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/954 ದಿ:30.09.2021.
9. ಎಲ್ಲ ನಿಖಾಯದ ಡೀನರು / ಸಂಪನ್ಮೂಲ ತಜ್ಞರ ಸಭೆ ದಿನಾಂಕ 21.10.2021.
10. ಎಲ್ಲ ಸ್ನಾತಕ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಅಧ್ಯಕ್ಷರುಗಳ ಸಭೆ ದಿನಾಂಕ 22.10.2021.
11. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 27.10.2021.
12. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 29-10-2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೊದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೊದನೆ ಪಡೆದು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

29/10/21
ಕುಲಸಚಿವರು.

ಅಡಕ: ಮೇಲಿನಂತೆ

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂರ್ತಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

Practical Subject

KARNATAK UNIVERSITY, DHARWAD

04 - Year B.Sc. (Hons.) Program

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SYLLABUS

Subject: MICROBIOLOGY

[Effective from 2021-22]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,

OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and

SKILL ENHANCEMENT COURSE (SEC) FOR SEM I

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Microbiology for B.Sc. (Hons.)

Effective from 2021-22

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks	Credits
I	DSCC 1	Theory	04hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-1	Theory	03 hrs	42	02 hrs	40	60	100	03
	*SEC-1	Practical	03 hrs	30	02 hrs	25	25	50	02
II	DSCC2	Theory	04 hrs	56	02 hrs	40	60	100	04
		Practical	04 hrs	52	03 hrs	25	25	50	02
	OEC-2	Theory	03 hrs	42	02 hrs	40	60	100	03
	Details of the other Semesters will be given later								

*** Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected**

Name of Course (Subject): Microbiology

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in Microbiology students will be able to:

PSO 1: Gain Knowledge and understanding of concepts of microbiology and its application in **pharma, food, agriculture, beverages, nutraceutical industries**. Knowledge on history, general characters and classification of Microorganisms, Understanding the microbiological techniques, cultivation and detection of microorganisms. Comprehend evolutionary importance and economic significance of microorganisms and microbiology. Understand the distribution, morphology and physiology of microorganisms and demonstrate the skills in aseptic handling of microbes including isolation, identification and maintenance.

PSO 2: To develop understanding about Biochemistry, enzymes, microbial metabolism, growth and bioenergetics. Students will become efficient in managerial skills, able to employ analytical reasoning, problems solving and interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry-level position in Microbiology.

PSO 3: Competent to apply the knowledge gained for conserving the environment and resolving the environmental related issues.

PSO 4: Learning and practicing professional skills in handling microbes and contaminants in laboratories and production sectors.

PSO 5: Exploring the microbial world and analyzing the specific benefits and challenges.

PSO 6: Applying the knowledge acquired to undertake studies and identify specific remedial measures for the challenges in health, agriculture, and food sectors.

PSO 7: Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.

PSO 8: Understanding biochemical and physiological aspects of microbes and developing broader perspective to identify innovative solutions for present and future challenges posed by microbes.

PSO 9: Understanding and application of microbial principles in forensic and working, knowledge about clinical microbiology. Enhance and demonstrate analytical skills and apply basic computational and statistical techniques in the field of microbiology.

PSO 10: Demonstrate the ability to identify ethical issues related to recombinant DNA technology, GMOs, intellectual property rights, bio-safety and biohazards. Demonstrate the ability to identify key questions in microbiological research, optimize research methods, and analyze outcomes by adopting scientific methods, thereby improving the employability.

B.Sc. Semester – I

Subject: Microbiology
Discipline Specific Course (DSC)

The course Microbiology in I semester has two papers (Theory Paper –I for 04 credits & Practical Paper -II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-1 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.1 (Theory): Title of the Course (Theory): DSC-1T MBL 101: General Microbiology

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1 : At the end of the course the student will have broad and balanced knowledge of Microbiology, history, general characters and classification of Microorganisms, Viz-Bacteria, Fungi, algae, protozoa and virus,

CO 2 : Understanding the microbiological techniques, cultivation and detection of microorganisms.

CO 3 : Comprehend evolutionary importance and economic significance of microorganisms and microbiology.

CO 4 : Learning and practicing professional skills in handling microbes. Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control..

Syllabus- Course 1(Theory): Title- DSC-1T, MBL 101, General Microbiology	**Total Hrs: 56**
Unit-I Introduction to Microbiology and Microscopy	**14 hrs**
Chapter No.1: History of Microbiology Microbes and origin of life. History, scope and relevance of microbiology as a modern science. Branches of Microbiology, Contribution of Scientists in the field of microbiology- Antonie von Leuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch and others.	**5 Hrs**
Chapter No. 2 Taxonomy Haeckel's Three Kingdom system, Whittaker's Five kingdoms classifications - Monera. Protista, Fungi, Plantae and Animalia. Principles and methods of classification. Different trends in classification of microorganisms	**4 Hrs**

Chapter No. 3: Microscopy Principles of Microscopy – Optical, Charge particle and Scanning probe microscope, Resolving power, Numerical Aperture, Working distance magnification and. Chromatic aberrations. Different types of Microscopes – Compound, Dark field, Stereo / Binoccular microscopes, Inverted microscope, Phase contrast, Fluorescent microscope, Electron microscope - Scanning and Transmission electron microscope.	**5 Hrs**
Unit-II General Characteristics of Microorganisms	**14 hrs**
Chapter No. 4: General characteristics of Bacteria General characteristics of different important archaeal and eubacterial group's. Classification in brief based on Bergey's Manual of Systematic Bacteriology. Bacterial Cell structure and organization. Emphasis on Rickettsiae, Chlamydia, Spirochaetes, Mycoplasma, **A**ctinomycetes.	**4 Hrs**
Chapter No. 5: Study of major groups of microorganisms **Viruses**: General characteristics of viruses. Concept of viroids, Satellite viruses, Bacteriophages, virusoids, virions and Prions. Structure and Importance of viruses. **Fungi**: History and scope of Mycology, General Characteristics, Classification, Reproduction and significance of fungi **Algae**: History and scope of Phycology. General Characteristics, Classification, Reproduction. Economic importance of algae **Protozoa:** History of Protozoa. General Characteristics, Classification and, Reproduction	**6 Hrs**
Chapter No. 6: Culturing of microorganisms Types of culture media. Methods of isolation of bacteria and fungi - serial dilution, pour plate, spread plate and streak plate techniques. Cultivation of Anaerobic bacteria. Maintenance of Pure Cultures, Culture Collection Centres	**4 Hrs**
Unit 3 Microbiological Techniques	**14 Hrs**
Chapter No. 7: Sterilization Techniques **A. Physical Methods and their mode of action :** Heat (Dry and Moist heat), Filtrations and Radiations Methods **B. Chemical methods** : Definition of terms - disinfectants, antiseptics. Sanitizers, Microbicides -bactericides, virucide, Fungicide and Sporicide. Microbiostatic – bacteriostatic and fungistatic agents. Use and mode of action - Alcohols, aldehydes, halogens, phenols, heavy metals. Detergents: Quaternary ammonium compounds.	**5 Hrs**
Chapter No. 8: Stains and Staining techniques Principles and types of stains - Preparation of bacterial smears for light microscopy: Fixation, simple staining (Positive and Negative), Differential staining (Grams staining and Acid - Fast staining) Structural staining (Cell wall, Capsule, Flagella and Endospore staining)	**4 Hrs**
Chapter No. 9: Instruments Working principles and applications of Centrifuge. pH meter, Incubator, Colorimeter and Spectrophotometer. Chromatography- Working principles of Paper, Thin layer, Column and Ion-Exchange Chromatography	**5Hrs**

Unit 4: Microbial Diversity	14 Hrs
Chapter No. 10: Microbial Interactions. Basic principles and types of interactions among microorganisms. Inter and Intraspecific interactions. Merits and demerits of microbial interactions.	**4 Hrs**
Chapter No. 11: Microbial Ecology Ecology of Microbial cells and population ecology. Distribution and Significance of Microorganisms in air, water and soil	**4 Hrs**
Chapter No. 12 Bio-productivity Concepts and scope Methods used in the study of microbial diversity. Different levels of assessment and measure of microbial diversity, Factors influencing microbial diversity. Diversity as a source of innovation. Various approaches to improve microbial diversity and bio-productivity	**5 Hrs**

Books recommended.

1. Aneja K R 2017: Experimental in Microbiology Plant Pathology and Biotechnology. 5th Edition, New age International. New Delhi
2. Pelczar, Jr. Michael J. (2018). "Microbiology" 6th edn., Tata MaGraw HillBook Co. New York.
3. Ronald M Atlas, Richard Bartha, and David Atlas 1998: Microbial Ecology: Fundamentals and application 2nd Edition McMillan publishing Co. New York
4. Josephine A. Morello Paul A. Granato Helen Eckel Mizer (2003)."Laboratory Manual and Workbook in Microbiology". The McGraw−Hill Companies.
5. Atlas, R. M. (1997). "Principles of Microbiology". 2nd edition. WM.T. Brown Publishers Cappuccino, J.G and Shermani, N - 1999 "Microbiology" - a laboratory Manual Adelioson Wesley.
6. Bhattacharya. (1986)."Experiments with microorganisms" - Emkay Publishers.
7. Cappucino. J. and Sherman, N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited.
8. Carter, J. and Saunders, V. (2007). "Virology: Principles and Applications". John Wiley and Sons
9. Vos, P., Goodfellow, M., Brenner, D. J., Castenholz, R. W. (2001). Bergey's Manual®of Systematic Bacteriology: Volume Two: The Proteobacteria (PartC). Germany: Springer.
10. Kumar, H. D and Swati Kumar 2004: Modern concepts of Microbiology. 2nd Edition,
11. Vikas Publishing House Pvt. Ltd. New Delhi
12. Dubey, R. C. and Maheshawari, D.K, (2013). "Text book of Microbiology" S Chand and company limited, Ramnagar, New Delhi.
13. Edward Alcamo T. (1997)."Fundamental of Microbiology - 5th edn., Adlison Wesley Longman Inc. New York.
14. Gunashekaran, P. (2009)."Laboratory Manual in Microbiology"New Age Intl Ltd.
15. Madigan, M.T. Martinko, J.M and Parker, J.(1997)."Biology of Microorganisms-8IIi edn., McGraw Hill Inc. New York.
16. Nelson David, L and Cox Michael, M., Lehninger. (2008). "Principles of Biochemistry" Macmillan Press, Worth Publishers, New Delhi.
17. Powar and Daginwala (1994)"Microbiology" - Vol I and II. Himalaya Publication, New York.
18. Salle, A.J. (2007)."Fundamental Principles of Bacteriology" Tata McGraw Hill Publishing Company Ltd., New Delhi.
19. Srivastava, S. and Srivastava, P. S. (2003). "Understanding Bacteria". Kluwer Academic Publishers, Dordrecht.
20. Stanier, R. Y., Ingraham, J. L., Wheelis, M. L. and Painter, P. R. (2005). "General Microbiology". 5th edition McMillan.
21. Sullia S. Band Shantaram. S. (1998) "General Microbiology" Oxford and IBH Publishing Co PvtLtd. New Delhi.
22. Sundara R. Rajan. (2013)."Tools and Techniques of Microbiology" - Anmol Publications.
23. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2021). Microbiology: An Introduction, 13th Edition. Pearson Education.
24. Peleczar, M.J.. Chan. E.C.S and Krieg, N.R. (2020)"Microbiology"7th Edition. Tata MaGraw HillBook.
25. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl and Thomas Brock. (2021). "Brock Biology of Microorganisms", 14th Edition.Pearson.
26. Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition.(2020). "Prescott's Microbiology". New York, NY : McGraw-Hill Education.
27. Stuart Hogg. (2013). "Essential Microbiology" 2nd Edition. Wiley-Blackwel

B.Sc. Semester – I

Subject: Microbiology
Discipline Specific Course (DSCI)

Course No.-1 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-01	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.1 (Practical): Title of the Course (Practical): **PAPER MB DSC-1P – General Microbiology (4 hrs/week)**

Course Outcome (CO):

After completion of course (Practical), students will be able to:

CO 1: Learning and practicing professional skills in handling microbes.
CO 2: Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control.
CO 3: To develop in students a range of practical skills so that they can understand and assess risks and work safely

List of the Experiments for 52 hrs / Semesters

1. Laboratory safety: General rules and regulations.
2. Study of Microscope - Structure and working principles of Light microscope
3. Demonstrations of laboratory instruments: Autoclave**,** hot air oven, incubator, Laminar Air Flow, Centrifuge, pH meter, Colorimeter and Spectrophotometer..
4. Cleaning and sterilization of glassware.
5. Preparation of culture media - Broth, Semisolid and solid media. Isolation and Enumeration of microorganisms using serial dilution, Pour plate. Streak plate and spread plate techniques..
6. Isolation of microorganisms from air, water and soil and studying their characteristics.
7. Staining methods - Simple staining, Grams staining, Acid fast staining and structural staining.
8. Microscopic observations of Prokaryotes and Eukaryotes: Bacteria. Cyanobacteria, Protozoa, Fungi and Algae.
9. Study of Bacterial Motility by Hanging drop method
10. Micrometry and Camera lucida.
11. Counting of yeast cells and fungal spores by Haemocytometer.
12. Demonstration of slide culture technique of fungi
13. Demonstration of Chromatographic techniques (Paper Chromatography)

General instructions:

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. **Major Question ---------- 10 Marks**
2. **Minor Question ---------- 06 Marks**
3. **Identify and comment ---------- 3X1 = 03 Marks**
4. **Viva----------03Marks**
5. **Journal---------- 03Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment examination) OE 1T MBL Human Microbial Diseases

Books recommended.

1. Aneja K R 2017: Experimental in Microbiology Plant Pathology and Biotechnology. 5th Edition, New age International. New Delhi
2. Pelczar, Jr. Michael J. (2018). "Microbiology" 6thedn., Tata MaGraw HillBook Co. New York.
3. Ronald M Atlas, Richard Bartha, and David Atlas 1998: Microbial Ecology: Fundamentals and application 2nd Edition McMillan publishing Co. New York
4. Josephine A. Morello Paul A. Granato Helen Eckel Mizer (2003)."Laboratory Manual and Workbook in Microbiology". The McGraw–Hill Companies.
5. Atlas, R. M. (1997). "Principles of Microbiology". 2nd edition. WM.T. Brown Publishers Cappuccino, J.G and Shermani, N - 1999 "Microbiology" - a laboratory Manual Adelioson Wesley.
6. Bhattacharya. (1986)."Experiments with microorganisms" - Emkay Publishers

B.Sc. Semester – I

Subject: Microbiologu
Open Elective Course (OEC-1)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessmen t Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-1: Title of the Course **OE 1T MBL Human Microbial Diseases**

Course Outcome (CO):

After completion of course, students will be able to:

CO 1 : Knowledge and understanding of the disease causing microorganisms.

CO 2 : Learning and practicing professional skills in handling microbes and diagnosing disease.

CO 3 : Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality and disease control

Syllabus- OEC: Title- OE 1T MBL Human Microbial Diseases	**Total Hrs: 42**
Unit-I	**11 hrs**
Introduction to medical microbiology: History and Development of Medical Microbiology. Normal flora of human body-skin, oral cavity, respiratory tract and urogenital tract. Infection-types of infection, modes of disease transmission, portal of entry of pathogen. Pathogenesis, virulence, attenuation and exaltation with an example each. Collection, transport and culturing of clinical samples.	
Unit-II	**10 hrs**
Bacterial diseases: Cultural and biochemical characteristics, pathogenesis, symptoms, mode oftransmission, prophylaxis and control of Respiratory diseases (*Streptococcus pyogenes*, *Mycobacterium tuberculosis*). Gastrointestinal diseases: *Salmonella typhi, Helicobacter pylori* Others*: Bacillus anthracis, Treponema pallidum.*	
Unit-III	**10 hrs**
Fungal and Protozoan disease Pathogenesis, clinical symptoms, laboratory diagnosis, epidemiology, prophylaxis and treatment of Viral diseases (Dengue, AIDS and Rabies). A brief description of swine flu, Ebola, Chikungunya, Japanese Encephalitis. Fungal diseases-transmission, symptoms and prevention of cutaneous mycoses (Athlete's foot), systemic mycoses (Histoplasmosis) and opportunistic mycoses (Candidiasis). Protozoan diseases (Malaria, Kala-azar).	

Unit-IV	11 hrs
Anti microbial agents: General characteristics, and of types antibacterial agents. Mode of action of Antibacterial (Penicillin, Streptomycin) Antifungal (polyenes, flucytosine, the imidazoles, and triazoles), antiviral-Acycloguanosine. Antibiotic resistance, MDR, XDR, MRSA, NDM-1.	

Books recommended.

1. Ananthanarayan, R. and Paniker, C.K.J. (2018). "Textbook of Microbiology". 8th edition, University Press Publication.
2. Goering, R., Dockrell Richard A., Kindt Thomas J. and Osborne Barbara A., Kuby, (2005) Immunology, W. H. Freeman and Company, H., Zuckerman, M. and Wakelin D. (2007).
3. Richard V Goering, Cedric A Mims. (2008). Mims' "Medical Microbiology". 4th edition. Elsevier.
4. Gupte, S.M.D.(1986)."The short text book of Medical Microbiology'7 Jaypee Brothers Medical Publishers New Delhi..
5. Jagadish Chandra, (1996). "Text Book of Medical Mycology". Orient Longman.
6. Jayaram Panicker, C.K. (1993). "Text Book of Medical Parasitology" Jaypee Brothers, Medical Publishers, New Delhi.
7. Kenneth Jr. (2001) "Medical Microbiology-Introduction to Infection Diseases" Prentice Hall International.
8. Madigan, M. T., Martinko, J. M., Dunlap, P. V. and Clark, D. P. (2014). "Brock Biology of Microorganisms". 14th edition. Pearson International Edition.
9. Peakman, M. and Vergani, D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg..
10. Richard, C. and Geiffrey, S. (2009). "Immunology". 6th edition. Wiley Blackwell Publication.
11. Roitt, I.M., (2016) "Essentials of Immunology", ELBS, Blackwell Scientific Publishers, London.
12. Sengupta, J. (1988)."Synopses of Clinical Pathology and Microbiology" Hilton and Co. Culcatta.
13. Topley and Wilson (2001) "Principles of Bacteriology. Virology and Immunity" Idward Arnold. Greenwood. David, Richards. C and Slack B. "Medical Microbiology".
14. Prescott's Microbiology (2020).Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition. New York, NY : McGraw-Hill Education
15. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2021). Microbiology: An Introduction, 13th Edition.Pearson Education.
16. Arun K. Bhunia. (2018). "Foodborne Microbial Pathogens" 2nd Edition. Springer New York
17. Patricia Tille. (2015). "Baileys and scott's diagnostic microbiology" 14th Edition. Elsevier.
18. Kenneth Ryan and Nafees Ahmad and J. Andrew Alspaugh and W. Lawrence Drew and Megan Reller. (2018)."Sherris Medical Microbiology" MC Graw Hill education.
19. Stefan Riedel, Jeffery A. Hobden, Steve Miller, Stephen A. Morse, Timothy A. Mietzner, Barbara Detrick, Thomas G. Mitchell, Judy A. Sakanari, Peter Hotez, Rojelio Mejia. (2019). "Jawetz, Melnick, & Adelberg's Medical Microbiology" 28th E. MC Graw Hill education.

B.Sc. Semester - I

Subject: Microbiology
SKILL ENHANCEMENT COURSE (SEC)-I

Title of Paper: SEC 1T, MBL Microbial Analytical Techniques and quality control

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Mode of Examination	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
SEC-I	Theory + Practical	02	03hrs	30	Practical	2hr	25	25	50

Course Outcome (CO):

After completion of Skill Enhancement course, students will be able to:

CO 1 : Learning and practicing professional skills in handling microbes.

CO 2 : Thorough knowledge and application of good laboratory and good manufacturing practices in microbial quality control..

CO 3 : To develop in students a range of practical skills so that they can understand and assess risks and work safely

CO 4 To provide students with industrial problem based knowledge and skill towards employment or higher education in Biotechnology or multi-disciplinary areas involving different branches of sciences

Theory Units

Syllabus- Title of : SEC 1T, MBL Microbial Analytical Techniques and quality control	**Total Hrs: 30 1hour Theory followed by 2 hours practical**
Unit-I Biosafety:	**08 hrs**
Good laboratory practices, Good microbiological practices Biosafety cabinets; Working of biosafety cabinets, using protective clothing, specification for BSL1, BSL-2, BSL-3. Discarding biohazardous waste-Methodology of Disinfection, Autoclaving & Incineration.	
Unit-II Determining Microbes in Samples	**08 hrs**
Culture and microscopic methods- Standard plate count, Most probable numbers, Direct microscopic counts, Biochemical and immunological methods: Limulus lysate test for endotoxin, gel diffusion, sterility testing for pharmaceutical products. Molecular methods - Nucleic acid probes, PCR based detection, biosensors.	
Unit-III Viral, Microbiological quality analysis of Food and Water:	**07 hrs**
Enrichment culture technique, Detection of specific microorganisms- on XLD agar, Salmonella Shigella Agar, Manitol salt agar, EMB agar, McConkey Agar, Saboraud Dextrose Agar. Ascertaining microbial quality of milk by MBRT, Rapid detection methods of microbiological quality of milk at milk collection centres (COB, 10 min Resazurin assay).	

Unit-IV Food safety and Standard:	**07 hrs**
HACCP for Food Safety and Microbial Standards. Hazard analysis of critical control point (HACCP) - Principles, flow diagrams, limitations Microbial Standards for Different Foods and Water-BIS standards for common foods and drinking water.	

List of the Experiments for the Semester

SEC-1P

Practicals: Microbiological analytical techniques and quality control

1. Isolation and enumeration of microorganisms from food utensils.
2. Isolation and enumeration of bacteria/fungi from spoiled vegetables/fruits.
3. Quantitative examination of bacteria in raw and pasteurized milk by SPC method.
4. Turbidity test to detect efficiency of sterilization.
5. Methylene blue reductase test and Resazurin test to determine the quality of milk.
6. Determination of efficiency of Pasteurization by Phosphatase test.
7. Casien hydrolysis test.
8. Litmus milk test.
9. Estimation of % of lactic acid present in given fermented dairy products.
10. Visit to food industries/ food research laboratories, dairy industries and distilleries.

General instructions:

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. **Major Question ---------- 10 Marks**
2. **Minor Question ---------- 06 Marks**
3. **Identify and comment ---------- 3X1 = 03 Marks**
4. **Viva----------03Marks**
5. **Journal---------- 03Marks**

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended.

1. Baird, R. M., Hodges, N. A. and Denyer, S. P. (2005). Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.
2. Garg, N., Garg, K. L. and Mukerji, K. G. (2010). Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Harrigan, W. F. (1998). Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.
4. Jay, J. M., Loessner, M. J., Golden, D. A. (2005). Modern Food Microbiology, 7th edition. Springer.
5. TimSandle.(2015). "Pharmaceutical Microbiology: essentials for quality assurance and quality control".Woodhead Publishing.
6. Frederick Kavanagh (Herausgeber).(2014).Analytical Microbiology. Elsevier Science **.**
7. David Roesti, Marcel Goverde. (2019). Pharmaceutical Microbiological Quality Assurance and Control: Practical Guide for Non Sterile Manufacturing. Willey.
8. Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition.(2020). "Prescott's Microbiology". New York, NY : McGraw-Hill Education.
9. Dubey, R. C. and Maheshawari, D.K, (2013). Text book of Microbiology, S Chand and company limited, Ramnagar, New Delhi.

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

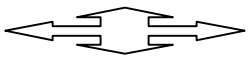
Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours prescribed.



B.Sc. Semester – II

Subject: Microbiology
Discipline Specific Course (DSC)

The course Microbiology in I semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No.-2 (Theory)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Theory	04	04	56 hrs	2hrs	40	60	100

Course No.2 (Theory): Title of the Course (Theory): Microbiology

Course Outcome (CO):

After completion of course (Theory), students will be able to:

CO 1 **:** Develop thorough knowledge and understanding of concepts of Biochemistry, enzymes, microbial metabolism, growth, bioenergetics and physiology ...

CO 2 **:** Students will become efficient in managerial skills,

CO 3 able to employ analytical reasoning, problems solving, interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry- level position in Microbiology

Syllabus- Course 2(Theory): Title- MB DSC-2T - Microbial Biochemistry and Enzymology	**Total Hrs: 56**
Unit – I Biomolecules	**18 hrs**
Chapter No.1: Carbohydrates Chemical and molecular basis of life- Monomer, multimer and polymeric units. A brief account of the properties, classification, characteristics and importance of Carbohydrates	**5 Hrs**
Chapter No. 2: Proteins Classification, general characteristics and properties of amino acid and proteins. Structural organization and significance of proteins.	**5 Hrs**
Chapter No. 3: Lipids Classification, General characteristics and properties of Lipids	**4 Hrs**
Chapter No. 4: Nucleic acids: General characteristics, Structure, types and significance of nucleic acids.	**4 Hrs**
Unit - II: Enzymology	**10 Hrs**
Chapter No. 5: Enzymes Nomenclature, classification, Characteristics and properties of enzymes. Enzyme kinetics-Michaeli's and Menten equation. Factors affecting enzyme activity-Competitive and non competitive inhibition and allosteric enzymes, cofactors, coenzymes, Ribozymes and their importance, clinical importance of enzymes.	**6 Hrs**
Chapter No. 6: Enzyme Regulation Types, modes and mechanism of enzyme action, factors affecting enzyme action, enzyme regulation.	**4 Hrs**

Unit III: Bioenergetics	14 Hrs
Chapter No. 7: Thermodynamics Laws of thermodynamics, Free energy, ATP and its production, other high-energy compounds, Oxidation and reduction reactions.	**4 Hrs**
Chapter No. 8: Energy yielding process Glycolysis, Outline of TCA cycle, Electron transport chain, Oxidative phosphorylation, Oxidation (alpha, beta and Omega oxidation pathway). Amino acid degradation (Transamination. Deamination and Decarboxylation). Anaerobic respiration Alcoholic, Lactic and acetic acid fermentation.	**6 Hrs**
Chapter No. 9: Bacterial Photosynthesis of bacterial photosynthesis, Photosynthetic pigments. Light reactions. Dark reaction, Comparison of photosynthesis in green plants and bacteria, Oxygenic and Anoxygenic Photosynthesis. Mechanism of photosynthesitic bacteria.	**4 Hrs**
Unit IV: Microbial Metabolism	**14 Hrs**
Chapter No. 10: Chemoheterotrophic Metabolism Concept and types of aerobic respiration, anaerobic respiration and fermentation. Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway, TCA cycle, Electron transport chain- uncouplers and inhibitors. Pasteur effect.	**4 Hrs**
Chapter No. 11: Nitrogen and Lipids metabolism Biological nitrogen fixation-symbiotic and asymbiotic nitrogen fixation, nodule formation, mechanism and biochemistry of N_2 fixation, nitrification and denitrification. A brief account on lipid metabolism-biosynthesis of triglycerides, β-oxidation.	**4 Hrs**
Chapter No. 12: Microbial Nutrition and Growth Nutritional requirements, modes of nutrition – Autotrophs, Heterotrophs, Phototrophs. chemotrophs, methanotrophs, organotrophs and saprotrophs. Microbial Growth: Growth Rate, generation time and growth curve - phases of growth and their significance physical and chemical factors affecting growth - Temperature, Light. pH, Oxygen and saline requirements. Measurement of growth by cell number, cell mass and cell viability.	**6 Hrs**

Books recommended.

1. Nelson David, L and Cox Michael, M., Lehninger, (2008). “Principles of Biochemistry”. Macmillan Press, Worth Publishers, New Delhi.
2. Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition.(2020). “Prescott's Microbiology”. New York, NY : McGraw-Hill Education.
3. Hrudayanath Thatoi, Pradeep K. Das Mohapatra, Sonali Mohapatra Keshab C. Mondal.. (2020). “Microbial Fermentation and Enzyme Technology”CRC press Taylor and Francis group.
4. Atlas, R. M. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers Cappuccino, J.G and Shermani, N. (1999)."Microbiology - a laboratory Manual Adelioson Wesley.
5. G. N. Cohen. (2014). “Microbial Biochemistry” 3rd Edition. Springer Nature.
6. Goutam Brahmachari. (2016). “Biotechnology of Microbial Enzymes”1st Edition.London, UK : Academic Press
7. Jose Luis Barredo. (2005). “Microbial Enzymes and Biotransformations” (Methods in Biotechnology) Humana Press.
8. Dubey, R. C. and Maheshawari, D.K, (2013). “Text book of Microbiology”, S Chand and company limited, Ramnagar, New Delhi.
9. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2021). Microbiology: An Introduction, 13th Edition.Pearson Education.
10. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl and Thomas Brock. (2021). “Brock Biology of Microorganisms”, 14th Edition.Pearson.
11. Cooper T.G. (1997)."The tools of Biochemistry" John Wiley and sons.
12. Peleczar, M.J.. Chan. E.C.S and Krieg, N.R. (2020)"Microbiology"7th Edition. Tata MaGraw HillBook

B.Sc. Semester – II

Subject: Microbiology
Discipline Specific Course (DSC)
Course No.-2 (Practical)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
Course-02	DSCC	Practical	02	04	52 hrs	3hrs	25	25	50

Course No.2 (Practical): Title of the Course (Practical): **PRACTICAL II**
PAPER DSC-2P Microbial Biochemistry and Enzymology (4 hrs / week

Course Outcome (CO):

After completion of course (Practical), students will be able to

CO 1 Develop thorough knowledge and understanding of concepts of Biochemistry, enzymes, microbial metabolism, growth, bioenergetics and physiology ...

CO 2 : Students will become efficient in managerial skills,

CO 3 : able to employ analytical reasoning, problems solving, interpretation and documentation of laboratory experiments at a level suitable to succeed at an entry- level position in Microbiology

List of the Experiments for 52 hrs / Semesters

PRACTICAL II
PAPER DSC-2P Microbial Biochemistry and Enzymology

1. Qualitative tests for the detection of Carbohydrates
   Glucose - Benedict's test, Molisch's test, Fehling's test and Picric acid test.
2. Qualitative tests for Proteins and Amino acids
   Protein -Biurette test. Ninhydrin test. Millons test and Xantho protein test.
3. Qualitative tests for Lipids
   Lipids - Acrolein test. Sudan III test, emulsification test and solubility test.
4. Colorimetric estimation of sugar by DNS method.
5. Colorimetric estimation of protein by burette method.
6. Study of Bacterial Growth curve and Measurement of growth by cell mass using turbidometer/ photocolorimeter/ spectrophotometer.
7. Estimation of Saponification value of oils.
8. Biochemical tests for the identification of bacteria
   a) IMViC
   b) Fermentation of glucose, sucrose and lactose - Acid and gas production.
   c) Starch hydrolysis
   d) Gelatin hydrolysis
   e) Catalase test
9. Effect of pH and temperature on bacterial growth.
10. Assay of salivary amylase by DNS method, determination of specific activity.
11. Effect of pH on enzyme activity
12. Effect of temperature on enzyme activity

General instructions:

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. **Major Question ---------- 10 Marks**
2. **Minor Question ---------- 06 Marks**
3. **Identify and comment ---------- 3X1 = 03 Marks**
4. **Viva----------03Marks**
5. **Journal---------- 03Marks**

Total 25 marks

Note: Same Scheme may be used for IA(Formative Assessment) examination

Books recommended.

1. G. N. Cohen. (2014). "Microbial Biochemistry" 3rd Edition. Springer Nature.
2. Goutam Brahmachari. (2016). "Biotechnology of Microbial Enzymes"1st Edition.London, UK : Academic Press
3. Jose Luis Barredo. (2005). "Microbial Enzymes and Biotransformations" (Methods in Biotechnology) Humana Press.
4. Dubey, R. C. and Maheshawari, D.K, (2013). "Text book of Microbiology", S Chand and company limited, Ramnagar, New Delhi.
5. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2021). Microbiology: An Introduction, 13th Edition.Pearson Education.
6. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl and Thomas Brock. (2021). "Brock Biology of Microorganisms", 14th Edition.Pearson.
7. Cooper T.G. (1997)."The tools of Biochemistry" John Wiley and sons.

B.Sc. Semester – II

Subject: Microbiology
Open Elective Course (OEC-2)
(OEC for other students)

Course No.	Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
OEC-2	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-2: Title of the Course **OE-2T MBL Food borne microbial infections**

Course Outcome (CO):

After completion of course, students will be able to:

CO 1 : Thorough knowledge and understanding of concepts of Food microbiology, principles of food preservation and spoilage of foods

CO 2 : Dairy Microbiological techniques and its application in different microbiological industries.

CO 3 : They will be well aware of the food borne outbreaks and handle them accordingly

Syllabus- OEC: Title- OE-2T MBL Food borne microbial infections	**Total Hrs: 42**
Unit –I	**11 Hrs**
Spoilage of food: Food as a substrate for growth of microorganisms. Intrinsic and extrinsic factors that affect growth and survival of microbes in foods. Sources of contamination. Groups of bacteria important in food bacteriology. Microbial spoilage and preservation of fruits, vegetables, meat, poultry, fish and canned foods.	
Unit –II	**10 Hrs**
Principles and methods of food preservation: Physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids (propionates, benzoates, sorbates), SO_2, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins.	
Unit –III	**10 Hrs**
Microbiology of milk: Sources of contamination of milk. Methods to detect microbial quality by SPC, Reductase test, Phosphatase test, clot on boiling test. Biochemical changes of milk-souring, gassy fermentation, proteolysis, lipolysis, ropiness. Starter culture and its role. Therapeutic value of Yoghurt, Butter milk. Cheese (preparation and types). Preservation of milk and milk products-Pasteurization.	
Unit -IV	**11 Hrs**
Food infection and safety: Food infection (Salmonellosis, Shigellosis, *Yersinia enterocolitica* & *Listeria monocytogenes*) **Food intoxication**- (Aflatoxin, Staphylococcal Intoxication & Botulism). Food safety and quality control- brief account of HACCP, FSSAI and Food safety and standard act 2006.	

Books recommended.

1. Baird, R. M., Hodges, N. A. and Denyer, S. P. (2005). Handbook of Microbiological Quality control in Pharmaceutical and Medical Devices, Taylor and Francis Inc.
2. Garg, N., Garg, K. L. and Mukerji, K. G. (2010). Laboratory Manual of Food Microbiology I K International Publishing House Pvt. Ltd.
3. Harrigan, W. F. (1998). Laboratory Methods in Food Microbiology, 3rd ed. Academic Press.
4. Jay, J. M., Loessner, M. J., Golden, D. A. (2005). Modern Food Microbiology, 7th edition. Springer.
5. Arun K. Bhunia. (2018). "Foodborne Microbial Pathogens" 2nd Edition. Springer New York
6. Patricia Tille. (2015). "Baileys and scott's diagnostic microbiology" 14th Edition. Elsevier.
7. Kenneth Ryan and Nafees Ahmad and J. Andrew Alspaugh and W. Lawrence Drew and Megan Reller. (2018)."Sherris Medical Microbiology" MC Graw Hill education.
8. Stefan Riedel, Jeffery A. Hobden, Steve Miller, Stephen A. Morse, Timothy A. Mietzner, Barbara Detrick, Thomas G. Mitchell, Judy A. Sakanari, Peter Hotez, Rojelio Mejia. (2019). "Jawetz, Melnick, & Adelberg's Medical Microbiology" 28th E. MC Graw Hill education.
9. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2021). Microbiology: An Introduction, 13th Edition. Pearson Education.
10. Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition.(2020). "Prescott's Microbiology". New York, NY : McGraw-Hill Education.
11. Arun K. Bhunia. (2018). "Food borne Microbial Pathogens" 2nd Edition. Springer New York
12. Patricia Tille. (2015). "Baileys and Scott's diagnostic microbiology" 14th Edition. Elsevier.
13. Kenneth Ryan and Nafees Ahmad and J. Andrew Alspaugh and W. Lawrence Drew and Megan Reller. (2018)."Sherris Medical Microbiology" MC Graw Hill education.
14. Stefan Riedel, Jeffery A. Hobden, Steve Miller, Stephen A. Morse, Timothy A. Mietzner, Barbara Detrick, Thomas G. Mitchell, Judy A. Sakanari, Peter Hotez, Rojelio Mejia. (2019). "Jawetz, Melnick, & Adelberg's Medical Microbiology" 28th E. MC Graw Hill education.
15. Aneja K. R. (2018) Modern Food Microbiology. Medtech; 1st edition

Details of Formative assessment (IA) for DSCC theory/OEC: 40% weight age for total marks

Type of Assessment	Weight age	Duration	Commencement
Written test-1	10%	1 hr	8th Week
Written test-2	10%	1 hr	12th Week
Seminar	10%	10 minutes	--
Case study / Assignment / Field work / Project work/ Activity	10%	------	--
Total	40% of the maximum marks allotted for the paper		

Faculty of Science
04 - Year UG Honors programme:2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(60 marks for semester end Examination with 2 hrs duration)

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions : 10marks

Part-B

2. Question number 07- 11 carries 05Marks each. Answer any 04 questions : 20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.