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 ಅನುಮೋದಿತ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಈಗಾಗಲೇ ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಮುಂದೆ ದಿನಾಂಕ 04.10.2021 ವರೆಗೆ ಸರಕಾರವು ಕಾಲಕಾಲಕ್ಕೆ ನೀಡಿದ ನಿರ್ದೇಶನಗಳನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ದಿನಾಂಕ 27.10.2021 ರಂದು ಜರುಗಿದ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯಲ್ಲಿ ಅನುಮೋದನೆ 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

***

SYLLABUS

Subject: Biotechnology

[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 Biotechnology 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):B.Sc., (Basics/Hons) Biotechnology

Programme Specific Outcome (PSO):

On completion of the 03/ 04 years Degree in **B.Sc., (Basics/Hons)** students will be able to:

PSO 1 : Understanding concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology

PSO 2 : Demonstrating the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects

PSO 3 : Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.

PSO 4 : Critically analyze the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.

PSO 5 : Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.

PSO 6 : Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.**;**

PSO 7 : Critically analyze, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health and Food.

PSO 8 : Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology**.** Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises or CROs.

B.Sc. Semester – I

Subject: Biotechnology
Discipline Specific Course (DSC)

The course B.Sc., (Basic/Hons) 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): **FUNDAMENTALS OF BIOTECHNOLOGY**

Course Outcome (CO):

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

CO 1 : Understanding concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology

CO 2 **:** Understanding of basic structure of cell and its functions

CO 3 **:**Understanding of basic of genetic s and it application in basic biology

Syllabus- Course 1(Theory): Title- FUNDAMENTALS OF BIOTECHNOLOGY	**Total Hrs: 56**
Unit-I	**14 hrs**
Chapter No. 1 Biotechnology: A Brief Introduction. Historical Advancement of Biotechnology, branches of Biotechnology	**3**
Chapter No. 2 Introduction to the living world: Cell theory, Cell ultra-structure and functions of cell, Different types of cells. Difference between prokaryotic and eukaryotic cells; Difference between animal and plant cell. (plant and Animal).	**5**
Chapter No. 3 Ultra-structure of cell organelles Cell wall, Plasma membrane, Mitochondria, Chloroplast, Ribosomes, Golgi complex. Endoplasmic reticulum. Nucleus, Lysosomes. Peroxisomes, Vacuole. Cytosol and Cytoskeletal structures	**6**
Unit-II	**14 hrs**
Chapter No. 4. Concept of genome and Chromosomes Discovery Morphology and structural organization: number, size and, fine structure, heterochromatin and euchromatin. Special types: giant chromosomes (Salivary gland and Lampbrush).	**6**
Chapter No. 5. Cell study techniques. Fixatives, Principles of staining, Types of stains, Auxochromes.	**4**
Chapter No. 6. Cell cultivation methods - Nutritional requirements (Bacteria and plant), laboratory facilities, growth curve, Single cell suspension cultures and their applications.	**4**

Unit-III	**14 hrs**
Chapter No. 7 Science of Genetics-Mendel's Laws of heredity, Mono and di-hybrid crosses, Test-cross, Incomplete dominance and multiple allelism. Cell cycle, mitosis and meiosis, mitotic apparatus, centrioles, spindles, cell plate formation, cell synchrony and significance. Amoeboid, flagella and ciliary motility, Spermatogenesis and Oogenesis.	**11**
Chapter No. 8. Cells for cloning: *E.coli, Bacillus subtilis, Saccharomyces cerevisiae.*	**3**
Unit-IV	**14 hrs**
Chapter No. 9. Concept of Genetic Engineering: Definition; Tools used in recombinant DNA Technology: Plasmids, **Transgenesis:** Production and significance of transgenic plants (Golden rice) and animals (sheep); the Basic concept of genetically modified organisms**.**	**9**
Chapter No. 10. Role of biology in allied fields: Role of biology in Information Technology (Bioinformatics), Nanotechnology (Nanobiotechnology), Micro-electromechanical systems (Bio-MEMS), and Sensors (Biosensors)	**5**

Books recommended.

1. Sudberry P. 2002, Human Molecular cytogenetics. Prentice hall publication
2. Knudson A.G. 1998, Anti – Oncogenes and Human cancer. Proceedings of the National academy of sciences USA 90: 10, 0114 – 10921
3. Lodish, H., Ber, A., Zipursky, L.S., Matsudaira, P., Bahimore, D and Darnell J. 2001, Molecular Biology W. H. Freeman G Co 47
4. Preeti G. 2011, Fundamentals of Biotechnology. Galgotia Publications.
5. Sabiha Khan. 2020, Fundamentals of Biotechnology.Lenin Media Pvt. Ltd.
6. Firdos A. K. 2020,Biotechnology Fundamentals. Third Edition CRC Press.
7. Bazlur Rashid. M. 2016, Methods in Biotechnology1st edition Wiley-Blackwell.
8. B. Alberts. D. Bray, J. Lewis, M. raff K, Roberts and J. D. Watson 2008 Molecular
9. Biology of the Gene. 2012, Garland Publisher Inc., New York
10. Gerald Karp 2004, Cell and Molecular Biology. John Wiley and Sons. Inc
11. Elliot and Elliot, 2001 Biochemistry and Molecular Biology. Oxford University Press.
12. Celis J E (Eds): 2008 Cell Biology: A Laboratory Hand Book. Vol I & II Academic Press.
13. Pollard J.P. and W.C. Earnshow 2002. Cell Biology, Sunders
14. Tamarin, R.H, (2000): Principles of genetics, 6th Edn. WMC Brown Publication. London.
15. Snustad, P.D, Simmons, M.J 2019: Principles of genetics 2nd Edn. John Wiley and sons,Inc. New York.
16. Fairbanks, D.J and Anderson, W.R 1999: Genetics – continuity of life. Brooks and Cole Publication Company. New York.
17. Lewin, B (2020): GENES VII. Oxford University Press, New York.
18. Strickberger, M.W (2000): Genetics Prentice - Hall of India private limited, New Delhi.
19. Miglani G.S 2000 Basic Genetics Narosa publishing New Delhi.

B.Sc. Semester – I

Subject: Biotechnology
Discipline Specific Course (DSC)

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): **FUNDAMENTALS OF BIOTECHNOLOGY**

Course Outcome (CO):

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

CO 1 **:** Learning and practicing the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects

CO 2 **:** Learning and practicing the concepts of Biotechnology and practical skills in interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology

List of the Experiments for 52 hrs / Semesters

1. Study of fixatives and stains: Preparation of formaldehyde (4-10%), Alcohol (70%), Bouin's fixatives, Carnoy's solution, Borox carmine (alcoholic), Eosin (alcoholic), Iron (Haematoxylin). Leishman's Stain, Ringer's Solution, Acetocarmine, Acetoorcein,Schiff's reagent (Feulgen), Giemsa's stain.
2. Mitochondrial staining
3. Micrometry
4. Cell counting methods: Heamocytometer and other aids.
5. Squash preparation of onion root tips to study stages of mitosis.
6. Smear preparation of grasshopper testes and flower buds to study stages of meiosis.
7. Smear preparation to study salivary gland chromosomes
8. Buccal epithelial smear and Barr body observation.
9. Extraction of cellular materials in saline buffers, solvents and precipitation.
10. Demonstration of laws of inheritance by using colour beads
    a. Laws of segregation
    b. Laws of independent assortment.
    c. Solve genetic problems
11. Study of different types cells using permanent slides
12. Spotters

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. Preeti G. 2011, Fundamentals of Biotechnology. Galgotia Publications.
2. Sabiha Khan. 2020, Fundamentals of Biotechnology.Lenin Media Pvt. Ltd.
3. Firdos A. K. 2020,Biotechnology Fundamentals. Third Edition CRC Press.
4. Bazlur Rashid. M. 2016, Methods in Biotechnology1st edition Wiley-Blackwell.

B.Sc. Semester – I

Subject: Biotechnology
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 Assessment Marks	Total Marks
OEC-1	OEC	Theory	03	03	42 hrs	2hrs	40	60	100

OEC-1: Title of the Course: **Biotechnology for human welfare**

Course Outcome (CO):

After completion of course, students will be able to:

CO 1 :Understanding importance of Genetic engineering in Industry and bio-therapeutic proteins

CO 2 :Applications of molecular Genetics in Forensic science to solve criminal cases by DNA analysis

Syllabus- OEC: Title- Biotechnology for human welfare	**Total Hrs: 42**
Unit-I	**14 hrs**
Industry: Protein engineering; enzyme and polysaccharide synthesis, organic compounds, alcohol and antibiotic synthesis **Environment**: Application of biotechnology in environmental aspects. Bioremediation, solid and liquid waste management.	
Unit-II	**14 hrs**
Forensic science: DNA finger printing, Solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods.	
Unit-III	**14 hrs**
Health: Biopharmaceuticals, development of non-toxic therapeutic agents, recombinant vaccines, insulin, gene therapy, molecular diagnostics using ELISA, PCR, monoclonal antibodies and their use in diagnostics and therapy, human genome project **Reproductive Biotechnology**: *In vitro* fertilization, IUI, nuclear transfer, embryo Transfer	

Books recommended.

1. H.K.Dass (2018)Text book of Biotechnology., Wiley India publication
2. B.D.Singh (2017)Biotechnology new horizon., Kalyani Publishers
3. R.C.Dubey (2015)Text book of Biotechnology, S.Chand and company
4. U. Satyanarayan (2005) Biotechnology. BOOKS & ALLIED (P) LTD.-KOLKATA.
5. W.T. Godbey(2014)An Introduction to Biotechnology, 1st Edition Academic Press.
6. K. Pranav, V. Praveen, M. Usha (2017). Biotechnology A Problem Approach, Fifth edition Pathfinder Publications.
7. Rup Lal (2020). An Introduction to Biotechnology - A Genetic Manipulation Perspective, First Edition Dreamtech Press

B.Sc. Semester - I

Subject: Biotechnology

SKILL ENHANCEMENT COURSE (SEC)-I

Title of Paper: BIOTECHNOLOGICAL SKILLS

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

Content of Course 1 (one hour theory followed by 2 hours practicals)	**Total 30 Hrs**
Unit –1	**7**
Rules and regulation, Safety measures in Biotechnology laboratory. **Titrimetric Analysis,** Concept of Molarity, Normality, Preparation of solutions of different Molarity/Normality of titrants, Preparation of reagents.	
Unit –2	**7**
Concept of Buffer and pH, its importance in Biological experiments, Preparation of buffer solutions of different pH. Sodium acetate-acetic acid. Phosphate buffer etc Preparation and Sterilization of Glassware and media 1. Calculation of Molarity, Normality and Molality 2. Calibration of pH meter using standard buffers 3. Preparation of Buffers- Phosphate Buffer, Acetate Buffer and TRIS Buffer.	
Unit- 3	**7**
Study of Biotechnology related laboratory instruments. Understanding principles of general lab instruments**:** Autoclave**,** hot air oven, incubator, Laminar Air Flow, Centrifuge, Colorimeter and Spectrophotometer. Colorimetric estimation of protein by Biuret method/ Barford's method.	
Unit –4	**9**
Principles of chromatography. Types of chromatography, Paper chromatography and applications. Demonstration of Chromatographic techniques (Paper Chromatography of amino acids) Extraction of protein from plant and animal source. Salt precipitation and organic solvent methods. Protein estimation.	

Books Recommended:

1. H.K.Dass (2018)Text book of Biotechnology., Wiley India publication
2. B.D.Singh(2017)Biotechnology new horizon., Kalyani Publishers
3. R.C.Dubey (2015)Text book of Biotechnology., S.Chand and company
4. William J. Thieman, Michael A. Palladino (2008), Introduction to Biotechnology Publisher: Benjamin Cummings
5. Colin Ratledge(2012),Basic Biotechnology: Cambridge University Press
6. Boyer, R (2017) Concepts in Biochemistry. 5thint. edn – Brooks / Cole, Australia.
7. David Leader RLP Adams, John Knowler (2020) The Biochemistry of the nucleic acids. 11thedn Chapman and Hall.
8. W.T. Godbey (2014)An Introduction to Biotechnology, 1st Edition Academic Press.
9. K. Pranav, V. Praveen, M. Usha (2017). Biotechnology A Problem Approach, Fifth edition Pathfinder Publications.
10. M. Bazlur Rashid (2016). Methods in Biotechnology1st edition Wiley-Blackwell.

Course Outcome (CO):

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

CO 1: Basic principles of reagents preparation and physic chemical nature and its application in Human life

CO 2 : Understanding basic of chromatography and its role in Pharma Industries

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

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

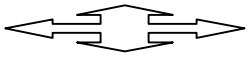
Part-C

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: Biotechnology
Discipline Specific Course (DSC)

The course B.Sc., (Basic/Hons) 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): **Microbiological methods**

Course Outcome (CO):

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

CO 1 : Understanding of Microbes and their handling , culture methods, etc.,

CO 2 : Learning of various methods for identification of microbes.

CO 3 : Microbiological diseases from bacteria, fungi and virus, its pathological significance

Syllabus- Course 2(Theory): Title- Microbiological methods	**Total Hrs: 56**
Unit-I	**14 hrs**
Chapter No. 1 Introduction and Scope of Microbiology: Historical perspectives. Importance and scope of microbiology as a modern science. Branches of microbiology and allied sciences.	**3**
Chapter No. 2 Sterilization techniques: -Physical, dry heat, moist heat, chemical and radiation methods of sterilization. pasteurization, Tyndalization, Filtration, HEPA, Principles and Applications. disinfection sanitization, antisepsis and fumigation	**4**
Chapter No. 3 Stains and staining techniques. Bacterial and fungal staining - Simple, Differential and Structural staining. Capsule, cell wall, flagella & endospore staining.	**3**
Chapter No. 4 Microbial taxonomy: Concept of microbial species and strains, Taxonomical characteristics of microorganisms, Classification of bacteria based on – morphology, Molecular identification of microbe, numerical taxonomy, Bergey's manual	**4**
Unit-II	**14 hrs**
Chapter No. 5. Ultra-structure of virus, bacteria and yeast: Typical bacteria, cell wall structure, flagella structure, plasmid, tobacco mosaic virus (TMV), Bacteriophage-λ phage, *Saccharomyces cerevisiae*.	**3**

Chapter No. 6. Culture of microorganisms: Culture media, Types of culture media, Preservation and sub culture of media. Lyophilization and long term storage media	**4**
Chapter No. 7. Microbial growth: Nutritional requirements of microorganisms. Bacterial growth curve. Factors influencing growth, Counting of Bacteria.	**3**
Chapter No. 8. Pathogenic microorganisms: Bacterial diseases of humans - Tetanus, Tuberculosis and Cholera, Viral diseases –HIV (AIDS), Hepatitis, Ebola & Corona virus.	**4**
Unit-III	**14 hrs**
Chapter No. 9. **Applied Microbial methods:** Environmental Microbial methods- Quality of air, water and soil sampling methods Food and dairy Microbial Methods- Food quality, health and hygiene of food Industrial Microbial methods- Microbial measurements and limits in industrial assessments.	**4**
Chapter No. 10. Introduction to Immunology: History and Scope of Immunology, Types of Immunity- Innate, active, passive and acquired immunity. Humoral and cell - mediated immunity **Organs of the Immune system**: Bone marrow. Thymus, lymph node and spleen.	**3**
Chapter No. 11. Antigens and Antibodies: Types of antigens, Super antigens, haptens, epitopes, paratope, Role of Adjuvant in immunogenicity (Fraud's Complete Adjuvant and Fraud's Incomplete Adjuvant) Blood group antigens; Antibody Structures, types, properties and functions of immunoglobulins	**7**
Unit-IV	**14 hrs**
Chapter No. 12. Advanced Microbial Methods: Identification and sequencing of unknown microorganisms (Culturable and non-culturable). High throughput sequencing. Mechanism of immune-precipitation, Agglutination, Complement fixation, Mechanism of immuno-toxin reaction, Immuno-blotting, Immuno-Fluorescence	**7**
Chapter No. 13. Hypersensitivity: Types of hypersensitivity - IgE mediated (type - I). Antibody mediated cyto-toxic (type-II), Immuno complex mediated (type-III) and T-mediated (type-IV) hypersensitivity reactions.	**7**

Books recommended.

1. Ananthanarayan R. JayarmanPaniker 2005: Textbook of Microbiology. 7th Edition, Orient Longman publication
2. Aneja K R 2017: Experimental Microbiology Plant Pathology and Biotechnology. 5th Edition, New age International. New Delhi
3. Ronald M Atlas, Richard Bartha, and David Atlas 1998: Microbial Ecology: Fundamentals and application 2nd Edition McMillan publishing Co. New York
4. Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition.(2020). "Prescott's Microbiology". New York, NY : McGraw-Hill Education.
5. 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.
6. Peleczar, M.J.. Chan. E.C.S and Krieg, N.R. (2020)"Microbiology"7th Edition. Tata MaGraw Hill Book.
7. Gerard J. Tortora, Berdell R. Funke and Christine L. Case (2021). Microbiology: An Introduction, 13th Edition. Pearson Education.
8. Ronald M Atlas, 1988: Microbiology: Fundamentals and application 2nd Edition McMillan publishing Co. New York
9. Ronald M Atlas 2005 Handbook of Media for Environmental Microbiology 2nd Edition, Taylor & Francis

10. Auro, P.T Kapoor, K.K. Yadav, K.S 2019: An introduction to Microbiology, 3rd Edition, New Age International Pvt. Ltd.
11. Gerhardt, R.G.E. Murray, W.A. Wood and N.R. Krieg 1996: Methods for general and
12. molecular bacteriology. American Society for Microbiology. Washington DC.
13. Bergey, D. H., Boone, D. R., Staley, J. T., Garrity, G. M., Krieg, N. R., De
14. Vos, P., Goodfellow, M., Brenner, D. J., Castenholz, R. W. (2001). Bergey's Manual® of Systematic Bacteriology: Volume Two: The Proteobacteria (PartC). Germany: Springer.
15. Kumar, H. D and Swati Kumar 2004: Modern concepts of Microbiology. 2nd Edition, Vikas Publishing House Pvt. Ltd. New Delhi
16. Michael J Pelczar, JR, E.C.S Chan, Noel R Krieg 2015: Microbiology – Tata McGraw Hill Publication

B.Sc. Semester – II

Subject: Biotechnology
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): **Microbiological methods**

Course Outcome (CO):

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

CO 1 : Understanding of Microbes and their handling , culture methods, etc.,

CO 2 : Understand and identification of methods for microbes.

CO 3 : Analyze microbial diseases from bacteria, fungi and virus, its pathological significance

List of the Experiments for 52 hrs / Semesters

1. Safety measures in microbiology laboratory
2. Cleaning and sterilization of glass wares
3. Study of instruments: Compound microscope, Autoclave, Hot air oven, pH meter, Laminar airflow, centrifuge, colony counter etc
4. Media preparation : Nutrients agar, Nutrient broth and potato dextrose agar
5. Inoculation technique: Stab, point, Streak, pour plate and spread plate
6. Isolation of bacteria and fungi from soil, air, and water – dilution and pour plate methods and study of colony characters
7. Bacterial staining techniques -simple and differential (Gram's)
8. Counting of micro-organisms – Total count (Haemocytometer)
9. Biochemical tests – Starch hydrolysis, catalase, Gelatin liquification
10. Preparation of bacterial and fungal antigens
11. Total RBC and WBC count
12. Estimation of haemoglobin in blood
13. Demonstration of ELISA and RIA
14. Study of Rocket electrophoresis

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. Aneja K R 2017: Experimental Microbiology Plant Pathology and Biotechnology. 5th Edition, New age International. New Delhi
2. Ronald M Atlas, Richard Bartha, and David Atlas 1998: Microbial Ecology: Fundamentals and application 2nd Edition McMillan publishing Co. New York
3. Joanne Willey and Kathleen Sandman and Dorothy Wood Eleventh edition.(2020). "Prescott's Microbiology". New York, NY : McGraw-Hill Education.
4. 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.
5. Peleczar, M.J.. Chan. E.C.S and Krieg, N.R. (2020)"Microbiology"7th Edition. Tata MaGraw HillBook.

B.Sc. Semester – II

Subject: Biotechnology
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: **Applications of Biotechnology in Agriculture**

Course Outcome (CO):

After completion of course, students will be able to:

CO 1 : Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, in pharma, agriculture, herbal and nutraceutical industries.

CO 2 **:** Application of Bio based nutrient and growth promoters for agriculture yields.

Syllabus- OEC: Title- Applications of Biotechnology in Agriculture	**Total Hrs: 42**
Unit-I	**14 hrs**
Agricultural Biotechnology: 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	
Unit-II	**14 hrs**
Transgenic plants: The GM crop debate – safety, ethics, perception and acceptance of GM crops GM crops case study :Bt cotton, Bt brinjal Plants as bio-factories for molecular pharming : edible vaccines, nutraceuticals	
Unit-III	**14 hrs**
Bio-pesticides: 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.	

Books recommended.

1. Primrose. S.B. and Twyman R.M. Principles of gene manipulation and genomics. Seventh Edition. 2006. Blackwell Publishing, Australia.
2. Sandhya Mitra. (1996). Genetic Engineering. Principles and Practice. Macmillan India Ltd, New Delhi.
3. Das. H.K. (2007). Textbook of Biotechnology. Third Edition. Wiley India Pvt Ltd, New Delhi.
4. David A Micklos and Greg A Freyer. (2005). DNA Science, a first course. Second Edition. I.K. International Pvt Ltd, New Delhi.
5. Gupta. P.K. Biotechnology and Genomics. 2008. Rastogi Publications, New Delhi.
6. Winnacker E.L. (1987) From Genes to clones, Introduction to gene technology. VCH, Verlagsgesellschaftmbh, Whinheim, Germany.
7. Channarayappa. (2006) Molecular Biotechnology, Principles and Practices. University press (India) Pvt. Ltd, Hyderabad, India.
8. Becker. J.M, Caldwell.GA, Zacgho. E.A. (1996) Biotechnology, A laboratory Course. Second Edition.. Academic Press. INC, California.
9. Principles of Gene Manipulations (1994) by Old and Primrose Blackwell Scientific Publications.
10. DNA Cloning: A Practical Approach by D.M. Glower and B.D. Hames, IRL Press, Oxford. (1995).
11. Molecular Biotechnology 2ndEdition by S.B. Primrose. Blackwell Scientific Publishers, Oxford. (1994).
12. S.M. Kingsman and A.J. Kingsman (1998) Genetic Engineering and Introduction to Gene Analysis and Exploitation in Eukaryotes by, Blackwell Scientific Publications, Oxford
13. PCR Technology - Principles and Applications for DNA Amplification by Henry A. Erlich (Ed.) Stockton Press. (1989).
14. Biotechnology: A Guide to Genetic Engineering by Peters.
15. Genetic Engineering – (2000) by Nicholl.
16. Recombinant DNA and Biotechnology: Guide for Teachers. 2nd Edition by Helen Kreuz. (2001). ASM Publications
17. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 2 nd Edition. (1998) by Bernard R. Glick and Jack J. Pastemak, ASM Publications.
18. From genes to clones by Winnaker.
19. Manipulations and expression of recombinant DNA by Robertson.
20. Gene targeting – A practical approach by Joyner.

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.